THRIP CONTROL WITH FLUVALINATE ON KIWIFRUIT

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SUMMARY

Field trials conducted in 1987-88 and 1988-89 evaluated the efficacy of fluvalinate for thrip control on kiwifruit. Applications of fluvalinate before or during flowering reduced flower infestation by thrips whereas a conventional programme using phosmet pre-flowering did not. Forty-eight percent of the leaves on unsprayed vines were damaged by thrip feeding, whereas only 1-3% of leaves were damaged on vines treated with spray programmes using fluvalinate or phosmet. Fruit harvested from unsprayed vines were infested with up to 13 thrips per fruit and 26% of fruit were infested with at least one thrip. All spray programmes considerably reduced the level of fruit infestation by thrips.

Keywords: kiwifruit, flowers, leaves, thrips, fluvalinate

INTRODUCTION

Thrips can infest the leaves, flowers and fruit of kiwifruit vines. It has been suggested that thrips (*Thrips obscuratus*), which are known to feed on kiwifruit pollen (Kirk 1987), may have an adverse effect on pollination (Macfarlane and Ferguson 1984). They have also been shown to transport the spores of some fungal diseases (Ellis *et al* 1988). Until recently, no chemical control measures have been used specifically to control thrips on kiwifruit, partly due to the toxicity to bees of most of the insecticides registered for use on kiwifruit (Clinch and Palmer-Jones 1974). The synthetic pyrethroid fluvalinate now has a registration for use on kiwifruit. This insecticide has low toxicity to bees (Rouas 1987), and good activity against thrips (Anon. 1981).

This paper reports on field trials conducted to determine the efficacy of fluvalinate for thrip control on kiwifruit flowers. The effects of fluvalinate applications on flower infestation by thrips and on thrips infesting leaves and fruit (typically greenhouse thrips (*Heliothrips haemorrhoidalis*) (D. Steven pers. comm.)) are also reported.

METHODS

Two trials were conducted on blocks of mature vines cv. Hayward located in orchards at Rukuhia (1987-88) and near Paeroa (1988-89) which had received no applications of any pesticide for several previous seasons. Randomised block designs were used with five (1987-88) or six (1988-89) replicates. Plots consisted of single vines buffered by at least one unsprayed vine within and between rows.

The insecticides and their rates (g ai/ 100 litres) used in the trials were: *Bacillus thuringiensis* as Thuricide HP (100 g product), chlorpyrifos as Lorsban 50WP (25 g), fenoxycarb as Insegar 25WP (37.5 g), fluvalinate as Mavrik 24FLO (9.6 g in 1987-88 and 4.8 g in 1988-89) and phosmet as Imidan 75WP (112.5 g). In both trials, spreader/sticker (Citowett) was used at 50 ml per 100 litres of solution with all insecticides formulated as wettable powders and with fluvalinate. All treatments were applied at a water rate of 2250 litres/ ha using a Hardi handgun at 1750 kPa.

Most of the experimental treatments involved the replacement of one or more applications of phosmet from a conventional programme with fluvalinate. The timing of applications followed conventional recommendations for current export spray programmes (Tables 1 and 2) with one exception for Treatment (v) in 1988-89 when an experimental application of fluvalinate was made just when the first flowers had begun to open (16 November 1988). This application replaced the conventional pre-

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flowering application made before flowers begin to open. In Treatments (ii), (iii) and (iv), pre-flowering applications of fluvalinate were made just as the flowers began to show white through the splitting sepals (10 November 1988).

In the 1987-88 trial, flower infestation was assessed by randomly sampling 10 fully open flowers per vine on 25 and 30 November 1987. The flowers from each vine were placed into separate plastic bags, which were then sealed until the flowers were removed and the thrips counted. Flower infestation was assessed *in situ* in the 1988-89 trial by counting the numbers of adult thrips per flower on 20 flowers per vine on 23 November 1988.

Leaf infestation was assessed at the end of the 1988-89 season by randomly sampling 20 mature leaves from each vine on 3 May 1989. Thrips damage to leaves was ranked into one of four categories according to the area of leaf surface affected by thrips rasping; i.e. severe leaf damage affected an area greater than 4 cm²/leaf, moderate damage was between 1 and 4 cm², a low level of damage affected less than 1 cm² or damage was absent.

Fruit infestation was assessed in both trials by randomly sampling 100 fruit per vine on 6 May 1988 and 11 May 1989. The sampled fruit from each vine were placed into plastic bags and held at 4°C until microscopic examination. Thrips found on all parts of the vines were not identified to species.

Data were analysed by ANOVA, after log_e transformation of the numbers of thrips per sample + 1, for each sample of flowers, leaves or fruit. Analyses were not performed on data for which all sprayed treatments had either very low or no thrips present.

RESULTS

Flower infestation

In the 1987-88 trial, there were approximately 28-31 thrips per flower on unsprayed vines on 25 November (Table 1). At the first examination of flowers, 12 days after the pre-flowering spray, the numbers of thrips on the flowers of vines treated with fluvalinate were 68-74% lower than that on unsprayed vine flowers. The conventional programme comprising a dormant application of chlorpyrifos followed by a full season programme of phosmet, did not reduce flower infestation. When the flowers were examined 4 days after the early petal-fall spray, the numbers of thrips on the fluvalinate-

TABLE 1: Number of adult thrips on flowers and fruit (1987-88 trial).

Treatment	Applications ^a	Mean number of thrips per		
		10 flowers ^b	100 fruit ^c	
		25 November	30 November	6 May
(i). unsprayed	-	5.74(315)	5.21(198)	2.3
(ii). chlorpyrifos	1	5.88(362)	5.01(162)	0.4
+ phosmet	2, 4-7			
+ <i>B. thuringiensis</i>	3			
(iii). fenoxycarb	1	4.39(82)	1.85(7)	0.0
+ fluvalinate	2-4			
+ <i>B. thuringiensis</i>	5-7			
+ phosmet	8, 9			
(iv). chlorpyrifos	1	4.60(101)	2.09(9)	0.0
+ fluvalinate	2-5			
+ phosmet	6-9			
SED		0.254	0.550	-

^a 1. dormant (1 September); 2. pre-flowering (13 November); 3. early petal-fall (26 November); 4. post-blossom (14 December); 5. 14-21 days later (30 December 1987); 6-9. at 3-4 weekly intervals until withholding period (12 January, 17 February, 17 March, 12 April 1988);

^b log_e (X+1) transformed with back-transformed means in brackets;

^c untransformed.

treated vines were 95-96% lower than on the unsprayed vines. The difference between the numbers of thrips on fluvalinate-treated vine flowers and those from the unsprayed vines was highly significant ($P < 0.001$) for both sample dates.

Although up to 95 thrips were found on a single flower, the overall level of flower infestation in the 1988-89 trial (Table 2), was lower than that recorded in the first trial in a different orchard in the previous season. Thirteen days after a pre-flowering application of fluvalinate thrip infestation on treated vines was 45% lower than on the flowers of unsprayed vines. On the vines treated with a delayed application of fluvalinate on 16 November, flower infestation was 64% lower than on unsprayed vines. The conventional programme did not reduce thrip infestation of flowers.

Leaf infestation

Most (86%) of the thrips found on unsprayed vine leaves sampled on 3 May 1989 were nymphs (Table 2). No thrip nymphs were found on the leaves of any sprayed vines. The numbers of thrip adults were 87-100% lower on sprayed vine leaves than on the unsprayed vine leaves.

Thrips damaged up to 100% of the leaves on individual unsprayed vines, with an average of 48% affected and 12% of leaves with severe damage (Figure 1). The spray programmes provided a similar level of control with only 1-3% of leaves suffering damage, all of which was minor (Figure 1). The difference in the percentage of leaves damaged between the unsprayed vine leaves and sprayed vine leaves was highly significant ($P < 0.001$) for all treatments.

Fig. 1: Levels of thrip damage to kiwifruit leaves collected on 3 May 1989.

Fruit infestation

All of the spray programmes used in both trials considerably reduced the level of fruit infestation by thrips (Table 1, 2). The numbers of thrips per 100 unsprayed fruit sampled on 11 May 1989 varied from 0-48 between vines, with up to 13 thrips per infested fruit. A maximum of two thrips was found per infested fruit on sprayed vines with most fruit having only a single thrip. Overall, an average of 15% of unsprayed fruit was infested by thrips, with the level of infestation varying from 6-26% between vines. On sprayed vines, the level of fruit infestation varied between 0-9%.

DISCUSSION

Thrips can heavily infest both the flowers and leaves of kiwifruit vines. In these trials, the level of fruit infestation was inconsequential. However, greenhouse thrips (*H. haemorrhoidalis*) have been recorded infesting much higher levels (44%) of fruit from unsprayed vines (Ferguson 1980). Phosmet provided good control of leaf and

fruit infestations, and prevented leaf damage by thrips, but did not reduce flower infestation. Some of the other insecticides registered for use on kiwifruit may be more effective at reducing flower infestation by thrips. These trials have shown that fluvalinate is very effective at reducing thrip infestation on kiwifruit flowers. Using fluvalinate during flowering resulted in a slight increase in the level of thrip control compared with an application of fluvalinate made just as flowering began.

TABLE 2: Number of adult thrips on flowers and fruit, and numbers of thrip nymphs and adults on leaves (1988-89 trial).

Treatment ^a	Applications ^b	flower ^c	Mean number of thrips per		100 fruit ^c
			20 leaves ^d nymphs	adults	
(i). unsprayed	-	2.37(11)	14.3	2.3	2.84(18)
(ii). phosmet + + <i>B. thuringiensis</i>	2, 5-10 4	2.75(16)	0.0	0.3	0.49(2)
(iii). fluvalinate + <i>B. thuringiensis</i>	2 4	1.82(6)	0.0	0.3	1.42(4)
+ phosmet	5-7				
(iv). fluvalinate + phosmet	2, 4, 5 6-10	1.85(6)	0.0	0.0	0.60(2)
(v). fluvalinate + phosmet	3-6 7-10	1.44(4)	0.0	0.2	0.51(2)
SED	0.254	-	-	0.445	

^a chlorpyrifos was applied to all spray treatments as a dormant spray on 12 September;

^b 2. pre-flowering (10 November); 3. at beginning of flowering when flowers have begun to open (16 November); 4. early petal-fall (25 November); 5. post-blossom (8 December); 6. 14-21 days later (22 December 1988), 7-10. at 3-4 weekly intervals until withholding period (11 January, 9 February, 10 March and 13 April 1989);

^c log_e (X+1) transformed with back-transformed means in brackets;

^d untransformed.

The consequences of thrip infestation of kiwifruit leaves and flowers are uncertain. However, an increase in the average weight of fruit from some fluvalinate-treated vines has been found (N. Pyke unpub. data). Improved pest control during flowering may be advantageous for reducing numbers of leafroller larvae which may also require control during flowering (Wearing *et al* 1980). This can be achieved using insecticides based on *B. thuringiensis*, but *B. thuringiensis* does not reduce thrip infestation. Furthermore, if thrips can transport *Botrytis cinerea* spores as has been shown for other fungal spores (Ellis *et al* 1988) then using fluvalinate before or during flowering may be advisable.

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