CONTROL OF ORIENTAL FRUIT MOTH (*GRAPHOLITA MOLESTA*) ON GOLDEN QUEEN PEACHES

V.C. MURRELL and P.L. LO

*The Horticulture and Food Research Institute of New Zealand Ltd.,
Hawke's Bay Research Centre, Private Bag 1401, Havelock North, New Zealand*

ABSTRACT

Oriental fruit moth (OFM) (*Grapholita molesta*) is an important pest of summerfruit that is currently well controlled by sprays applied to control leafrollers. The development of an Integrated Fruit Production programme has resulted in fewer applications of organophosphate insecticides. This could see OFM become a more widespread and serious problem. Tebufenozide and pheromone mating disruption were evaluated as alternatives to azinphos-methyl for control of OFM on three commercial process peach cv. Golden Queen orchards. The three treatments had similar levels of damage at harvest (0.6-3.2%), but this was unacceptably high because process crops currently have a nil tolerance for OFM. Tebufenozide was a more cost effective alternative than mating disruption for integrated fruit production in summerfruit. A spray threshold for tebufenozide needs further evaluation.

Keywords: *Grapholita molesta*, tebufenozide, mating disruption, peach, integrated pest management.

INTRODUCTION

The oriental fruit moth (OFM), *Grapholita molesta*, is a serious pest of summerfruit in Europe, Australia and North America. In New Zealand, it was first discovered in Auckland in 1976 (Cox and Dale 1977) and had reached Hawke's Bay by 1982 (Baker 1982), but is still confined to the North Island. OFM has been slow to spread in Hawke's Bay and was recorded on 5/19 orchards monitored in 1997/98 (Lo unpubl. data). It has the potential to become the most serious pest of summerfruit and Baker (1982) reported cases of 100% infestation on unsprayed crops. On commercial orchards, OFM is controlled by sprays applied against leafrollers, principally lightbrown apple moth (LBAM) (*Epiphyas postvittana*). However, OFM has occasionally caused crops to be downgraded or rejected for processing. Unlike leafrollers which generally feed on the fruit surface, OFM enter the fruit, immediately boring through the flesh to the centre and feeding around the pit (Baker and Dale 1980). OFM infested fruit are therefore unsuitable for fresh produce or processing.

The summerfruit industry in New Zealand is developing an integrated approach to pest and disease management. Spray thresholds have been developed for key pests and the number of post-blossom pesticide applications has been reduced by 70% on process peaches (Lo *et al.* 1995, 1997). Ultimately, the industry intends to reduce insecticide use and replace organophosphate insecticides with more selective products and adopt alternative methods for pest management. A potential consequence of a reduction in the use of organophosphates is that pests which were previously of minor significance, such as OFM, will become more important.

Tebufenozide is an insect growth regulator that has replaced organophosphates for control of lepidopterous pests in the New Zealand Integrated Fruit Production programme for apples. It is expected to be registered for use on summerfruit in the 1998/1999 season (A. Kale pers. comm.). It was not known whether tebufenozide was effective in controlling OFM or whether the thresholds that had been developed (Lo *et al.* 1997) for the standard insecticide azinphos-methyl were appropriate. Pheromone

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mating disruption is a non-insecticidal method for controlling lepidopterous pests that is widely used against OFM overseas (Audemard *et al.* 1989; Vickers 1990). It has not been tested on OFM in New Zealand. This paper compares the effectiveness of mating disruption, tebufenozide and the standard insecticide azinphos-methyl for control of OFM on process peaches.

MATERIALS AND METHODS

Three treatments, pheromone mating disruption, tebufenozide and azinphos-methyl, were replicated across three peach cv. Golden Queen orchards growing fruit for processing in Hawke's Bay. The three plots at Orchard A were each approximately 1 ha, with the mating disruption plot separated by 70 m of open ground from the other two treatments. At Orchard B, one block was divided into three 0.5 ha plots with the plot treated with pheromone dispensers on the downwind (eastern) end. Orchard C comprised two blocks, one 3 ha block which was treated with azinphos-methyl was 300 metres from a 6 ha block that was divided in half for the other two treatments. The plot treated with mating disruption was placed down wind from the plot treated with tebufenozide. Being commercial orchards, it was not possible to leave untreated control areas.

All blocks received a dormant application of oil during August. In late October or early November, each mating disruption block received 1000 pheromone dispensers per hectare containing Z-8-dodecenyl, E-8-dodecenyl acetate and Z-8-dodecenol (ShinEtsu Chemical Co.). The dispensers were placed in the top third of the trees. Apart from Orchard A where an aphicide was applied in early November, no other post-bloom insecticides were applied until predetermined thresholds were exceeded. The spray thresholds were an average of >1 OFM/trap/day or >4 LBAM/trap/day (Lo *et al.* 1997). Fungicide programmes on all blocks were determined by the growers.

Populations of both OFM and LBAM were monitored approximately weekly between early November 1997 and late February 1998 using pheromone traps. Two traps for each species were used in each treatment block, with each set being placed in the middle row and a third of the way into the block from either end. In mid January, 500 fruit per treatment were examined for insect damage (100 fruit from each of the corners and in the centre of each plot) and an insecticide applied if fruit had more than 0.2% or 2% OFM or leafroller damage respectively.

Insect damage was assessed at harvest in early March. During the main pick, 100 fruit from each of 10 randomly selected bins situated throughout each treatment block were inspected, i.e. 1000 fruit/block. At Orchards A and C, the contract pickers discarded an unknown proportion of damaged fruit (insect or otherwise), whereas at Orchard B, all the fruit picked went into the bins and were assessed. All fruit were inspected for OFM and leafroller chewing and were cut open when an internal larva was suspected.

Differences amongst treatments in the levels of OFM damage to fruit on the three orchards were analysed by a Kruskal-Wallis test with the correction for tied ranks (Zar 1996). Treatment differences on individual orchards were analysed by Chi-squared tests.

RESULTS

Trap catches of OFM in the tebufenozide and azinphos-methyl treated blocks were similar at Orchards A and B, but much higher at Orchard C (Figure 1). No OFM were caught in any of the mating disruption blocks throughout the season. Trap thresholds for OFM were exceeded at all three orchards in early December, when tebufenozide or azinphos-methyl was applied to the appropriate blocks. At Orchards A and B, the catches of OFM remained close to or below the threshold for the remainder of the season. In contrast, at Orchard C trap catches usually stayed above the threshold, particularly in the azinphos-methyl block. A second spray was applied to both the tebufenozide and azinphos-methyl blocks in early January. Catches of LBAM at Orchards B and C remained below the threshold of 4 moths/trap/day throughout the season. At Orchard A, they were low until early February which was too close to harvest to apply an insecticide.

FIGURE 1: Pheromone trap catches of oriental fruit moth on three peach cv. Golden Queen orchards in Hawke's Bay. Dates of insecticide applications are indicated by arrows.

The inspection of fruit in January at Orchard C found the following levels of OFM damage: mating disruption 2.2%, tebufenozide 0.4% and azinphos-methyl 0.6%. Because of concerns over these levels and the continuing high numbers in pheromone traps, a third insecticide application was advised in late January on the tebufenozide and azinphos-methyl blocks. An insecticide was also recommended for the mating disruption block. However, the grower decided not to apply any insecticides at this time. No OFM damaged fruit were found in the azinphos-methyl treatment at Orchards A and B, or in the tebufenozide treatment at Orchard B. One damaged fruit (0.2%) was found in the mating disruption blocks at both orchards and the tebufenozide block at Orchard A. Based on these levels and the low numbers of OFM in traps during January, it was decided that Orchards A and B would receive no further insecticide applications.

At harvest, no significant difference in the percentage of fruit with OFM damage among treatments was found overall (Figure 2). The highest level of damage found was in the block treated with azinphos-methyl at Orchard C. Damage in both of the other blocks was significantly lower. Fruit damage in the mating disruption and

tebufenozide blocks at Orchard A was about 3.5 fold higher than that found in the azinphos-methyl block. At Orchard B, there were no significant differences between treatments. Fruit damage by leafrollers at harvest was between 0-1.5% per block.

FIGURE 2: Percentage fruit damage by OFM at harvest, with Chi-squared tests for differences between treatments on individual orchards and a Kruskal-Wallis test on the mean data. H_c is the Kruskal-Wallis test statistic with the correction for tied ranks. Error bars are the SEM.

DISCUSSION

Control of OFM and leafrollers by tebufenozide was as effective as the standard insecticide azinphos-methyl. Leafroller damage was well within the thresholds for processing, but OFM damage was exceeded in every block, including those blocks treated with azinphos-methyl. Heinz-Wattie Ltd presently have a nil tolerance for OFM damaged fruit, although this is under review. The trap threshold of 1 OFM/trap/day operated with an azinphos-methyl programme has previously kept damage below 1% (Lo *et al.* 1997). Trap catches recorded in this study, however, were much higher than in Lo *et al.* (1997). The current study suggests that either monitoring needs to start earlier, or that the threshold is not sensitive enough and needs to be lower.

Poor insecticide timing as well as the grower's decision not to apply an insecticide in late January may have contributed to the levels of OFM damage at Orchard C. A second insecticide application was recommended on 23rd December, but was not applied until the 9th and 10th of January in the azinphos-methyl and tebufenozide blocks respectively. Insecticides applied against OFM have to target the eggs and newly hatched larvae which are relatively exposed on the outside of the fruit or shoots (Baker and Dale 1980). The longer the period between peak flight and insecticide application, the higher the chance of larvae having already burrowed into the fruit or shoot and being well protected. On the other two orchards, insecticides were applied well within the recommended time frame of seven days.

Mating disruption was just as effective as the other two treatments but to provide adequate control, especially with the population densities experienced this year, would still require some insecticide applications. Pree *et al.* (1994) found that Canadian peach orchards with low pest pressure (trap catches averaging less than 0.5/trap/day) had well below 1% fruit damage. However, orchards with catches higher than 1.5/trap/day could not use mating disruption alone. This was confirmed by the results from the current research where trap catches of OFM in the two insecticide blocks at Orchard C averaged about 2.5/trap/day.

One option is to use a combination of mating disruption with well timed insecticides targeting the first generation to reduce population numbers (Vickers 1990; Pree *et al.* 1994). In this study, however, monitoring OFM populations under mating disruption using pheromone traps with standard dose lures was not effective. Pree *et al.* (1994) found that there was no apparent relationship between the degree of suppression of male moth catches and subsequent fruit damage at harvest. An alternative monitoring method such as high dose pheromone lures needs to be considered. Inspecting fruit during the season is another option, although this method means reacting to damage that has already occurred. In this study, the January fruit inspections generally underestimated damage levels at harvest.

In the current trial, mating disruption may have been more successful had dispensers been put out in early October instead of a month later. Trap catches are well below the threshold at this time (Lo unpubl. data), but it may be important to disrupt the earliest emerging moths to reduce the population numbers for subsequent generations. The results obtained for mating disruption may also have been affected by the immigration of mated females into the pheromone treated plots from adjacent insecticide treated plots. Audemard *et al.* (1989) suggest that mating disruption blocks should be at least 1 ha in size and 100 m from the nearest potential source of OFM.

In terms of the costs of treatment, this trial indicated that tebufenozide was a better alternative to azinphos-methyl than mating disruption for control of OFM. One or two applications of tebufenozide achieved similar levels of control as mating disruption, whereas the cost of pheromone dispensers was equivalent to about three insecticide applications. If mating disruption is not sufficiently effective by itself, then the cost is likely to prevent its widespread adoption by growers. A suitable spray threshold for tebufenozide needs further investigation to improve the results under all circumstances.

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