Woolly Apple Aphid Control

upward and downward migration of aphid throughout trees reduced in preliminary experiments with chemical compounds

Harold F. Madsen and Stanley C. Hoyt

Continual movement of the woolly apple aphid throughout the tree is one of the major difficulties in its control.

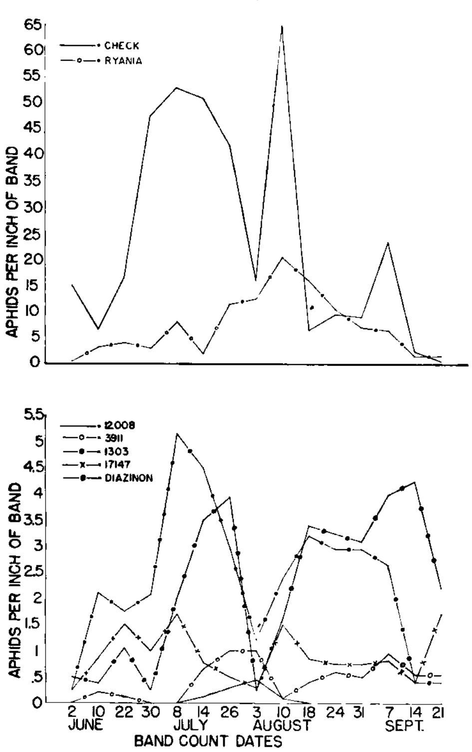
During the summer months, the movement is both upward and downward—from the roots to the aerial portions of the tree and from the limbs and twigs to the roots.

The woolly aphid overwinters as colonies both on the roots and on the limbs and twigs. Although a dormant oil-dinitro spray—applied in January or February—will destroy the colonies in the aerial portions of the tree, summer movements from the roots soon re-establish the infestations.

Damage from aphid feeding consists of swellings and bumps on the limbs, twigs, and roots, and the production of honeydew which may fall on the fruit. The black fungus which grows in the honeydew causes the fruit to blacken.

In addition to this damage, the yellow Newtown pippin apple—grown in the Watsonville district—is subject to core aphid attack. This variety of apple has a high percentage of fruit with open calyx ends, which—while not always apparent by superficial examination—are disclosed when a channel is cut from the calyx end to the core. Aphids may infest the cores through this open channel and establish colonies. Since the yellow Newtown pippin is used for canning purposes as well as for fresh fruit, the presence of the aphids inside the apple creates a problem to the processor. It is not always possible to remove the complete core during the canning operation and, as a result, the finished product may have a high insect parts count.

Upward movements—woolly apple aphid plots, Watsonville, 1955.



Chemicals Tested

In order to evaluate several new chemicals for control of the woolly apple aphid, a plot was established—near Watsonville—in a young block of Newtown pippin apples. There was a history of heavy aphid infestation in this orchard the past several seasons, and the trees showed evidence of aphid attack. Materials chosen for the experiment were Ryania, a botanical compound; 12008 and 3911, two systemic phosphate compounds; and 1303, 17147, and Diazinon, three nonsystemic phosphate compounds.

The plots consisted of single trees, replicated eight times. Materials were applied with conventional ground equipment, and applied gallonage averaged 350 gallons per acre. The first application was made at the petal-fall stage on April 19, and additional applications were made at monthly intervals. The trunks of the trees as well as the foliage were carefully sprayed each treatment.

During the course of the experiment, records were kept of the upward and downward movement of aphids on both treated and untreated trees. Aluminum foil bands, 2″ in width, were tightly placed around the trunks of the trees. The foil bands were then treated with a ring of sticky material—such as tree tanglefoot or deadline—which served to trap the aphids. The bands were removed each week and replaced with new bands. The upward and downward movement of the aphids were determined by counting the numbers of aphids caught on the edges of the sticky band, and were recorded as the number of aphids per inch of band.

The seasonal aphid movements are shown in the two charts on this page. As indicated in the chart showing the upward movement, the aphids began their migration from the roots in early June, reaching peaks—on the unsprayed trees—in July and August. The variation in movement on the treated trees was apparently due to the effect of the chemicals on the tree trunks. The two systemic materials—12008 and 3911—stopped almost all movement from the roots, apparently because of the residual effect of the materials on the bark rather than any systemic effect in the roots. The upward movement was also reduced to a low level by 17147, as well as by Diazinon and 1303.

Ryania, although reducing the movement below that of the check, was considerably less effective than the other materials mentioned.

In the chart showing the downward movement, considerable migration is again indicated on the unsprayed plots.

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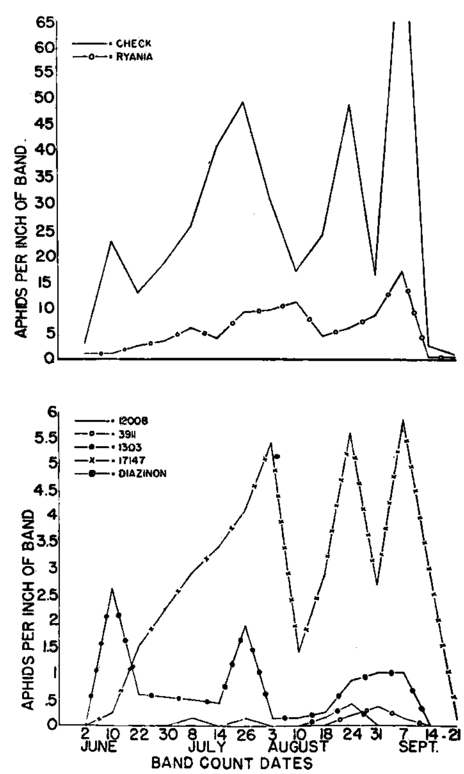
Downward movements—woolly apple aphid plots, Watsonville, 1955.



SODIUM–CALCIUM

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solutions and decreasing those of calcium was to greatly reduce the fresh and dry weights of the root systems.

In drained soil cultures of three-gallon capacity the effect of adding increasing concentrations of sodium nitrate to Hoagland's nutrient solution was studied to determine whether any changes occurred in the calcium content of the dry matter of the roots when calcium was always abundantly supplied. At the two highest sodium concentrations, the calcium content of the roots of rough lemon seedlings showed a decrease. An increase in sodium nitrate in the nutrient solution was accompanied by an increased calcium content in Cleopatra mandarin roots.

The table on page 13 shows the consistently high calcium content of the roots of the sour orange—Spanish—seedlings in the various sodium nitrate cultures.

Results of the tests confirm previous preliminary findings on the calcium content of the roots of various citrus rootstocks collected from trees in the rootstock variety plots. In the plots of these orchard trees, there were no appreciable sodium concentrations and the results in the table indicate the tendency to maintain a more or less stable calcium and magnesium content in the roots of citrus seedlings when sodium is increased and the supply of calcium is maintained by the nutrient solution and initially increased by base exchange.

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APPLE APHID

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There were three heavy peaks of movement—in late July, late August, and early September. The sudden drop in September was due to the action of parasites which killed a high percentage of aphids during this time. In the treated plots, the downward movements can be used as a measure of the control obtained following the foliage applications. As shown by the almost negligible number of aphids trapped on the bands, 12008, 3911, and Diazinon were very effective. Good control—though less outstanding—was also obtained with 1303. In contrast to its effect on upward movements, the weakest of the phosphate compounds was 17147, the reason for which is not clear. Ryania—as compared with the check—again showed a reduction in aphid movement but was far less effective than the systemic and nonsystemic phosphate compounds.

As a check on the method of analyzing results by the use of sticky bands, colony counts and core aphid counts were made on each plot at harvest. The colony counts were made by recording the number of active colonies on four limbs in each tree and were expressed as the average number of aphid colonies per limb. The core aphid count was made by selecting 100 apples at random from each plot, cutting them in half from calyx to stem, and recording the number of infested cores. The materials used, dosages, times of application, and harvest counts are summarized in the table below.

Summary of 1955 Woolly Apple Aphid Plots, Watsonville, California

Material	Dosage per 100 gals.	Dates of application	Harvest counts: Av. no. aphid colonies per limb	Harvest counts: % core aphid
Ryania	6 lbs. 100% wettable	Apr. 19 May 26 June 23 July 27	2.7	7.0
Am. Cy. 12008	1 qt. 48% emulsion	Apr. 19 May 26 June 23 July 27	0.1	0.0
Stauffer 1303	1 pt. 50% emulsion	Apr. 19 May 26 June 23 July 27	0.5	1.0
Bayer 17147	1 lb. 50% wettable	Apr. 19 May 26 June 23 July 27	1.2	2.0
Diazinon	1 qt. 25% emulsion	Apr. 19 May 26 June 23 July 27	0.3	0.0
Check	No spray	....	9.6	16.0

The harvest counts correlated closely with the band counts. Excellent control was obtained with 12008, 3911, and Diazinon. Less effective—but still providing commercial control—were 17147 and 1303. Ryania was the least effective of the materials used.

At harvest—because the number of colonies present in the check trees indicated that a higher percentage of core aphid should have been present—a check was made and 50% of the apples were found to have an open calyx, which was less than had been recorded in previous seasons. Although many apples in the unsprayed plot had active aphid colonies on the stem and calyx end, the aphids were nevertheless unable to penetrate to the core. The variation in core aphid infestations from season to season is no doubt connected not only with the severity of aphid infestations in the tree but also with the factors which cause open and closed calyx ends in the fruit.

Most of the chemicals used in the Watsonville plots are still in the experimental stage. In the case of the systemic compounds—which were so effective in reducing the aphid movements—it may be possible, in further tests, to lengthen the intervals between treatments.

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PINE

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roots within the first month, October and November seedlings produced an average of less than three new roots over ½″ long per seedling, whereas the April transplants averaged more than eight new roots over ½″ long per seedling—a highly significant difference statistically.

Close examination of the seedlings that produced roots and of those that did not failed to reveal any external morphological differences. Apparently, therefore, some physiological condition exists which is associated with the ability of seedlings to produce new roots.

If these findings are substantiated by later and more comprehensive observations, a basic change taking place during the winter which increases the ability of the seedling to produce roots will be indicated.

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WALNUT APHID

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results can be obtained only where they are thoroughly applied with adequate equipment under favorable weather conditions.

In areas where the resistant walnut aphid is known to occur, an aphicide other than parathion, malathion, or TEPP must be used.

Insecticides used in the walnut aphid control program are poisonous and care must be exercised in handling and applying them, especially with parathion, TEPP, and Systox. Precautions—as given on the insecticide manufacturer's container—should be followed carefully.

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