California Avocado Society 2000 Yearbook 84:95-109

Effect of Abamectin Treatment for Avocado Thrips on Populations of Persea and Avocado Bud Mite and Their Associated Damage to Leaves and Fruit

Ben A. Faber, Wee L. Yee and Phil A. Phillips
University of California Cooperative Extension, Ventura County

Abstract

Use of abamectin for avocado thrips, *Scirtothrips perseae,* also has effects on the persea mite, *Oligonychus perseae,* and avocado bud mite, *Tegolophus myersi,* in Ventura County, California. In this study individual trees were treated with the standard insecticides for thrips, sabadilla (Veratran D) and abamectin (Agri-Mek), using a backpack sprayer, or left untreated. Sabadilla reduced *S. perseae* numbers on young and old leaves but failed to reduce *O. perseae* and *T. myersi* numbers. Abamectin significantly reduced numbers of all three pests. In addition, abamectin reduced the amount of leaf drop associated with *O. perseae* feeding. In a companion trial, where abamectin and sabadilla were applied by ground rig in one orchard and another orchard was left untreated, there were no differences in *T. myersi* populations. When all three pests are present, the use of abamectin may be a more efficient strategy than the use of sabadilla.

Introduction

Avocados, *Persea americana* var. *drymifolia,* in Ventura County and other parts of coastal and southern California have been subjected to a wave of arthropod pests recently. Persea mite, *Oligonychus perseae,* appeared in Ventura in the summer of 1993, avocado thrips, *Scirtothrips perseae,* appeared in May of 1996 in a Saticoy avocado orchard, and an old pest, avocado bud mite, *Tegolophus myersi,* first identified in 1938, reemerged in significant numbers in 1997. Persea mite and avocado thrips are widespread in avocado orchards throughout coastal and southern California. Persea mite causes dramatic damage to leaves, whereas avocado thrips damages both leaves and fruit. The actual economic damage caused by persea mite is difficult to estimate because infestation is area-wide and comparisons among sites have not been made. Economic damage caused by avocado thrips feeding resulted in 15% or more of fruit from the Ventura area being downgraded at packinghouses in 1997-98. However, this did not include fruit that dropped off trees and never made it to the packinghouses. Bud mite can be nearly as or equally damaging to avocados, causing elongated, deformed fruit that drop from the tree. It is found throughout Ventura County, but seems to affect some groves more than others. The fruit drop caused by bud mite and perhaps avocado thrips can easily be confused with the normal fruit drop that occurs at fruit set.

The insecticide sabadilla plus sugar bait (Veratran-D, Dunhill Chem.) has been regularly used against avocado thrips over the last couple of years, but with only moderate success. Its effectiveness is limited by factors such as its relatively short residual activity, inability to kill high numbers of large larvae and adults, and greatly reduced efficacy under high humidity and rainfall. An alternative, environmentally safe insecticide that is more effective against thrips is needed for use in avocado thrips infested areas of California. In February 1999 a Section 18 for abamectin (Agri-Mek) (Novartis), a miticide and insecticide, plus 0.25%-1.0% NR (narrow range) 415 oil, was approved for avocado thrips control. Abamectin is derived from the soil microorganism, *Streptomyces avermitilis,* and seems to be less harsh and safer on the environment than certain pyrethroids (e.g., Baythroid) that are also effective against avocado thrips. Abamectin has been used for mite control on citrus and is known to reduce persea mite populations. It is unknown whether abamectin is effective against bud mite, but the related citrus bud mite, *Acería sheldoni,* is effectively treated with this chemical. Sabadilla does not seem to control either bud mite species.

The impact of widespread use of abamectin is unknown, although it has been used quite successfully on citrus. The intentional application of abamectin for avocado thrips may have the added side effect of controlling the other two pests. Alternatively, it may have the unintended effect of causing further damage from these pests. This might occur if natural enemies of the persea mite, which include other mites such as native *Euseius hibisci* and introduced *Galendromus helveolus,* are affected, or if leaf tissue is injured by the chemical, resulting in leaves that are more susceptible to damage and more likely to drop. Although persea mite has been studied for nearly nine years, its economic effect on avocados is still unknown.

The purpose of this project was to evaluate the effects of abamectin application for avocado thrips on persea mite and bud mite populations and subsequent damage to avocado leaf health and fruit production.

Materials and Methods

Trial 1 Study Site: Abamectin and Sabadilla Effects on Pest and Predator Complex.

The study site was located in Somis, Ventura County, in a six to seven year old commercial 'Hass' avocado orchard. Individual trees, approximately eight feet tall were sprayed between June and September 1999 with either abamectin or sabadilla, or left as untreated controls. Each tree was a replicate and was spaced 15 feet from the nearest trees. Ten replicates were used for each treatment, for a total of 30 trees in the experiment. Two rows of the orchard were chosen, each with 15 trees. The treatments were arranged in a completely randomized block design within the two rows. Treatments were assigned by blocking on avocado thrips densities as numbers of thrips per 3/4 expanded young leaf.

Pre-treatment counts of avocado thrips and persea mite were made on flagged trees (using the sampling method described below). Applications of abamectin (10 oz/acre) plus 1% oil and sabadilla (15 Ibs + 10 Ibs sugar/acre) were made 4 days after mean numbers of immature thrips reached 30-35 per 3/4 expanded leaf. Using a backpack sprayer, materials were applied in approximately 0.6 liters water per tree. Post-treatment counts were made 3, 6, 12, 19, 26, 33, 46, and 53 days after treatment (DAT). Trees were sprayed again 29 days after the initial application.

To determine avocado thrips and persea mite populations, counts (pre- and post-treatment) were made using a head lens on ten randomly selected older and ten 3/4 expanded leaves per tree throughout the season. Numbers of first and second instar and adult thrips and all motile mites per leaf were recorded. Percentages of leaves with mite damage were determined by assessing fallen leaves on tarpaulins for the presence of necrotic spotting (indication of mite feeding and nesting sites). All leaves were counted on the tarpaulins on a weekly basis to assess total leaf drop.

To determine bud mite numbers, ten buds per tree were collected and returned to the laboratory, where they were dissected for mites under a microscope. All motile stages of bud mite were counted in each bud examined.

To relate the effects of abamectin and sabadilla on fruit drop, one mesh tarpaulin (6 ft by 6 ft) was placed under each of the five trees per treatment. Fruit that accumulated on tarpaulins were counted twice a week. All fruit were collected and scored for scarring attributable to avocado thrips and persea mite, and malformations attributable to bud mite.

Natural Enemy Populations.

Beneficial arthropods (primarily predatory thrips and mites) were also recorded on all leaves sampled for pests.

Effect of Persea Mite on Leaf Drop and Chlorophyll Levels.

The same plot design and trees used in the previous study were used to measure chlorophyll levels of leaves infested with persea mite. On 11 August, chlorophyll readings were made on 5-10 leaves of two stages: the younger, fully expanded terminal leaves and the older 4th or 5th node leaves on the middle of the branch in each plot. A SPAD 502 chlorophyll meter (Minolta) was used to take readings. This meter measures the amount of green in a leaf, an indicator of the leaf's relative nitrogen content. On 1 September, five older leaves from each plot were also measured.

Leaf drop was determined using the same method for capturing fallen fruit as described above. Numbers of leaves collected on the mesh tarpaulins were related to persea mite numbers on leaves over the course of the season.

Trial 2 Study Site: Abamectin and Sabadilla Effects on Bud mite.

Two 'Hass' orchards, one (12 year old trees) treated with sabadilla on 7 June and abamectin on 5 July and the other (20 year old trees) left untreated and located 2 miles away, were surveyed for bud mite beginning from June to September. Ten selected trees with high numbers of flower buds were selected from each site and sampled weekly. Five buds from four branches (20 total buds) were clipped from each tree using shears. Only buds from the terminal five inches of a branch were removed. Buds (400 total each week) were placed in plastic bags, transported to our laboratory, and examined under a

Natural Enemy Complex.

Predator levels were too low throughout the trial to be analyzed. This was likely due to the small tree size and lack of favorable habitat.

Leaf Drop and Chlorophyll Levels Associated with Persea Mite.

Trees sprayed with abamectin showed less leaf drop than those sprayed with sabadilla or unsprayed (Fig. 5). Fallen leaves under the control and sabadilla treatments had significantly more persea mite damage (necrotic spotting) than the abamectin treatment. However, there were no discernible differences in chlorophyll content measurements among any of the treatments.

Avocado Bud Mite Populations.

In Trial 1, avocado bud mites were unaffected by sabadilla, but like persea mite, were affected by abamectin, up to 29 days after treatment; the second application further reduced numbers to near zero (Figs. 6A and 6B). Numbers in the controls were consistently around one per bud throughout the season.

In Trial 2, where 2 commercial orchards were either treated or untreated with abamectin, pre-treatment bud mite populations in the 2 orchards were similar to those in the untreated small experimental plot just mentioned. However, in the case of this larger trial there were no post-treatment population differences between treated and untreated plots, and there was no relation to fruit drop (Figs. 7A and 7B). Despite the presence of the bud mites, no fruit at these orchards were malformed.

Discussion

The results suggest that abamectin has multiple effects and thus may be more suitable in an integrated pest management (IPM) program on avocado than sabadilla, which is limited only to thrips, when all three pests are present. It is important to realize that use of a backpack sprayer, which allows thorough leaf coverage on small trees, will be more effective than the use of a helicopter on large trees. Ground rigs will provide an intermediate efficacy. This seems to be suggested in Trial 2 by the abamectin application against avocado bud mite in the two commercial orchards, where bud mites numbers were not decreased. In this trial, materials were applied by a commercial applicator to the treatment orchard specifically to control avocado thrips. Possibly if the abamectin had been applied earlier and more thoroughly, there might have been an effect on bud mite numbers and fruit drop. As it was, there was no measurable effect on bud mite numbers after the July application in the large plot trial.

Because so few beneficiáis were found, it is not possible to determine if sabadilla or abamectin is less harsh. Previous studies suggest both are relatively safe against the predatory mites. However, given that abamectin is such an effective miticide, it may not be surprising if there is some predatory mite mortality associated with its use, especially after potential food chain effects.

A very important effect of abamectin was the prevention of leaf drop, presumably the result of reduced persea mite populations. Mites feeding on leaves caused the leaf drop, and in the most heavily infested trees, the canopy was nearly opened completely.

Avocado bud mite biology is little known, as are its effects on fruit. There was no evidence in this study that the mites were causing early drop or deforming fruit, and therefore, the necessity of controlling them is debatable when densities are below one per bud. However, when populations are greater than two per bud, malformed fruit can result and in these situations control measures may be necessary.

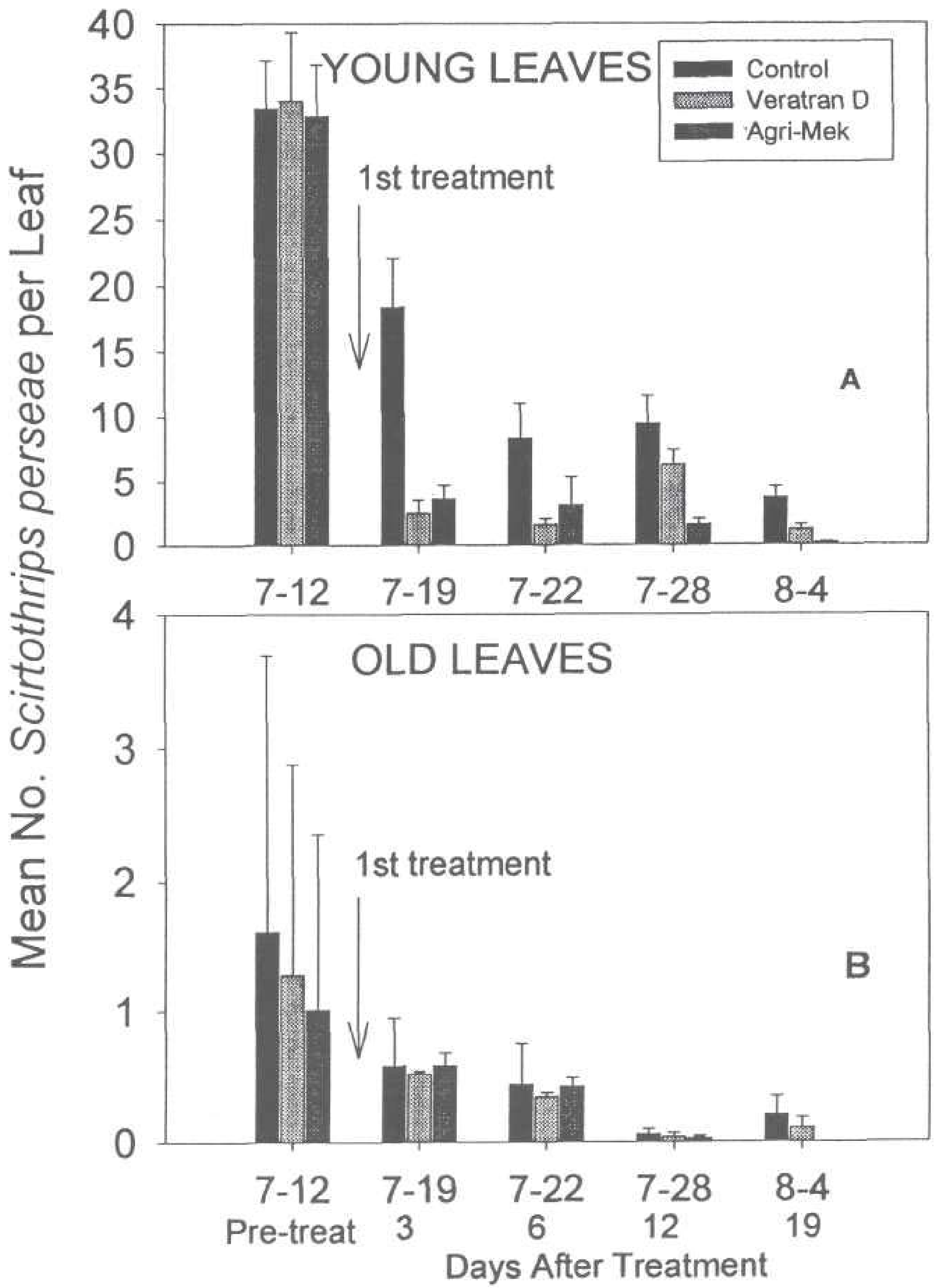

Figure 1. Mean numbers of avocado thrips (July 12 to August 4) on young and old leaves after treatment with Veratran D and Agri-Mek. *Note: scale is different for the two charts.*

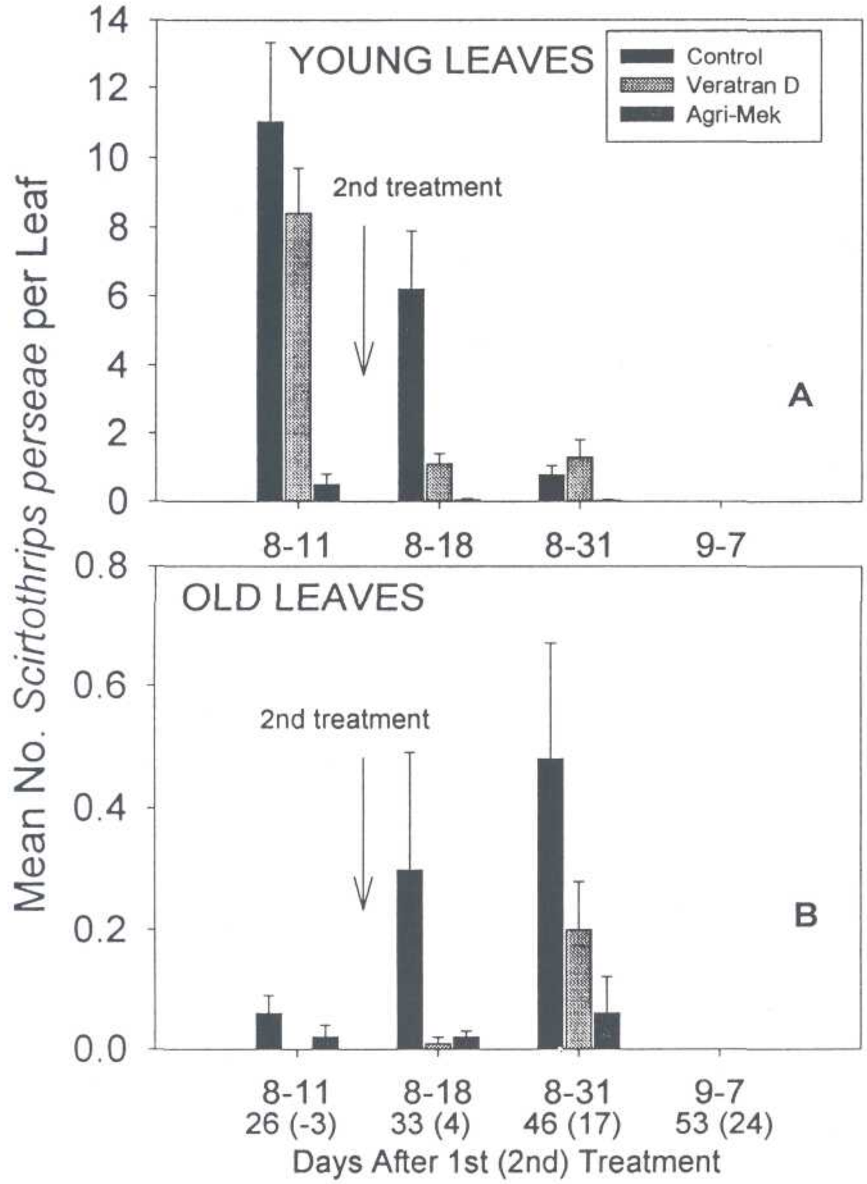

Figure 2. Mean numbers of avocado thrips on young and old leaves from August 11 to September 7. There were no thrips on last sampling date. *Note: scales on the two charts are different.*

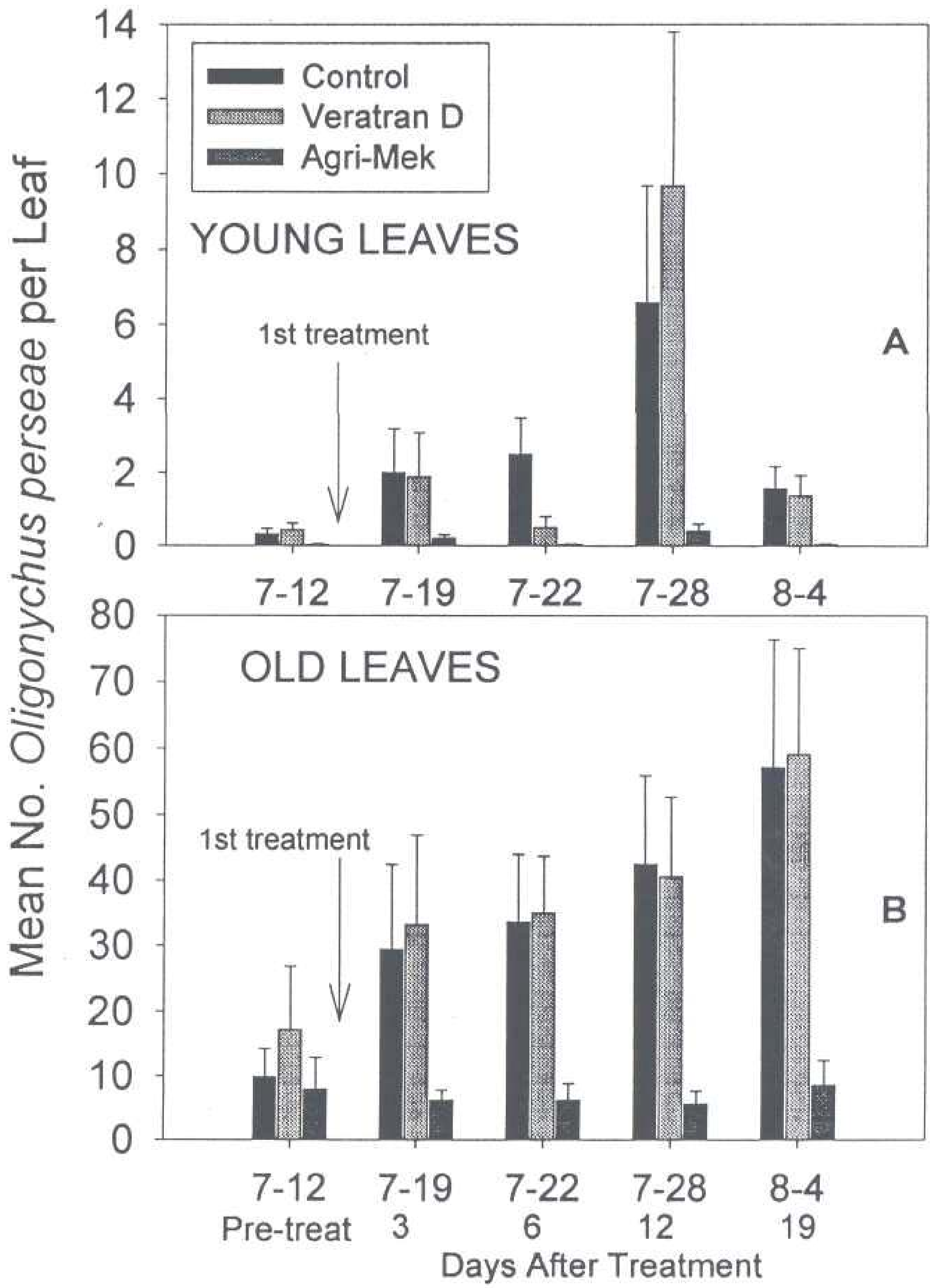

Figure 3. Mean numbers of persea mite on young and old leaves July 12 to August 4. *Note: scales on the two charts are different.*

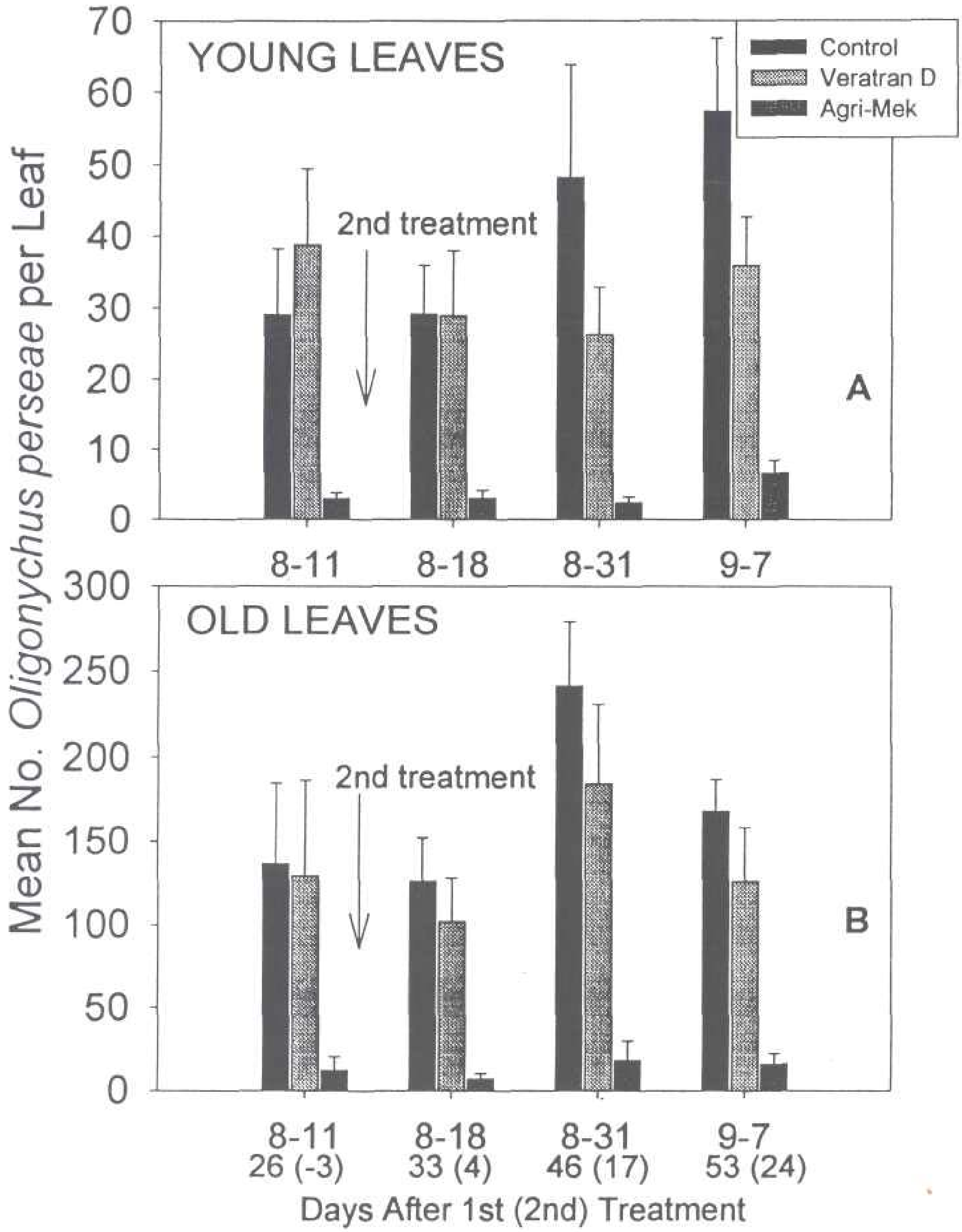

Figure 4. Mean numbers of persea mites on young and old leaves August 11 to September 7. *Note: scales on the two charts are different.*

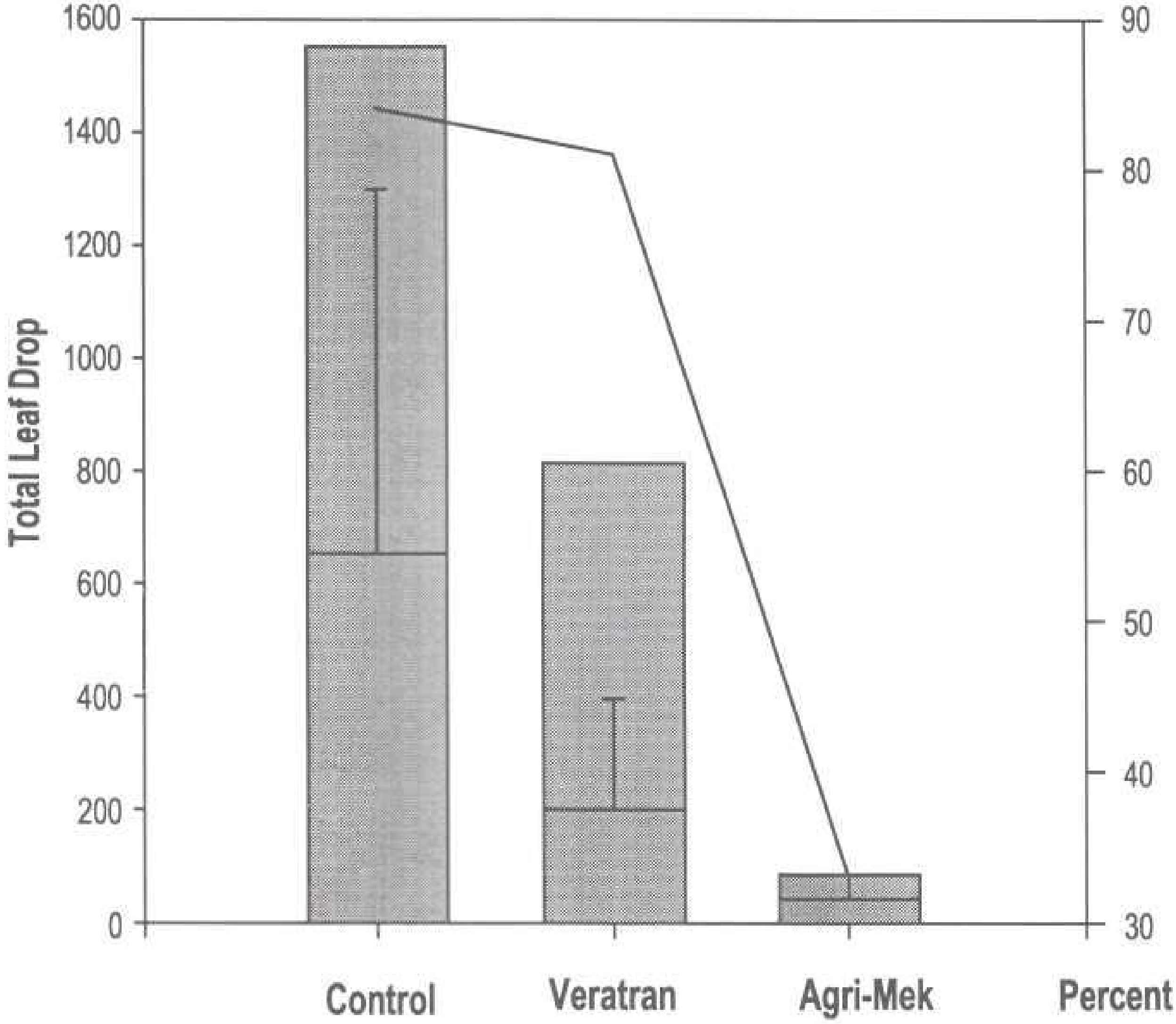

Figure 5. Total leaf drop (bars) under five trees of each treatment. Percent of fallen leaves that had mite damage are shown as a line.

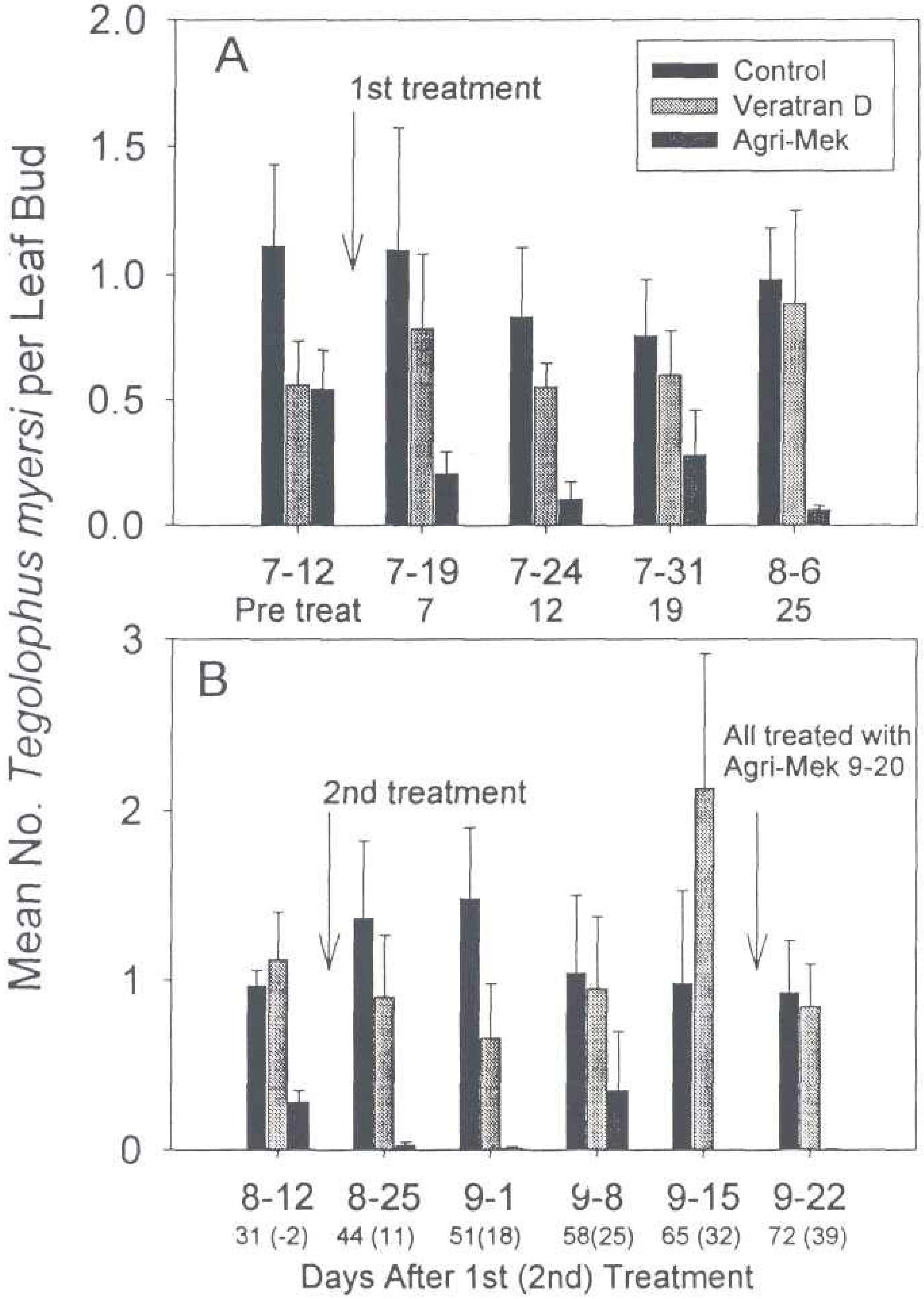

Figure 6. Mean numbers of bud mites per bud.

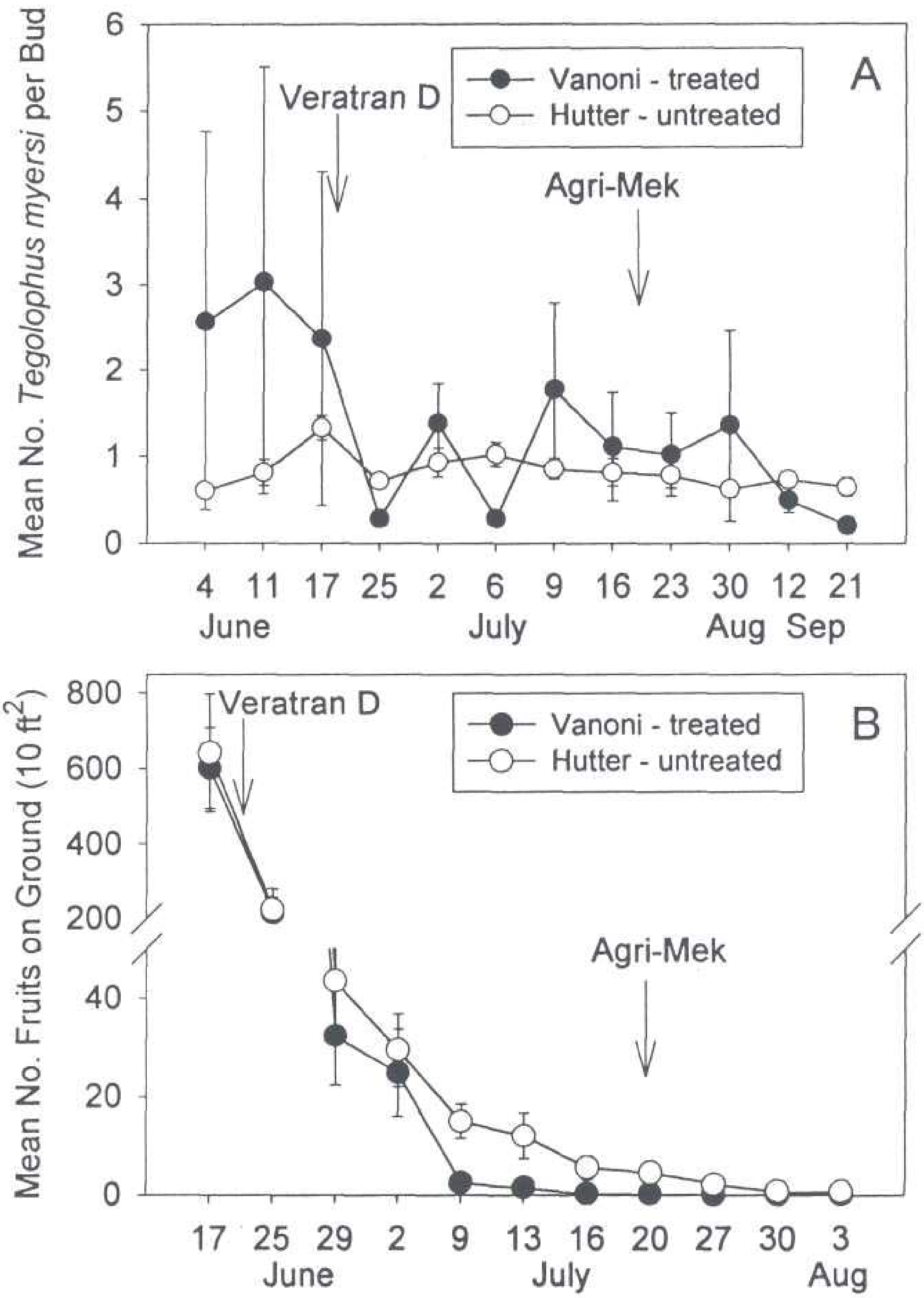

Figure 7. Mean numbers of bud mite and fruit drop at two orchards, one untreated and the other sprayed with sabadilla followed by a second abamectin application a month later.