TYDEID MITE CONTROL ON PERSIMMONS

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ABSTRACT

Tydeid mites (*Orthotydeus californicus*, *O. caudatus*) occasionally contaminate persimmon fruit. Field trials were conducted in 1990/91, 1991/92, 1994/95 and 1996/97 on persimmon or adjacent poplar shelter trees to evaluate avermectin, mancozeb, mineral oil, permethrin plus pirimiphos-methyl, pirimiphos-methyl, propargite or taufluvinalinate to reduce tydeid mite populations. Full (1990/91), mid-late (1991/92, 1994/95) or early season applications (1996/97) were evaluated. Mite populations were assessed on leaves and/or fruit. Spraying poplar trees did not reduce mite numbers on adjacent persimmon trees. Pre-harvest or full season spray programmes lowered but did not prevent fruit contamination. The most effective treatments, early season applications of mineral oil or avermectin, show promise for use in a pest management system being developed for export persimmons.

Keywords: persimmons, *Diospyros kaki*, tydeid mites, *Orthotydeus californicus*, *Orthotydeus caudatus*

INTRODUCTION

Persimmons (*Diospyros kaki*) have been grown as an export crop in New Zealand since the 1980s (Kitagawa and Glucina 1984). However, the industry has had ongoing problems with crop damage or contamination by a range of insects and mites, in particular leafrollers, mealybugs and tydeid mites (*Orthotydeus californicus*, *O. caudatus*) (Tomkins *et al.* 1996). Tydeid mite populations can build up to high levels on persimmon trees and some of the tree species used for their shelter (Brown and Lupton 1991; 1992; Lupton and Brown 1995).

Whether *O. californicus* or *O. caudatus* are actually pests is not clear. While some reports indicate that tydeids may be phytophagous (Fleschner and Arakawa 1952; Bayan 1984), plant damage by tydeids has never been observed on New Zealand persimmons or any other fruit crop. Honeydew produced by sucking insects has been shown to be a very suitable substrate for the development of tydeid species (Brickhill 1958; Bayan 1984) and they may also feed on fungi or predate other insects or mites including scale insects (Baker and Wharton 1952; Brickhill 1958). Whatever the actual feeding preferences of tydeid mites, they are still regarded as a quarantine pest by some regulatory authorities. The New Zealand persimmon industry has therefore been attempting to develop improved methods for preventing crop contamination by *O. californicus* or *O. caudatus* (Brown and Lupton 1991; 1992; Lupton and Brown 1995). Recent studies are part of a programme to develop an Integrated Pest Management (IPM) system for export persimmons commonly referred to as Greengold (Tomkins *et al.* 1996). This paper describes some of the field trials involved in the ongoing process to develop improved methods for managing *O. californicus* and *O. caudatus* on persimmons.

MATERIALS AND METHODS

The trials were conducted on 4-8 year old Y-trellis or free-standing persimmon trees cv. 'Fuyu' in commercial orchards near Gisborne. Treatments were replicated four

(1990/91, 1991/92 and 1996/97) or five (1994/95) times in a completely randomised block design using three tree (1990/91), single tree (1994/95) or 8 x 2 m of row (1996/97) plots buffered by unsprayed trees or 2 x 1 m of rows (1996/97), except in 1990/91 when no buffers were used. In 1991/92, the treatments were applied to eight year old, 10–15 m tall lombardy poplar (*Populus nigra*) trees, with 50 m plots.

The insecticides and their rates (g ai/100 litres) were: avermectin (Abamectin 1.8EC (0.7 g), carbaryl as Carbaryl 50F (120 g), chlorpyrifos as Lorsban 50WP (50 g), dichlorvos as Nuvan 100EC (50 g), mancozeb as Mancozeb 80W (160 g), mineral oil as Sunspray 6E (1% - 1991/92) or Ultrafine oil (1% - 1995/96 and 1996/97), phosmet as Imidan 75WP (112.5 g), permethrin + pirimiphos-methyl as Attack (2.5 g + 47.5 g and 5 g + 95 g), pirimiphos-methyl as Actellic 50EC (50 g) or propargite as Omite 30W (60 g). Sunspray Ultrafine oil (950 ml) was used with or without an organosilicone enhancer (Silwet 560) used at 50 ml per 100 litres in 1995/96.

Treatments were applied on: 17 December 1990, 2 and 23 January, 16 February, 13 and 28 March 1991; 22 February, 10 and 25 March 1992; or 24 March and 10 and 22 April 1995; or 12 November, 12 December 1996 and 9 January 1997. A knapsack (1991/92) or Solo 412 motorised knapsack with a mistblower attachment was used for all trials with treatments applied to runoff (approximately 2000–2500 litres/ha). The poplar trees used in 1991/92 were sprayed from both sides to 7m with a boom.

Tydeid mite infestation on persimmon trees was monitored in 1990/91 by randomly sampling 30 mature leaves per plot prior to the first spray (6 March 1990) and harvest (16 April 1991). In 1996/97, 100 leaves were sampled per plot on 27 January 1997. Mite infestation of the poplar trees in 1991/92 was monitored by sampling 50 leaves from the central 20 m of each plot before each spray (20 February, 10 and 24 March 1992) and 10 and 24 days (2 and 18 April 1992) after the final application. Thirty leaves were sampled from four persimmon trees in the middle bay of the row immediately east of the sprayed poplar shelter on the same sample dates plus an extra sample 61 days (25 May 1992) after the final application. Mites were then brushed from persimmon or poplar leaves onto a sticky plate using a Leedom leaf brushing machine, and counted beneath a binocular microscope.

Fruit were randomly sampled from trees on 17 April 1991 (50 per tree), 6 May 1995 (40 per tree) and 3 May 1997 (50 per tree). The fruit were held under ambient conditions until microscopic examination for tydeid mites and fruit marking due to physical or chemical factors.

The counts of tydeid mites were subjected to $\log_e$ transformation before analysis using ANOVA.

RESULTS AND DISCUSSION

Full season programme

The 1990–91 trial showed that six applications of chlorpyrifos or permethrin plus pirimiphos-methyl reduced leaf infestation by tydeid mites, but was inadequate to prevent fruit contamination at harvest (Table 1). Phosmet did not affect leaf infestation or fruit contamination. Mid-late season programme

(a) Shelter treatment

In the 1990–91 trial, the persimmon trees in the trial block closest to a poplar shelter belt had a higher infestation of tydeid mites (e.g. 1285 cf. 292–938 mites per 50 leaves), than on the unsprayed trees in other trial blocks. Therefore in the 1991–92 trial, the possibility of reducing tydeid mite infestation on persimmon trees by controlling them on the suspected source, the poplar shelter trees, was evaluated. Tydeid mite populations were found to be considerably lower on the leaves of the poplar (Fig. 1) than persimmon trees (Fig. 2), with up to 2318 mites per 30 persimmon leaves recorded compared with 263 mites per 50 poplar leaves. This would be at least partially due to the larger size of the persimmon leaves which are approximately 2–3X larger than poplar leaves. A second study conducted on the same orchard specifically to determine whether poplar trees were the source of tydeid mites on the persimmon trees, found no clear evidence of a relationship (Steven 1992).

TABLE 1: Mean number ($\log_e$) of tydeid mites per leaf or 100 fruit ($\log_e$) on

persimmon trees in a Gisborne orchard, 1991 (back-transformed means in brackets).

Treatment	Rate g a.i./100 litres	Mites per leaf ¹ 5 March	Mites per 100 fruit	
			16 April	17 April
untreated	-	-0.22 (0.6)	2.51 (12.3)	4.67 (107.2)
chlorpyrifos	50.0	-1.34 (0.1)	1.22 (3.4)	2.71 (15.1)
permethrin +	2.5	-0.90 (0.2)	0.97 (2.6)	4.16 (63.9)
pirimiphos-methyl	47.5			
permethrin +	5.0	-1.38 (0.1)	0.16 (1.2)	3.70 (40.5)
pirimiphos-methyl	95.0			
phosmet	112.5	0.12 (0.9)	1.94 (7.0)	4.36 (78.5)
SED		0.37	0.27	0.62

¹ after $\log_e (X+0.2)$ (5 March), or $\log_e$ (16 April) transformation.

On both the persimmon (Fig. 2) and poplar (Fig. 1) trees, tydeid mite numbers rose from

FIGURE 1: Mean number of tydeid mites per 50 poplar leaves in a Gisborne persimmon orchard, 1992 (bars represent SED).

the beginning of leaf sampling in mid-February, to peak in late March-early April, and had declined considerably by the time of harvest in late April-early May. A similar pattern has been observed in other studies (Steven 1992; Tomkin *et al.* 1996).

(b) Crop treatment

The 1994-95 trial evaluated the efficacy of using several applications of relatively short-lived insecticides for the pre-harvest control or cleanup of various pests including tydeid mites. No significant differences between treatments in the level of fruit contamination at harvest were found, although mineral oil used alone or with the surfactant Silwet 560 did considerably reduce fruit contamination. Similarly, Gaskinet *et al.* (1996) had found that fruit contamination could be reduced with three applications between mid-April and mid-May of mineral oil (Shellspray All Purpose oil) used alone or with a surfactant (Y-12780). Previously, Prestidge *et al.* (1989) had found that fruit

FIGURE 2: Mean number of tydeid mites per 30 persimmon leaves in a Gisborne persimmon orchard, 1992 (bars represent SED).

contamination could be reduced by a single spray of some insecticides five days before harvest. However, neither single (Prestidge *et al.* 1989) or multiple (Table 2, Gaskin *et al.* 1996) pre-harvest applications of any of the pesticides tested were able to provide fruit free of tydeid mites.

TABLE 2: Mean number ($\log_e(X+1)$) of tydeid mites per 100 persimmon fruit sampled from a Gisborne orchard on 6 May 1995 (back-transformed means in brackets).

Treatment	Rate (g ai/100 litres)	Mites per 100 fruit
untreated	-	4.0 (52.4)
dichlorvos	50.0	3.8 (43.9)
	100.0	2.4 (10.4)
carbaryl	120.0	4.1 (58.1)
	240.0	3.9 (48.4)
mineral oil	450 ml	2.6 (12.8)
mineral oil	950 ml	2.8 (15.4)
plus Silwet 560	50 ml	
SED		0.78

Early season programme

Studies of tydeid mite phenology on persimmons (Figs. 1 and 2; Steven 1992; Tomkins *et al.* 1996) indicate the existence of a single peak. The 1996-97 trial evaluated single or multiple applications of avermectin or mineral oil at the beginning of the peak in tydeid mite numbers. Highly significant ($P < 0.001$) differences were found between treatments in the numbers of tydeid mites infesting leaves sampled in January (Table 3). By harvest in early May, the numbers of mites per 100 fruit were lower on the treatments using a single application of avermectin or two or three applications of mineral oil than on unsprayed trees, although the magnitudes of the differences were not significant. The lack of significance between treatments was due to a high degree of variation between

replicates, with for example the numbers of tydeid mites per 100 fruit varying from 0-120 on the trees treated with a single oil application.

TABLE 3: Number of tydeid mites per 100 leaves (after $\log_e (X+1)$ transformation, with back-transformed means in brackets) or fruit ($\log_e$) on persimmon trees in a Gisborne orchard, 1997 (back-transformed means in brackets).

Treatment	Mites per 100 leaves 27 January 1997	Mites per 100 fruit 3 May 1997
untreated	6.5 (645.4)	3.85 (46.0)
avermectin	2.0 (6.1)	2.32 (9.2)
mineral oil applied at:		
pre-flowering only	4.4 (79.4)	2.97 (18.5)
pre- and post blossom	2.3 (8.8)	1.42 (3.1)
pre-, post-blossom and January	0.9 (1.4)	1.80 (5.1)
SED	0.68	2.63

CONCLUSION

Tydeid mite populations reach high levels on persimmon trees midway through the growing season resulting in some fruit contamination. Attempts to reduce fruit contamination by lowering tydeid mite populations of adjacent shelter trees, the suspected source of mites, were unsuccessful. Pre-harvest cleanup sprays to the persimmon trees were also unsuccessful, probably because spray applications at this stage of the season coincided with large tydeid mite populations. A full season spray programme using chlorpyrifos or permethrin + pirimiphos-methyl reduced but did not prevent fruit contamination. The most effective treatments evaluated to date involve two or three early season applications of mineral oil or a single application of avermectin timed to coincide with the beginning of the buildup of tydeid mites. These treatments show promise for incorporation as part of an IPM system being developed for export persimmons.

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