

## ORGANIC PEST CONTROL: TWO YEARS EXPERIENCE IN A COMMERCIAL APPLE ORCHARD<sup>1</sup>

H. F. MADSEN AND B. E. CARTY

Agriculture Canada, Research Station,  
Summerland, British Columbia V0H 1Z0

### ABSTRACT

An orchard under an organic control program was studied for the incidence of pests during 2 years. Sex pheromone traps were used to control codling moths, *Laspeyresia pomonilla* (Linnaeus), by removing males. The only pesticides used in the orchard were petroleum oil at the delayed dormant period to suppress the overwintering eggs of the European red mite, *Panonychus ulmi* (Koch); and *Bacillus thuringiensis* to control leafrollers, *Archips argyrospilus* (Walker), and *Archips rosanus* (Linnaeus). Leaf and fruit samples were taken for all the major pests which attack apples but the only pests which required treatment were the white apple leafhopper, *Typhlocyba pomaria* McAtee in 1977 and the codling moth in 1978. The failure to control codling moth may result in the curtailment of the organic program unless supplemental controls can be found.

### INTRODUCTION

Considerable experience has been obtained in British Columbia interior apple orchards on pest management (Madsen, Peters and Vakenti 1975, Madsen and Carty 1977). All of the pest-managed programs so far have depended upon chemical control when samples indicated a need for treatment. In 1977, one of our orchardists, who had been under a pest-managed program for 4 years, decided to manage his apple orchard organically. We viewed this move as an opportunity to evaluate organic control on a commercial basis. The orchardist did not eliminate pesticides, but restricted their use to petroleum oils, *Bacillus thuringiensis*, and soaps which are approved as organic pesticides.

### METHODS

The isolated orchard of about 5 ha was bordered by Vaseux Lake on the west and Highway 97 on the east. A relative of the orchardist had about 2 ha of peaches and apples across the highway and there were a few apple trees 1 km to the south and an orchard 2 km to the north. There were three cultivars in the orchard, 'Spartan', 'Red Delicious' and 'Golden Delicious'.

We decided to use pheromone sticky traps to remove male codling moths, *Laspeyresia pomonella* (Linnaeus), since this method had been successful in an isolated orchard in another area of the Okanagan Valley (Madsen, Vakenti and Peters 1976). Pheroncon<sup>®</sup> 1 CP traps (Zoecon Corp., Palo Alto, CA) baited with Pherocon<sup>®</sup> rubber caps containing 1 mg of codlemone were used to capture male codling moths. The traps were installed at a density of 10 per ha because codling moth populations were similar to those in the orchard where male removal had been successful. The traps were

suspended about 1.6 m from the ground, examined weekly and the captured moths recorded and removed. The entrapment portion of the trap was replaced if contaminated and was changed routinely after 3 months use. The attractant caps were replaced at 4-week intervals.

All major pests were sampled during 1977 and 1978 but because the orchard was under an organic program, sprays were not necessarily applied even though an economic threshold level may have been exceeded. Sampling methods were the same as those described by Madsen and Carty (1977) with one exception: a limb tap sample at full bloom was substituted for the pink bud cluster sample to assess lepidopterous pests which attack apples during this period.

Only 2 chemicals were used during 1977 and 1978. One was petroleum oil which was applied as a delayed dormant spray to reduce populations of aphids and European red mites, *Panonychus ulmi* (Koch), by suppressing their eggs. The other was Dipel<sup>®</sup> a 3.2 percent wettable powder formulation of *Bacillus thuringiensis* applied at the pink and petal fall stages to control leafrollers and other lepidoptera.

The final evaluation of the program was made at harvest where about ¼ of the three apple cultivars were examined in the field for insect damage. All damage was recorded and used to calculate the percentage of the fruit injured by insects which attack fruit directly. We estimated the injury caused by pests which attack leaves and have an indirect effect upon the apples, by examining the apples for size and color.

### RESULTS AND DISCUSSION

The best way to discuss our data over the 2-year period is to present the information by pest species.

**Codling Moth** — Male codling moth captures

<sup>1</sup>Contribution No. 499, Research Station, Summerland.

are illustrated in Fig. 1. In 1977, we captured a total of 166 male moths and the percentage injured fruit, an average of the 3 varieties, was 0.6. These were encouraging results in the initial year of male removal, but an infestation of 0.6 presented a potential problem for the following season. Total male captures during 1978 was 878, a 5-fold increase over the previous year. As Fig. 1 illustrates, most of the moths were captured during second generation activity. The percent injured fruit was 7.0 which is an 11-fold increase and an unacceptable level in a commercial orchard. These data demonstrate the resurgence capability of the codling moth and indicate that male removal is effective only under special circumstances, of which isolation is one (Madsen, Vakenti and Peters 1976).

Leafrollers — Two species of leafroller were present, the fruittree leafroller, *Archips argyrospilus* (Walker), and the European leafroller, *Archips rosanus* (Linnaeus). In addition, heavy populations of Bruce spanworm, *Operophtera bruceata* (Hulst) were recorded in 1977. Bruce spanworm is active during the pre-bloom period and is mainly a blossom and leaf

feeder (McMullen 1973). Since *Bacillus thuringiensis* is considered an organic pesticide, we applied 2 sprays, one at the pink stage and one at the petal fall in both seasons. Samples indicated a need for treatment in 1977, but not in 1978. The orchardist, however, decided to apply *Bacillus* in 1978 regardless of our sample and advice. Injury to the fruit caused by this complex of lepidoptera was 0.2 percent in both 1977 and 1978 which is excellent control. Although we were not able to establish a control plot in the orchard, injury caused by leafroller was in the range of 2.0 percent in 1976 following a single petal fall spray of axinphos-methyl. These data indicate that *Bacillus thuringiensis* can provide control of leafroller and Bruce spanworm on apples although 2 applications are required to provide protection during the period from pink to petal fall.

Scale Insects — The samples at harvest showed no infestation of San Jose scale, *Quadraspidiotus perniciosus* (Comstock), although it is abundant in the area. It is probable that the routine application of petroleum oil keeps this pest under control.

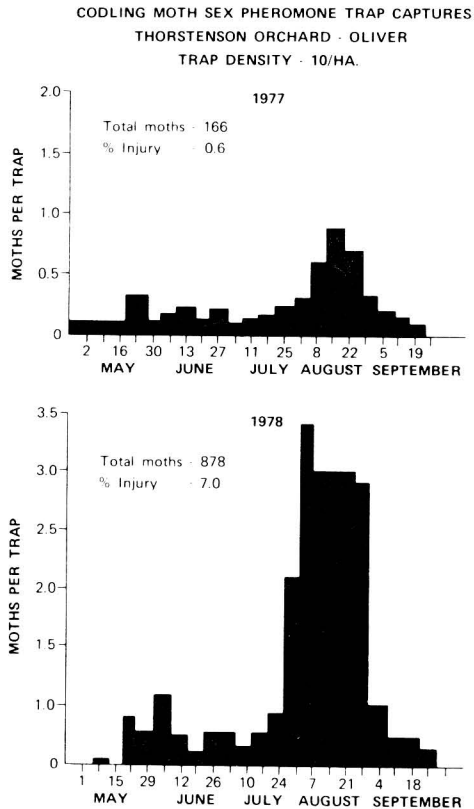


Fig. 1. Male codling moth captures, 1977-1978, in the Thorstenson Orchard, Vaseaux Lake, Oliver, B.C.

**Leafhoppers** — The white apple leafhopper, *Typhlocyba pomaria* McAtee, exceeded our treatment level in 1977 and leaf damage was extensive. At harvest, we were unable to show any effect upon size or color of the apples as a result of this heavy infestation. Leafhopper adults were so numerous, however, that they were a nuisance factor to the pickers. In 1978, our samples showed very few leafhoppers and examination of leafhopper eggs indicated a high percentage of parasitism from an unidentified braconid parasite. This parasite effectively controlled white apple leafhopper so that it was not a problem during the entire season.

**Thrips and Campyloomma** — The western flower thrips, *Frankliniella occidentalis* (Pergande), was present in both years, but blossom samples did not indicate a need for treatment. Injury to the susceptible 'Spartan' variety was negligible. *Campyloomma verbasci* (Meyer), a fruit feeding mirid, was present but in very low numbers and there was no indication of injury to the susceptible varieties 'Red Delicious' and 'Golden Delicious'.

**Aphids** — Rosy apple aphid, *Dysaphis plantagina* (Passerini) was present on scattered trees in both seasons, but the orchardist was able to keep the pest under control by pruning the infested terminals. Apple aphid, *Aphis pomi* DeGeer was noted only on young trees and was

not abundant enough to cause any damage.

**Mites** — Biological control of the European red mite and the apple rust mite, *Aculus schlechtenali* (Nalepa), occurred in both seasons. The applications of delayed dormant petroleum oils assisted by reducing the number of viable eggs of the European red mite. There was an excellent ratio of the predator, *Typhlodromus occidentalis* Nesbitt to the phytophagous mites and the latter was held well below a treatment level. Downing and Arrand (1978) state that a ratio of 10:1, European red mite to predators, is sufficient to control this pest; the ratio here was about 5:1 to 8:1 throughout the growing season. The eggs of European red mite were sampled in December 1978; the counts indicated a very low level of eggs and thus no need for an oil spray in 1979.

In summary, 2 years of organic control in this orchard has resulted in satisfactory control of all pests except white apple leafhopper in 1977 and codling moth in 1978. The codling moth is the key pest on apples and an infestation of 7.0 percent in 1978 will undoubtedly result in a considerable increase in codling moth in 1979. Our data indicate that male removal will not suppress this population level and that the experiment on organic control will have to be abandoned unless supplemental controls for codling moth are found.

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