PEST MANAGEMENT: FOUR YEARS EXPERIENCE IN A COMMERCIAL APPLE ORCHARD

H. F. MADSEN AND B. E. CARTY[1]
Research Station, Agriculture Canada,
Summerland, British Columbia

ABSTRACT

Pest management in a 12 ha apple orchard from 1973 to 1976 resulted in a 50 percent reduction in the number of sprays that are normally applied to control insects and mites. Codling moth, *Laspeyresia pomonella* (L.), populations were monitored by sex pheromone traps and populations of other insects and mites were assessed by specific sampling techniques. Leafrollers were the most difficult pests to control and fruit injury was 1.5 to 2.0 percent in 3 of the 4 years. Mites were held below treatment levels by the predator, *Typhlodromus occidentalis* Nesbitt, except for the apple rust mite, *Aculus schlechtendali* (Nalepa) which required chemical control.

INTRODUCTION

Six commercial apple orchards were pest managed from 1973 to 1976 in order to validate sampling techniques and economic injury levels for major apple pests. This paper examines the data from one of these orchards over a 4-year period. Pest intensity varies from orchard to orchard, and date from one site is not completely representative of all areas. However, it does illustrate the efficiency of procedures and the value of pest management as a method of pest control.

METHODS

The pest managed orchard was located in East Kelowna, B.C. in the heart of an apple and cherry growing area. It was 12 ha in size and planted to 4 apple cultivars, McIntosh, Spartan, Red Delicious and Golden Delicious. The McIntosh and Spartan trees were in solid blocks and the Red Delicious were interplanted with Golden Delicious. All trees were standard plantings with variable planting distances. Previous to 1973, the orchard was sprayed routinely following recommendations in the B.C. Tree Fruit Production Guide and received ca. 7 applications each season.

The following pests were monitored during the 4-year study: European fruit scale, *Quadraspidiotus ostreaeformis* (Curtis); San Jose scale, *Quadraspidiotus perniciosus* (Comstock); fruittree leafroller, *Archips argyrospilus* (Walker); European leafroller, *Archips rosanus* (Linnaeus); codling moth, *Laspeyresia pomonella* (Linnaeus); western flower thrips, *Frankliniella occidentalis* (Pergande); the mirid *Campylomma verbasci* (Meyer); white apple leafhopper, *Typhlocyba pomaria* McAtee; eyespotted budmoth, *Spilonota ocellana* (Denis & Schiffermüller); apple aphid, *Aphis pomi* DeGeer; European red mite, *Panonychus ulmi* (Koch); McDaniel spider mite, *Tetranychus mcdanieli* McGregor; and apple rust mite, *Aculus schlenchtendali* (Nalepa).

Sampling methods and economic injury thresholds for the above pests have been described by Madsen et al. (1975). A few modifications in sampling methods and a few changes in economic injury thresholds were made after the above paper was prepared. The treatment level for fruittree leafroller was reduced from 10 larvae per 100 leaf clusters to 5 because injury was 1 to 2 percent when the treatment level was 10.

We devised a new method of assessing thrips populations. A sample of blossom clusters was placed in a Berlese funnel and left there for 6 hours. As the blossoms wilted, the thrips moved down and were captured in a jar of alcohol at the base of the funnel. This method was quicker and more accurate than the previously used extractor.

The treatment level for *Campylomma verbasci* was reduced from 5 nymphs per limb tap sample to 2. Although *C. verbasci* was not a problem in the orchard described in this paper, evidence from other orchards indicated that a level of 5 per limb tap resulted in ca. 3 to 4 percent fruit injury.

Although 2 species of leafrollers were present in the orchard, their seasonal history and behavior is similar and they cause the same type of damage to apples (Madsen et al. 1976). Therefore, all fruit with leafroller injury was placed in a single category.

The effectiveness of the program was assessed by harvest samples for insects that attack fruit directly. A total of 250 apples per bin were examined while the fruit was being picked and fruit injury by the various pests was recorded. We sampled a minimum of 1/4 of the total bins picked for each apple cultivar. Pests that attack leaves and do not directly affect fruit were assessed by rating leaf injury if populations exceeded the treatment level.

[1]Contribution No. 458, Research Station, Summerland.

RESULTS AND DISCUSSION

Codling moth is the key pest in an apple management program because chemical control directed against this insect affects other pests as well as natural enemies. The data on codling moth monitoring in this orchard during 1973 and 1974 have been discussed by Vakenti and Madsen (1976). In 1973, sex pheromone traps indicated low codling moth populations within the orchard, but high numbers in neighboring orchards. No sprays were applied and the percent injured fruit at harvest was only 0.1 (Table 1). We have calculated that a codling moth infestation of 0.5 can be tolerated by orchardists and does not justify the cost of a spray application (Vakenti and Madsen 1976). In 1974, trap captures indicated a need for treatment on 3 occasions, but the moth numbers were only slightly above the treatment level of 2 per trap. We suggested chemical control but the orchardist chose not to apply a spray. The codling moth injury at harvest was 0.7 percent which indicated at least one spray would have been justified.

Fig. 1 illustrates the codling moth captures for 1975 and 1976. The traps captured an average of over 4 per trap in early June of 1975 and a codling moth spray was applied a week later. No further sprays were applied although the moth capture was slightly above treatment level the first week of July. In 1976, the treatment level was exceeded during the week of July 12, but over 70 percent of the moths were captured in a single block of Red and Golden Delicious trees. We suggested that treatment be limited to this area which was ca. ⅓ of the total orchard. A single application was applied to this block and was the only codling moth spray the orchard received. Fruit injury by codling moth was well below the acceptable level of 0.5 percent in both years. During the 4-year period, only 1⅓ sprays were applied for codling moth control in contrast to a calendar based program which would have required a minimum of 8 treatments.

Leafrollers required treatment in all 4 years, but control from 1973 to 1975 was not as effective as expected. Diazinon was used until 1975 when there was evidence of tolerance by leafrollers to this pesticide from orchards in the same general area (Madsen and Carty 1977). In 1976, azinphosmethyl was used instead of diazinon, and fruit injury was reduced by ca. 90 percent from the previous year.

Injury by eyespotted budmoth was negligible and noted only in 1975 and 1976. Thrips injury, represented by pansy spot on McIntosh and Spartan cultivars, was variable and our earlier sampling method did not detect populations that caused 2 percent injury in 1973. The population when sampled by the Berlese funnel method indicated a treatment level in 1975, but the grower chose not to spray. It is doubtful if a spray would have been justified since fruit injury was less than 1 percent.

Campylomma verbasci was not present in sufficient numbers to be of concern in this orchard. White apple leafhopper populations

Table 1. Summary of pest management — Fitzgerald Orchard, Kelowna, 1973-1976.

Pest	Number of sprays applied, percent fruit injury and degree of foliage injury							
	1973		1974		1975		1976	
	S	I	S	I	S	I	S	I
Codling moth[1]	0	0.1	0	0.7	1	0.2	⅓	0.1
Fruittree leafroller and European leafroller[1]	1	2.0	1	1.5	1	1.6	1	0.2
Eyespotted budmoth[1]	0	0.0	0	0.0	0	0.1	0	0.1
Thrips[1]	0	2.1	0	0.0	0	0.8	0	0.0
Campylomma verbasci[1]	0	0.0	0	0.1	0	0.0	0	0.1
San Jose scale[1]	0	0.0	0	0.0	0	0.0	0	0.0
European fruit scale[1]	0	0.0	0	0.0	0	0.0	0	0.0
White apple leafhopper[2]	0	nil	0	nil	0	nil	1	nil
Apple aphid[2]	0	nil	o	nil	0	nil	0	nil
European red mite[2]	1	nil	1	nil	½	nil	1	nil
McDaniel spider mite[2]	0	nil	0	nil	0	nil	0	nil
Apple rust mite[2]	1	+[3]	1	nil	¼	nil	0	nil

[1]damage assessed by fruit injury.
[2]damage assessed by leaf injury.
[3]+= slight damage, no effect on Apple quality.
Abbreviations: S=sprays, I=injury.

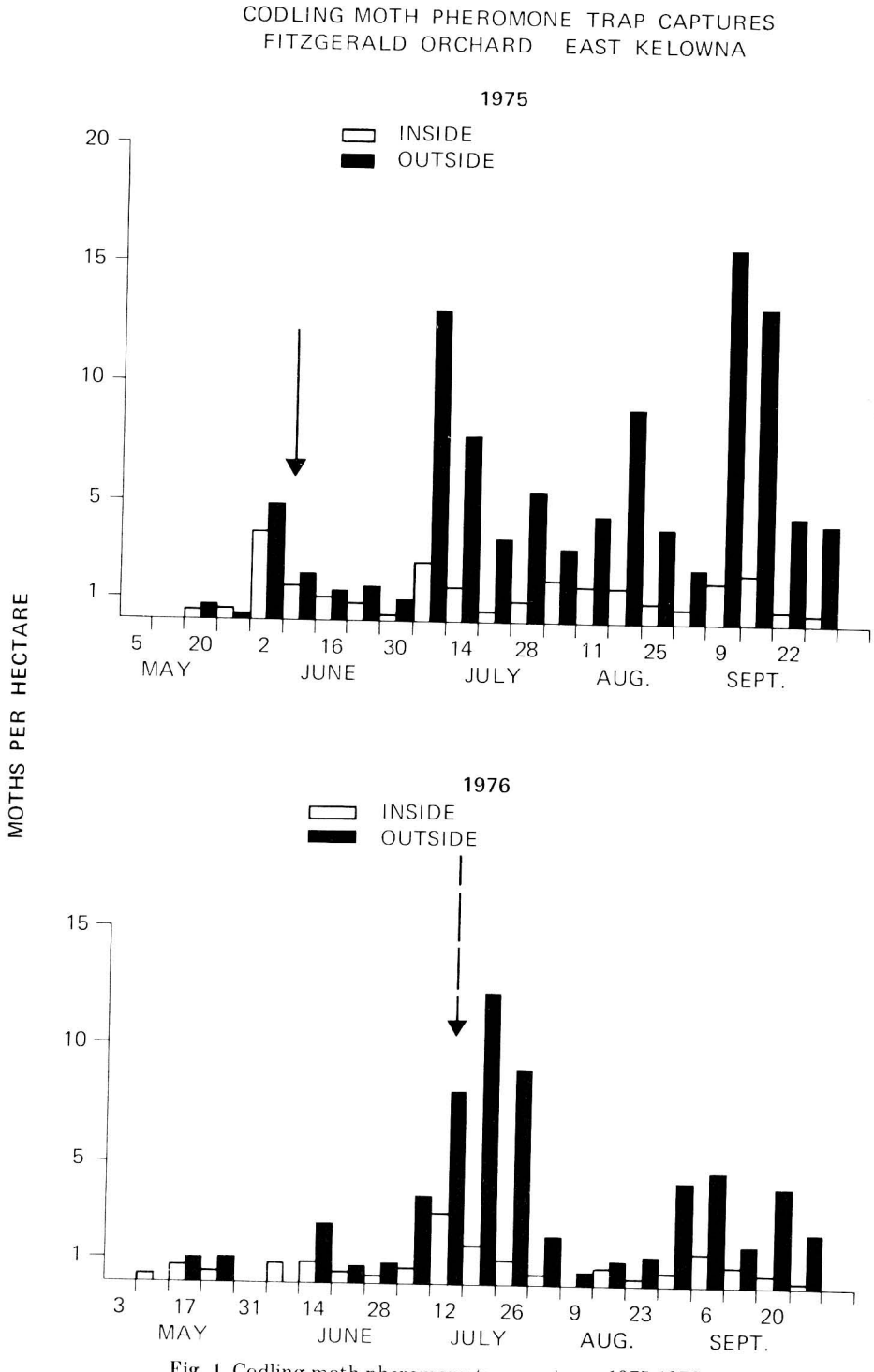

Fig. 1. Codling moth pheromone trap captures 1975-1976.
Arrows indicate date of spraying. Unbroken arrow=entire orchard sprayed, broken arrow=⅓ of orchard sprayed.

were below treatment levels from 1973 to 1975, but a spray was required in 1976. Apple aphid was present on young trees in all 4 years, but colonies were restricted to terminal growth and populations did not reach treatment level.

Mites were not a problem in the orchard during the 4-year experiment except for apple rust mite. The principal mite predator in British Columbia orchards, *Typhlodromus occidentalis* Nesbitt, increased during the first year of pest management and there was an excellent ratio of predators to phytophagous mites during the subsequent 3 years. The sprays in Table 1 for European red mite control were delayed dormant oil treatments directed against overwintered eggs. Downing and Arrand (1976) stated that a delayed dormant oil spray is often necessary to ensure that integrated mite control programs will be successful. Apple rust mite increased to treatment level in 1973 and 1974 and light foliage injury occurred in 1973 although a spray was applied. In 1975, one block of Red Delicious trees required a spray for apple rust mite control and no leaf injury was detected.

No San Jose scale or European fruit scale was encountered in any of the harvest samples. European fruit scale is prevalent in other orchards in this area and packinghouses have advised growers to spray routinely. Our management techniques did not indicate a need to spray for this pest, but the dormant oil spray used for European red mite eggs probably had an effect on any scales that were present.

Over the 4-year period, 14 applications were made for pest control which is a 50 percent reduction over a calendar based spray program. On the whole, results in other pest managed orchards were similar and the number of sprays necessary to obtain control was reduced by 35 to 50 percent. The cost of an advisory program has been calculated as $50 per ha (Haley 1976). To apply a single spray of azinphosmethyl for codling moth or leafroller control costs ca. $25 per ha for the material alone. It is evident that the cost of an advisory program would be realized if the yearly spray program were reduced by 2 applications. Another advantage of pest management which has seldom been mentioned is improved control when it is necessary to spray. Timing of sprays is more accurately based upon samples rather than on calendar dates or phenological data used in production guides.

References

Downing, R. S. and J. C. Arrand. 1976. Integrated control of orchard mites on apple in British Columbia. Can. Ent. 108. 77-81.

Haley, Sue. 1976. Apple pest management in the North Okanagan Valley, British Columbia: A feasibility study. M.A. Thesis, Simon Fraser University, Burnaby, B.C. 1-48.

Madsen, H. F., F. E. Peters and J. M. Vakenti. 1975. Pest management: Experience in six British Columbia apple orchards. Can. Ent. 107: 873-877.

Madsen, H. F., and F. E. Peters. 1976. Pest management: Monitoring populations of *Archips argyrospilus* and *Archips rosanus* (Lepidoptera: Tortricidae) with sex pheromone traps. Ibid 108: 1281-1284.

Madsen, H. F. and B. E. Carty. 1977. Fruittree leafroller (Lepidoptera: Tortricidae): Control of a population tolerant to diazinon. J. Econ. Ent. (in press).

Vakenti, J. M. and H. F. Madsen. 1976. Codling moth (Lepidoptera: Olethreutidae): Monitoring populations in apple orchards with sex pheromone traps. Can. Ent. 108: 433-438.