

STUDIES ON NATURAL CONTROL OF THE AVOCADO BROWN MITE

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Introduction

The avocado brown mite, *Oligonychus punicae* Hirst, is one of few pest species on avocado which sometimes reaches damaging proportions. Feeding by this mite begins on the upper surface of the leaf, causing brownish areas. In severe infestations partial defoliation of the trees may result.

As shown by Fleschner et al (1955) predators are very important in regulating the numbers of the brown mite. Since the use of chemical control might produce undesirable side effects, such as resistance, or outbreaks of other potential pests normally controlled by their natural enemies, it is important to utilize biological control of the mite.

This paper summarizes the results of a 4-year study conducted to determine the principal factors affecting the abundance of the avocado brown mite and its predators. Such a study should suggest possible measures that could be taken to increase the effectiveness of the predators.

Although the study involved many orchards, data from 3 representative Hass orchards are presented in this summary. These are the Beck and the Burroughs orchards near Fallbrook in San Diego County, and the Bailard orchard in Carpintería in Santa Barbara County. From each orchard, 4 sample trees were selected for following the trends of the brown mite and predator populations. Although records were kept on all species of predators known to feed on mites, only 2 types are presented in this report, including predaceous mites of the genus *Amblyseius* in the family Phytoseiidae (Fig. 1) and the lady beetle *Stethorus picipes* Casey (Fig. 2). The trends of the brown mite and predaceous mites were determined by taking a sample of 10 leaves from each of the 4 selected trees and counting the mites under a binocular microscope in the laboratory. The *Stethorus* population was sampled by walking around each sample tree and counting all of the beetles seen on the foliage for a period of 5 minutes. Samples were taken at 1-2 week intervals. The counts for individual trees were averaged and expressed in numbers of mites per 10 leaves and *Stethorus* per 5 minute count,

Results

Beck Orchard (Fig. 3). In 1961 and 1962, the avocado brown mite was considered under good control. The population density reached in 1961 was sufficient to cause

some browning of the leaves, but both *Stethorus* and predaceous mites multiplied rapidly before the brown mite population became too high, resulting in a rapid decline in brown mites.

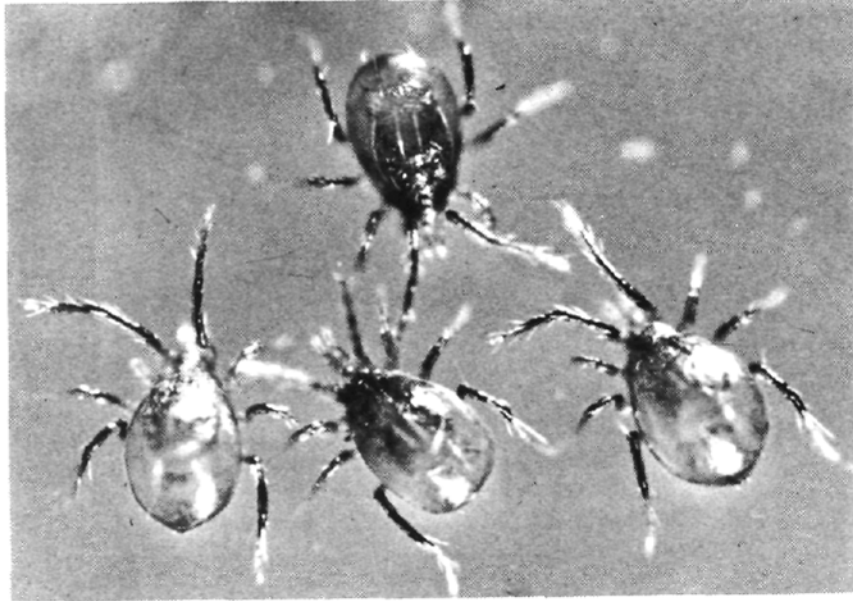


Figure 1. Predaceous mites (Family Phytoseiidae). Actual size about 1/60 inch.

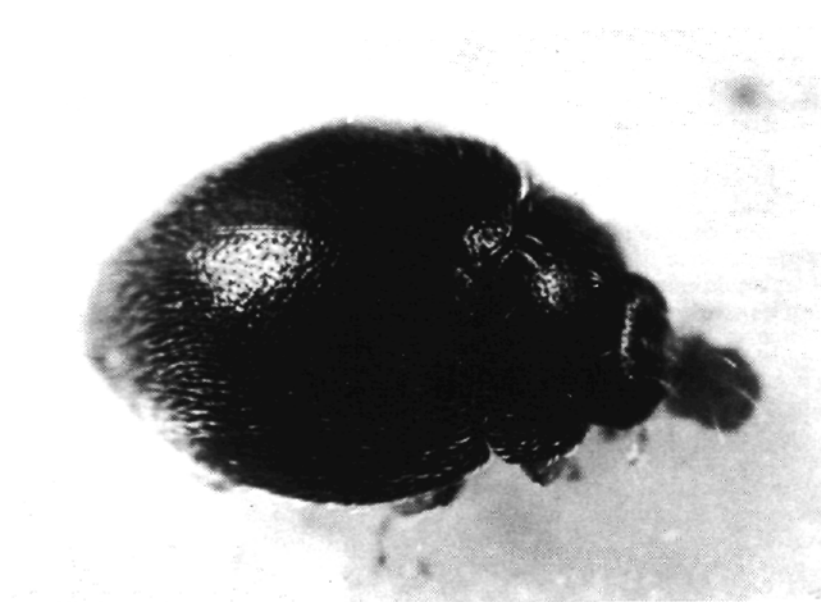


Figure 2. The lady beetle *STETHORUS PICIPES* Casey. Actual size about 1/16 inch.

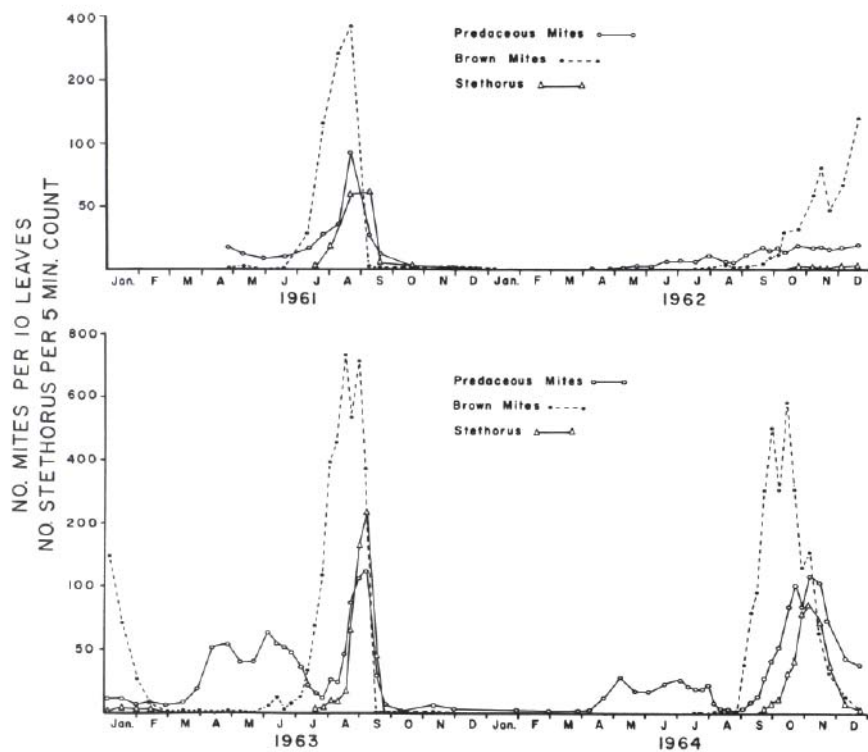


Figure 3. Population trends of the avocado brown mite and its two major predators in the Beck orchard in San Diego County.

In 1962 the brown mites did not start building up until late September, and they caused only a slight browning of a few of the leaves. It was not definitely determined why the population remained so low. Predaceous mites were the only abundant predators. They may have been an important factor, but were clearly unable to prevent rapid increases in the brown mite populations the 2 following years.

In 1963 there were high numbers of the predaceous mite, *Amblyseius hibisci* (Chant) in the spring, when there were almost no brown mites. This is a common phenomenon with this species. It has been determined that these early increases are induced by the presence of pollen from the avocado blossoms. *A. hibisci* feeds and reproduces readily on pollen as well as on plant-feeding mites. However, the predaceous mites decreased in numbers in June and July, at which time the brown mites started increasing rapidly. There was no corresponding increase in the populations of either predator until the population index of the brown mite was over 500 (Fig. 3) and causing considerable browning of the leaves. By the time the predators reached high numbers, some leaf drop had already occurred. The peak density of the brown mite reached an index of over 700, nearly twice as high as in 1961.

The infestation in 1964 was less severe than it was in 1963. There was no significant leaf drop, although many leaves had severe browning. As in 1963, *Stethorus* again did not start building up until the brown mite population was quite high (Fig. 3).

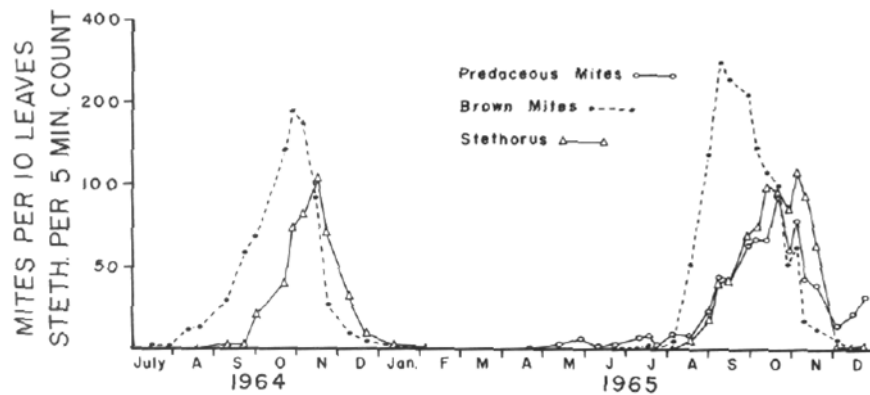


Figure 4. Population trends of the avocado brown mite and its two major predators in the Burroughs orchard in San Diego County.

Burroughs Orchard (Fig. 4). Data from this orchard provided an excellent example of the ability of *Stethorus* to control the avocado brown mite. Both in 1964 and 1965 the beetles started multiplying rapidly before the brown mite population was high. As a result, there was no severe browning of the leaves. The *Stethorus* population was already increasing rapidly when the brown mite population index was little more than 100 (Fig. 4), as compared with about 500 in the Beck orchard in 1963 (Fig. 3), when the predators did not provide good control. Predaceous mites were virtually absent in the Burroughs Orchard in 1964. The reason for this is still under investigation.

Bailard Orchard (Fig. 5). This is a typical example of an orchard near the ocean, where natural enemy activity is usually somewhat different than it is in areas further inland. The dominant species of predaceous mite in coastal orchards is *Amblyseius limonicus* Carman and McGregor. In 1961 the avocado brown mite population attained a level comparable to that in the Beck orchard during the same year (Fig. 3). There was some browning of the leaves, but the degree of control was acceptable. Increases of both *Stethorus* and predaceous mites in response to increase of the brown mite, followed by a rapid decline of the pest are shown in Figure 3. The decline was apparently caused by the combined activity of the 2 predators. Laboratory studies have shown that *A. limonicus* consumes more prey mites, reproduces faster, and has a stronger preference for plant feeding mites over other kinds of food, than *A. hibisci*. Therefore, the former species of predaceous mite probably has a much greater effect on phytophagous mite populations than that of comparable numbers of the latter species.

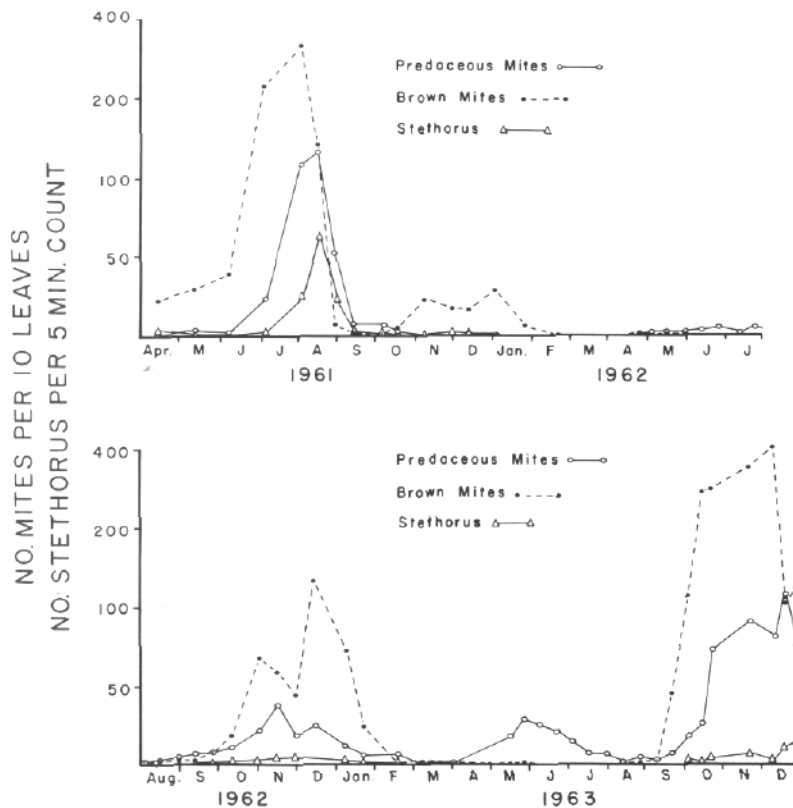


Figure 5. Population trends of the avocado brown mite and its two major predators in the Bailard orchard in Santa Barbara County.

The numbers of brown mite were low in 1962 (Fig. 5) with few leaves showing any browning from mite feeding. The predaceous mites could have been the controlling factor. In 1963, a moderate population of brown mite was present for an extended period. Browning of the leaves was more severe than in 1961, when the peak was lower, and moderate or high populations existed for only a short time. However, there was no leaf drop, and the trees remained in vigorous condition. The amount of feeding damage to the leaves depends on the length of time that large numbers of mites are present as well as on the peak numbers reached. *Stethorus* did not build up during 1963. This may have been due to the predominantly overcast and cool weather during the time of the mite infestation since *Stethorus* is retarded even at moderately cool temperatures. Predaceous mites were apparently the major control factor. As many as 20-30 were sometimes found on a leaf, and such high numbers undoubtedly caused a high mortality of the brown mite.

Discussion

With the possible exception of the coastal area, *Stethorus* seems to be the key predator of the avocado brown mite. In every situation where this predator started building up

before the brown mite population got very high (i.e., an index of 100-200), control resulted before damage was severe. Conversely, where *Stethorus* was slow in responding to the increase in mites, damage was usually severe. These beetles must consume about 30-40 mites per day in order to lay eggs. Therefore, a moderate population density of mites must be present before they can multiply, and partial browning of some leaves can be expected before they bring the mites under control.

It is not known why *Stethorus* is more effective in some situations than in others. However, in the Burroughs orchard, where good control resulted, at least 1 adult *Stethorus* could be found during a 30-60 minute search even during the winter and spring when mites were extremely scarce. Thus better control may result if a residual population carries over in the orchard, and starts multiplying as soon as the mites begin increasing.

Amblyseius hibisci, the dominant predaceous mite in most areas, apparently cannot stop a rapidly increasing population of brown mites by itself, although its possible importance at certain times should not be discounted. *Amblyseius limonicus* seems to be a more effective predator than *A. hibisci*, and is sometimes able to control brown mite when other predators are scarce. Its overall effectiveness is limited, however, because it thrives only near the coast. The importation and establishment of a species having the desirable characteristics of *A. limonicus* and also the ability to live in the more interior avocado growing areas would probably be a significant addition to the predator complex. New species are being imported into California in the hope of accomplishing this.

In addition to new importations, the results also suggest possibilities of improving upon the effectiveness of native predators. One possible method is that of liberating large numbers of *Stethorus* in orchards early in the season when brown mite increases are first detected. This might hasten the build-up of the predator population and prevent severe infestations. Investigations on this approach have recently been initiated.

It is possible that low numbers of predators at certain times of the year are the result of a scarcity of food. Therefore, predator activity might be encouraged by providing a supplemental food during critical times of the year. Since both *Stethorus* and predaceous mites can utilize such liquid foods as nectar and honey for survival, it is possible that a synthetic food could be developed and sprayed on the trees in small quantities at critical times. Also worthy of future investigation might be growing plants, in strategic areas of the orchard, which would support alternate species of prey mites; so that more predators would be retained during periods of scarcity of the brown mite.

LITERATURE CITED

Fleschner. C. A., J. C. Hall and D. W. Ricker. 1955. Natural balance of mite pests in an avocado grove. California Avocado Society Yearbook 39:155-162.