

## FURTHER STUDIES ON CONTROL OF AVOCADO BROWN MITE WITH RELEASES OF *STETHORUS PICIPES*

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### INTRODUCTION

In 1966, a project was initiated in San Diego County to investigate the possibility of preventing severe infestations of the avocado brown mite, *Oligonychus punicae* (Hirst), by mass releases of the lady beetle *Stethorus picipes* Casey. This predator occurs naturally in southern California and is an important factor in the natural control of avocado brown mite (McMurtry and Johnson 1966). However, there are sometimes too few *Stethorus* present to multiply and control the mites soon enough, so that severe "bronzing" and some defoliation sometimes occurs. Therefore an experimental program of releasing beetles early in the season to supplement the natural population was conducted.

In an initial trial during 1966, large numbers of *Stethorus* beetles (up to 1000 per tree) were released on small plots in 4 orchards (McMurtry and Johnson 1967). The results were encouraging, and the following year releases of 400 adult beetles per tree were made on 16-tree blocks in each of 3 orchards. In all 3 orchards, the release plots showed a faster buildup of *Stethonis* populations, lower peak populations of avocado brown mites and a lower percentage of heavily damaged leaves compared to check plots where no releases were made (McMurtry *et al.* 1969).

A release rate of 400 *Stethorus* per tree is still beyond economic feasibility for use as a control program, as it is difficult and expensive to rear and collect large numbers of these predators. Therefore, subsequent research on this program has been devoted to determining the minimum number of beetles needed to obtain satisfactory control and the optimum timing of the releases. Results of these studies are summarized in this article.

### PROCEDURE

#### 1968 Experiments

Release experiments were conducted in 2 Hass orchards in the Fallbrook area of San

Diego County: (1) on Morro Hills Road, owned by A. Chaikin (2) on Sleeping Indian Road, managed by J. Diamond. The release area in each orchard consisted of an 8x8 block of trees. Eight trees were selected from the inner portion of the block for regular sampling to determine the population density of the avocado brown mite and *Stethorus* beetles. Another 8 sample trees were selected from a "cheek" area, where no releases were made. The check trees were located at least 8 rows away from the release blocks.

The trees were sampled at weekly intervals, counting all stages of *Stethorus* seen while examining each tree for a 5-minute period, and then taking a sample of 10 leaves per tree. Adult female brown mites on the leaves were counted in the laboratory with the aid of a binocular microscope (McMurtry and Johnson 1966).

A leaf-damage rating was also made at weekly intervals. A sample of 200 leaves each was taken at random from the release and check plots. The leaves were inspected in the laboratory and placed into one of the following categories: *light* — bronzing on only a small portion of the upper surface, usually along the midrib or main veins; *medium* — bronzing more widespread but still having definite green areas on the upper surface; *heavy* — bronzing over all or nearly all of the upper surface.

The first release of *Stethorus* beetles was made on August 5 at the rate of 50 adults per tree when the avocado brown mite population averaged 63 and 50 adult females per 10 leaf sample in Orchards No. 1 and 2 respectively. Three additional releases of 50 per tree were made at weekly intervals, for a total of 200 *Stethorus* per tree and 12,800 per plot. The beetles were carried to the field in small plastic tubes. The predators were tapped onto the trees after which the tubes were attached to a leaf to allow any remaining beetles to escape naturally.

### **1969 and 1970 Experiments**

Orchard No. 1 was used for the experiments during these 2 seasons. In 1969 the same experimental procedure was followed as in 1968 except that 4 releases of 25 adults per tree were made at weekly intervals (total 100 per tree) starting September 3 when the avocado brown mite population averaged 21 adult females and 58 immatures per 10-leaf sample. In 1970, the same sized release block was used, but releases were made only on every fourth tree. A release of 200 *Stethorus* adults on each of 16 release trees was made on July 28 when the avocado brown mite population averaged about 20 adults plus immatures combined, per 10-leaf sample; one week later 400 adult beetles were liberated on each release tree, resulting in a total of 9600 in the entire plot or an average of 150 per tree. Vials containing the beetles were hung in the release trees and then opened to let the *Stethorus* disperse naturally.

The sampling procedure for brown mite in 1970 was changed from that of 1968 and 1969. Twenty leaves were taken from each of 10 sample trees in each plot and the leaves were brushed in a mite-brushing machine. This machine removed the mites from the leaves and onto a rotating glass plate below. Both adult and immature mites were counted on the plates.

## RESULTS

### 1968 Experiments

Average population trends of the avocado brown mite (*O. punicae*) and *Stethorus* beetles (*S. picipes*) on release and check trees are shown for the 2 orchards in Figures 1 and 2. The mite population peak in Orchard No. 1 was equally high in both release and check plots. However, the mites were reduced sooner in the release plot (Fig. 1). The releases of *Stethorus* resulted in a faster buildup of these predators than that which occurred in the check plot. The timing of the releases may not have been optimum. If they had been started one or two weeks earlier, the predators probably would have suppressed the brown mite population sooner.

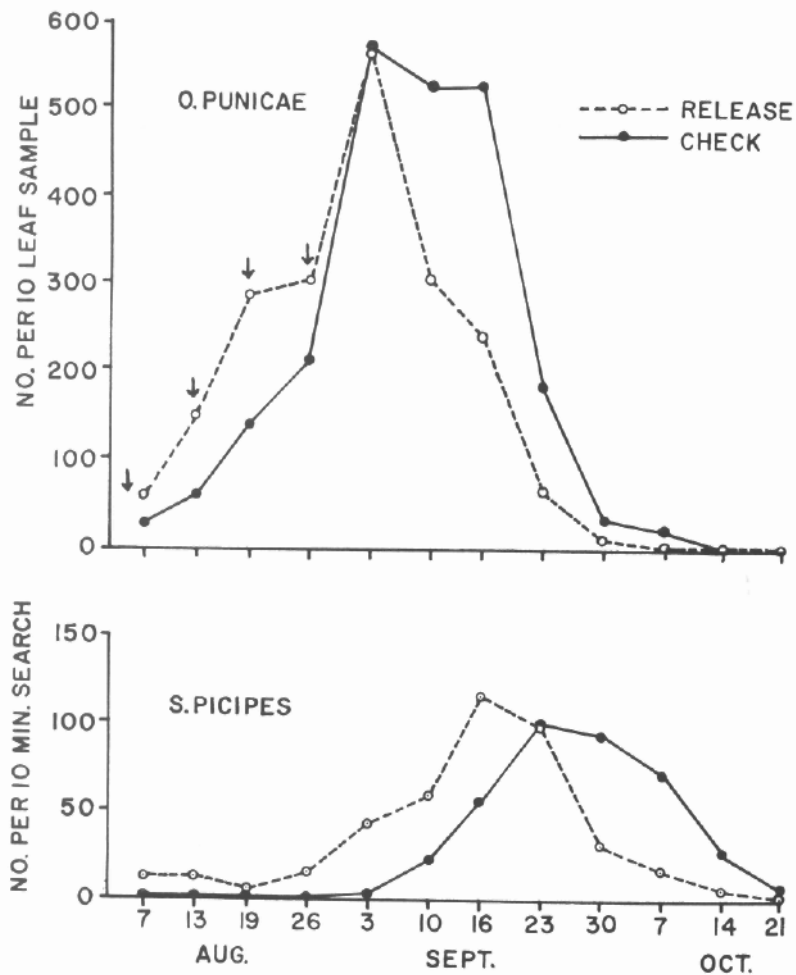


Figure 1—Population trends of avocado brown mite (*Oligonychus punicae*) and *stethorus picipes* in *Stethorus* release plots and check plots in Orchard No. 1 in 1968. Arrows indicate dates of releases.

In Orchard No. 2, the peak in the avocado brown mite population was lower and the decline started considerably sooner in the release plot compared to the check plot (Fig.

2). This was attributed to the *Stethorus* releases.

There were significantly less heavily damaged leaves (as shown by a t-test analysis) on the release plots as compared to the check plots in both orchards. Table 1 shows the ratings on the dates when leaf damage had reached a maximum, just after the mite populations declined. Depending upon environmental conditions, some or many of the heavily damaged leaves may drop. Therefore, the percentage of heavily-bronzed leaves is an important factor, and a significant reduction of heavily-bronzed leaves should be beneficial. In this experiment, little or no leaf drop occurred in the release trees, whereas there was obvious leaf drop on the check trees in both orchards. This indicates that the *Stethorus* releases were beneficial.

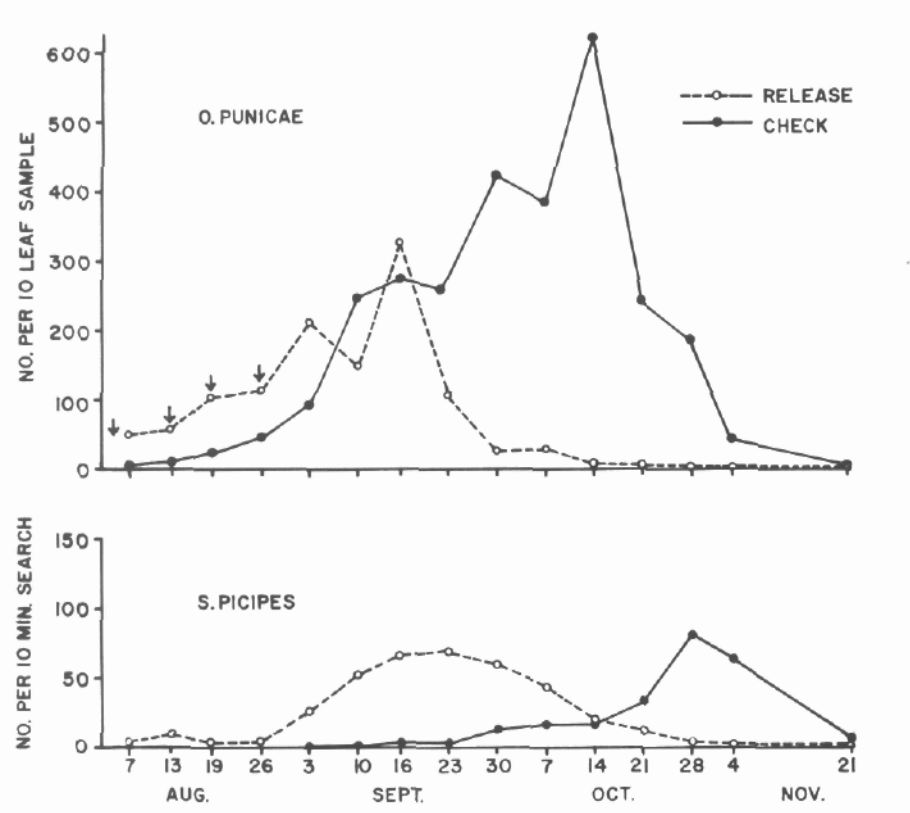


Figure 2—Population trends of avocado brown mite (*Oligonychus punicae*) and *Stethorus picipes* in *Stethorus* release plots and check plots in Orchard No. 2 in 1968. Arrows indicate dates of releases.

TABLE 1. MITE DAMAGE RATINGS OF LEAF SAMPLES TAKEN FROM *STETHORUS PICIPES* RELEASE PLOTS AND CHECK PLOTS.<sup>1</sup> FALLBROOK, CALIFORNIA 1968.

	% Leaves in Each Injury Category <sup>2</sup>		
	Light	Medium	Heavy
	Orchard No. 1		
Release	12.5	75.5	12.0
Check	3.0	67.0	30.0
	Orchard No. 2		
Release	10.0	77.5	12.5
Check	11.0	66.5	22.5

<sup>1</sup> Based on a sample of 200 leaves per plot taken after mite populations had declined (October 7 in Orchard No. 1, November 4 in Orchard No. 2).

<sup>2</sup> Light damage = bronzing confined to only a small area, usually along midrib or main veins; medium damage = bronzing more extensive, but upper surface still having large green areas; heavy damage = all or most of upper surface heavily bronzed.

### 1969-1970 Experiments

In 1969, the buildup of avocado brown mite started late (September) and the infestation was very light. Therefore, it was impossible to make evaluations of the effect of the *Stethorus* releases.

In 1970, the brown mite infestation was also generally light and "spotty." The peak averaged 400 adults plus immature stages per 10-leaf sample in the release plot and 640 per 10 leaves in the check plot. The latter figure represents a much lighter infestation than that which occurred in the check plots in 1968 (Figs. 1 and 2), since the 1970 samples included both adult and immature mites. Heavily damaged leaves reached a maximum of 10% in the check plot and 2.5% in the release. The natural abundance of *Stethorus* during this season was unusually high, probably because the avocado brown mites persisted in low numbers throughout the previous winter. This was apparently sufficient prey for a few of the predators to remain in the orchard and start reproducing before the brown mites reached high numbers in the summer. Consequently, relatively good mite control occurred in both release and check plots, and a critical evaluation of the effectiveness of the release could not be made.

### DISCUSSION

Research to date indicates that releases of *Stethorus* beetles can prevent severe defoliation from the avocado brown mite during "heavy" mite years, provided that the releases are properly timed and sufficient numbers of beetles are used. The minimum numbers required for effective control has not yet been determined. If as few as 25-50 per tree would be sufficient, this method of control might become economically feasible. Additional research is needed on this point. Although significant advances have been made on the mass-production of *Stethorus*, the problem of obtaining large numbers cheaply still poses a major obstacle to practical use of a release program. Because of reductions in funds and personnel, extensive research to improve insectary techniques of mass-producing mite predators has been curtailed. An alternative method is presently

being studied at Riverside whereby plantings of field corn are artificially infested with spider mites (*Tetranychus cinnabarinus* and *T. pacificus*), to encourage a buildup of *Stethorus* for collection and release in avocados. During 1971, *Stethorus* entered the cornfield naturally as spider mite numbers increased and by mid-August were increasing to large numbers. This method thus shows some promise and will be investigated further.

As stated previously (McMurtry and Johnson 1967), the releases must be properly timed in order to be effective. Although more trials are needed, it appears that releases should be started when the mite population has reached an average of about 2-5 (adults plus immatures) per leaf. To determine when this level is reached, frequent surveys are necessary. The 1970 studies indicated that a leaf-damage rating system could be used for a rapid assessment of mite populations to decide when *Stethorus* releases should be made. This would be a great improvement over the time-consuming process of counting mites under the microscope.

## LITERATURE

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