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CONTROL OF SIX-SPOTTED MITE, *EOTETRANYCHUS SEXMACULATUS*

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ABSTRACT

Six-spotted mite (6SM) *Eotetranychus sexmaculatus* (Acari: Tetranychidae) remains a major pest of avocados in New Zealand, causing leaf drop and hence reducing productivity. Abamectin (Avid) was tested in a small-plot trial with 1 or 2 sprays at a range of timings (October to December), together with a new miticide fenpyroximate (Fenamite) and the alternative mectin milbemectin (Mit-é-mec). Oil (D-C-Tron Plus) was used with both mectin products and on its own at 0.5 %. Avid, Mit-e-mec and Fenamite all reduced mite numbers and damage. Timing of application and number of sprays applied (1 or 2) made little difference, but pest pressure was only moderate with considerable tree-to-tree variability in mite numbers. A single spray of oil had no apparent effect, but two sprays did reduce mite numbers, although the difference was not statistically significant. Observations on biological control agents and tydeid mites are included.

Keywords: *abamectin, milbemectin, pest control*

INTRODUCTION

Six-spotted mite (6SM) *Eotetranychus sexmaculatus* (Riley) (Acari: Tetranychidae) has been present in New Zealand since the early 1950s, but only since the late 1990s has it been a serious problem in avocado orchards. Infestations of 6SM cause severe premature defoliation of avocado trees, with a consequent impact on productivity (Stevens, 2001). This type of indirect damage is difficult to quantify, and hence complicates the development of monitoring systems and thresholds.

Growers are restricted in the range of pesticides that can be used on export avocados, and many still use organophosphate chemicals against 6SM even though these are registered against other pests on this crop and not specifically against 6SM. Such products have a limited life expectancy, because of consumer and environmental concerns. Avid (abamectin) was recently registered against 6SM on avocados and the related compound Mit-é-mec (milbemectin) is in the process of obtaining registration. Both products have similar chemistry and belong to the avermectin group. These are more selective chemicals derived from micro-organisms. Abamectin is used under a dispensation system in California against several mite species including 6SM.

Research undertaken for the AIC in the 2002/2003 season screened both avermectin products together with a number of novel compounds (Steven, 2003). None of the latter was effective, while both Avid and Mit-é-mec gave similar and very significant reductions in 6SM populations. The research described here was to help optimise the spray strategy against 6SM using Avid and included 3 timings, with 1 or 2 applications and 2 intervals. A new miticide, fenpyroximate (Fenamite), and the alternative mectin milbemectin were included as single spray treatments.

Mectins are recommended to be used with 0.5% mineral oil, and since some growers claim that oil sprays alone control 6SM, two additional treatments, each involving 2 sprays of 0.5% D-C-Tron Plus, were also included.

METHODS

The trial was conducted in a block of young 'Hass' avocado trees, 1.5 2.7 m tall, near Kaitaia in the Far North. Single tree plots were used in a randomised block design with 4 replicates of 2-spray treatments and 6 of the single spray treatments. There were 12 spray treatments and an unsprayed control (Table 1). Second sprays were either 2 or 4 weeks after the first spray and all applications were high volume to runoff using a Solo 412 motorised mistblower. Spray dates were 16.10.03, 29.10.03, 12.11.03, 27.11.03, 13.12.03 and 27.12.03.

Table 1. The treatments applied, number of replicates, timing and number of applications.

Treatment	Product	*replication*	Timing and number of sprays Oct	Nov	Dec
1	Fenamite	6	✓	-	-
2	Mit-é-mec + 0.5% oil	6	✓	-	-
3	Avid + 0.5% oil	6	✓	-	-
4	Avid + 0.5% oil	4	-	✓	-
5	Avid + 0.5% oil	4	-	-	✓
6	Avid + 0.5% oil	4	✓✓	-	-
7	Avid + 0.5% oil	4	-	✓	-
8	Avid + 0.5% oil	4	-	-	✓✓
9	Avid + 0.5% oil	4	✓	✓	-
10	Avid + 0.5% oil	4	-	✓	✓
11	D-C-Tron Plus 0.5%	4	✓	✓	-
12	D-C-Tron Plus 0.5%	4	-	✓	✓
13	untreated control	6	-	-	-

Fenamite (50 g/L fenpyroximate) at 50 ml / 100 L plus the non-ionic wetter Contact at 25 ml / 100 L,
Mit-é-mec (10 g/L milbemectin) at 75 ml / 100 L
Avid (18 g/L abamectin) at 37.5 ml / 100 L,
Oil used with both mectins was D-C-Tron Plus, batch L2B71472.

Mite numbers on leaves were counted using a stereomicroscope, with eggs, immature stages and adults counted separately. The pre-spray check of 5 leaves per tree was used to group plots into replicate blocks, but later samples used 20 leaves per plot. A factorial scoring system was used to transform counts for each leaf before analysis:

Scores 0 = 0 1 = 1 2 = 2, 3 3 = 47 4 = 815 5 = 1631
6 = 3263 7 = 64127 8 = ≥128

Damage from mite feeding was scored on individual leaves for the amount of leaf area affected using the following scale:

None, Trace, Little, Some, Extensive (1-2 cm^2), Severe (>2 cm^2).

An overall plot damage score was calculated from the proportion of leaves in each category, using the weightings of 0, 1, 3, 5, 7, and 9, respectively.

Results were analysed using the GLM analysis of variance model in Systat 9. Percent data were transformed to arc-sine values for analysis, and tydeid numbers to square-root values, but all means shown are derived from raw figures. Means were compared using Fisher's LSD test at the 5% probability level. Tabled means in the same column are significantly different if they do not have a letter in common.

RESULTS AND DISCUSSION

Pre-spray

All stages of 6SM present on 5 old leaves per plot were counted (Table 2). Plots were ranked for both active mites and for eggs and the rank values averaged to sort plots into replicates of decreasing mite pressure. This was done to allow for the high degree of tree-to-tree variability encountered, with no obvious pattern. With this design there were no significant differences among treatment means for total mite numbers or for mite damage (Table 2).

Table 2. Pretrial sample : The average total number of all stages of 6SM sample and weighted damage score per 5-leaf, with means for replicates A-D and A-F.

Treatment		Total No Means		Damage Score Means	
		A - D	A - F	A - D	A - F
Fenamite	Oct x 1	4.2	4.2	20.5	14.0
Mit-é-mec + 0.5% oil	Oct x 1	4.4	4.4	23.8	16.0
Avid + 0.5% oil	Oct x 1	5.7	4.9	11.3	7.5
Avid + 0.5% oil	Nov x 1	5.7	-	21.5	-
Avid + 0.5% oil	Dec x 1	6.4	-	14.8	-
Avid + 0.5% oil	Oct x 2	4.4	-	12.8	-
Avid + 0.5% oil	Nov x 2	6.6	-	17.0	-
Avid + 0.5% oil	Dec x 2	4.1	-	16.5	-
Avid + 0.5% oil	Oct Nov	5.3	-	26.5	-
Avid + 0.5% oil	Nov Dec	6.1	-	24.3	-
DCTron Plus 0.5%	Oct Nov	5.9	-	14.5	-
DCTron Plus 0.5%	Nov Dec	5.9	-	31.5	-
untreated control	-	6.8	6.9	33.8	23.0

When the number of all stages of mites or active mites for each replicate group and damage scores are compared there were no correlations (Table 3), indicating that the damage was due to previous mite populations rather than those present at the start of the trial. As these leaves were old, from the previous season, this was not unexpected. It does indicate that leaf drop does not always immediately follow damage.

Table 3. The average damage score for 6SM and average mite numbers per replicate (n) before the trial began.

	Replicate					
	A	B	C	D	E	F
Factor	n = 13	n = 13	n = 13	n = 13	n = 4	n = 4
Damage score	5.65	5.49	5.49	5.37	5.30	4.15
Total mite numbers	58.2	15.2	7.0	2.2	1.5	0.0
6SM - adults + immatures	17.4	6.0	2.6	0.9	0.8	0.0

Post-spray sample 7

Four weeks after the main October sprays and just before the main November sprays were applied, samples of 20 old leaves per plot were picked. Because samples were taken before the full programme of sprays had been applied, some treatments were equivalent and results for these plots have been combined (Table 4). This gives a very variable replication for different treatments.

Table 4. The percent of old leaves infested by 6SM, total numbers of 6SM and scores for mite damage in mid-November.

Treatment		*reps*	% leaves infested		Nº of 6SM - all		Damage score	
Fenamite	Oct x 1	*6*	3.3	a	3.3	a	5.08	ab
Mit-é-mec + 0.5% oil	Oct x 1	*6*	1.7	a	0.5	a	4.43	a
Avid + 0.5% oil	Oct x 1	*10*	4.0	a	4.4	a	5.24	ab
Avid + 0.5% oil	Oct x 2	*4*	3.8	a	0.8	a	4.09	a
D-C-Tron Plus 0.5%	Oct x 1	*4*	11.3	ab	14.8	ab	5.30	ab
untreated control	-	*30*	15.0	b	15.3	b	5.71	b

Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

There was a clear impact from all spray regimes except the single oil spray on the mite populations present, expressed as either the percentage of leaves infested or the total numbers of mites present (Table 4). There was a suggestion that sprays may have impacted on the level of damage present, although the score was primarily due to old damage present before the trial began. Mit-e-mec showed a trend to fewer mites than Fenamite or Avid, but this was not statistically significant. There was no clear benefit from 2 sprays of Avid rather than 1, but there was a slight trend indicating fewer mites were present after 2 sprays.

The effects of the sprays on the 3 separate life stages of 6SM were very similar to those on total mite numbers (Table 5). The numbers of eggs were most variable and gave the least discrimination of treatments. The fact that the spray of 0.5% oil had demonstrably fewer adult mites present may indicate that this treatment had a transitory impact that had largely worn off by the time that this sample was taken, 4 weeks later.

Table 5. The average number of 6SM in each stage, November sample.

Treatment		reps	Number in each stage adult		immature		egg	
Fenamite	Oct x 1	*6*	0.3	a	0.7	ab	2.3	ab
Mit-é-mec + 0.5% oil	Oct x 1	*6*	0.2	a	0.3	a	0.0	a
Avid + 0.5% oil	Oct x 1	*10*	0.6	a	0.5	a	3.3	ab
Avid + 0.5% oil	Oct x 2	*4*	0.0	a	0.0	a	0.8	ab
D-C-Tron Plus 0.5%	Oct x 1	*4*	0.3	a	6.0	ab	8.5	ab
untreated control	-	*30*	2.0	b	5.0	b	8.3	b

Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

Post-spray sample 2

On 13 December, 4 weeks after the main November sprays and just before the main December sprays were applied, samples of 20 full-sized young leaves per plot were picked. There were no longer enough old leaves to sample from. This was 8 weeks after the initial spray application. More of the spray programmes had been put into effect, but a few were still incomplete (Table 6).

Table 6. The percent of leaves infested by 6SM, total numbers of 6SM per 20 leaves and scores for mite damage in mid-December, young foliage.

Treatment		reps	% leaves infested		Nº of 6SM - all		Damage score	
Fenamite	Oct x 1	*6*	5.8	ab	10.8	bc	0.12	abc
Mit-é-mec + 0.5% oil	Oct x 1	*6*	2.5	a	3.5	ab	0.09	ab
Avid + 0.5% oil	Oct x 1	*6*	3.3	ab	2.2	ab	0.09	ab
Avid + 0.5% oil	Nov x 1	*8*	1.9	a	0.4	a	0.07	ab
Avid + 0.5% oil	Oct x 2	*4*	3.8	ab	0.8	ab	0.18	bc
Avid + 0.5% oil	Nov x 2	*4*	0.0	a	0.0	a	0.09	ab
Avid + 0.5% oil	Oct Nov	*4*	0.0	a	0.0	a	0.01	a
D-C-Tron Plus 0.5%	Oct Nov	*4*	3.8	ab	4.3	abc	0.16	bc
D-C-Tron Plus 0.5%	Nov	*4*	5.0	ab	14.0	abc	0.15	abc
untreated control	-	*14*	8.2	b	14.4	c	0.24	c

Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

Most spray programmes now appeared to have had some impact on 6SM populations or damage (Table 6). The damage scores recorded are much lower than previously due to the change in leaf age sampled which removed the affect of accumulated exposure to mites before the trial began.

As in the first sample, a single spray of 0.5% D-C-Tron Plus oil showed minimal effect. However, a 2spray oil programme appeared to be more effective, although not significantly so. After 8 weeks, there was an indication that Fenamite may be less efficacious than either Mit-é-mec or Avid, but both mectins gave very similar results.

There was also a trend for November sprays to have lower mite numbers than October sprays, although the October numbers were still very low. This would probably reflect the deminished impact of any remaining residues that decay over time. By this stage there was also better evidence that one spray of Avid was as good as two.

The pattern of results for the counts of all mites was also shown by the separate stages (Table 7). Note that the occurrence of a number of zero data means that anova results need to be interpreted with caution.

Table 7. The average number of 6SM in each stage, mid-December sample

			Number in each stage				
Treatment		*reps*	**adult**	**immature**		**egg**	
Fenamite	Oct x 1	*6*	0.7	1.8	ab	8.3	ab
Mit-é-mec + 0.5% oil	Oct x 1	*6*	0.5	0.3	ab	2.7	ab
Avid + 0.5% oil	Oct x 1	*6*	0.0	1.8	ab	0.3	a
Avid + 0.5% oil	Nov x 1	*8*	0.3	0.1	a	0.0	a
Avid + 0.5% oil	Oct x 2	*4*	0.3	0.0	a	0.5	a
Avid + 0.5% oil	Nov x 2	*4*	0.0	0.0	a	0.0	a
Avid + 0.5% oil	Oct Nov	*4*	0.0	0.0	a	0.0	a
D-C-Tron Plus 0.5%	Oct Nov	*4*	0.3	0.8	ab	3.3	ab
D-C-Tron Plus 0.5%	Nov	*4*	0.8	1.8	b	11.5	ab
untreated control	-	*14*	0.9	1.4	b	12.1	b

Columns without letters showed no significant effect. Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

The change in the leaf type being sampled potentially confounds comparisons between this and previous samples. Samples of unsprayed leaves in mid-December (young leaves) had basically the same numbers of mites present as had been found 4 weeks previously on old leaves. The proportion of mites in each stage on unsprayed trees in particular had changed with fewer active stages and more eggs than earlier (Table 7 *cf.* Table 5).

Post-spray sample 3

A further 20-leaf sample of maturing leaves of the current growth flush was picked on 9 January 2004, 4 weeks after the main December sprays had been applied. Numbers of mites had decreased to low levels, and variation in mite numbers within a treatment were more pronounced, so that fewer differences among treatments were apparent (Tables 8 and 9).

As the damage score reflects accumulated mite feeding from the time the leaves had been formed, this measure was not as affected by the population decline (Table 8). The damage score was reduced by all spray treatments except the late oil spray. The early oil sprays were effective so the poor result of later applications probably reflects that the slow and limited response from a single spray of oil at 0.5% allowed some damage to accrue before any direct effect on mite numbers was apparent. Conversely the immediate and prolonged impact of the October sprays of Avid, Mit-é-mec and

Fenamite meant that these treatments still had relatively low damage scores although numbers of mites had since increased. Note that the relative positions of these 3 treatments varied in the December and January samples.

Table 8. The percent of leaves infested by 6SM, total numbers of 6SM per 20 leaves and scores for mite damage in early January, young foliage.

Treatment		*reps*	% leaves infested		Nº of 6SM	Damage score	
Fenamite	Oct x 1	*6*	1.7	ab	1.0	0.14	bc
Mit-é-mec + 0.5% oil	Oct x 1	*6*	5.8	bc	8.2	0.15	bc
Avid + 0.5% oil	Oct x 1	*6*	5.0	abc	7.7	0.19	c
Avid + 0.5% oil	Nov x 1	*4*	0.0	a	0.0	0.04	ab
Avid + 0.5% oil	Dec x 1	*4*	0.0	a	0.0	0.10	abc
Avid + 0.5% oil	Oct x 2	*4*	5.0	abc	3.5	0.11	abc
Avid + 0.5% oil	Nov x 2	*4*	0.0	a	0.0	0.04	ab
Avid + 0.5% oil	Dec x 2	*4*	0.0	a	0.0	0.11	abc
Avid + 0.5% oil	Oct Nov	*4*	2.5	abc	0.8	0.06	abc
Avid + 0.5% oil	Nov Dec	*4*	1.3	abc	0.3	0.00	a
DCTron Plus 0.5%	Oct Nov	*4*	1.3	abc	3.5	0.10	abc
DCTron Plus 0.5%	Nov Dec	*4*	6.3	bc	4.5	0.35	d
untreated control	-	*6*	5.9	c	11.0	0.39	d

Columns without letters showed no significant effect. Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

Table 9. The average number of 6SM in each stage, early January sample.

Treatment		*reps*	Number in each stage: adult	immature	egg
Fenamite	Oct x 1	6	0.2	0.2	0.7
Mit-é-mec + 0.5% oil	Oct x 1	6	1.7	1.7	4.8
Avid + 0.5% oil	Oct x 1	6	0.3	2.0	5.3
Avid + 0.5% oil	Nov x 1	*4*	0.0	0.0	0.0
Avid + 0.5% oil	Dec x 1	*4*	0.0	0.0	0.0
Avid + 0.5% oil	Oct x 2	*4*	0.5	0.3	2.8
Avid + 0.5% oil	Nov x 2	*4*	0.0	0.0	0.0
Avid + 0.5% oil	Dec x 2	*4*	0.0	0.0	0.0
Avid + 0.5% oil	Oct Nov	*4*	0.3	0.3	0.3
Avid + 0.5% oil	Nov Dec	*4*	0.3	0.0	0.0
DCTron Plus 0.5%	Oct Nov	*4*	0.3	0.0	3.3
DCTron Plus 0.5%	Nov Dec	*4*	0.3	2.5	1.8
untreated control	-	6	0.5	3.7	6.8

Columns without letters showed no significant effect.

Although a further sample was initially planned, numbers of 6SM on the orchard continued to decline and so sampling was terminated.

Plant safety

On 9 January each tree in the trial was scrutinised and 3 of the 60 showed a trace of black speckling on their leaves (Figure 1). These were plots B2, sprayed in October plus November, B5 and G9, both sprayed in November plus December.

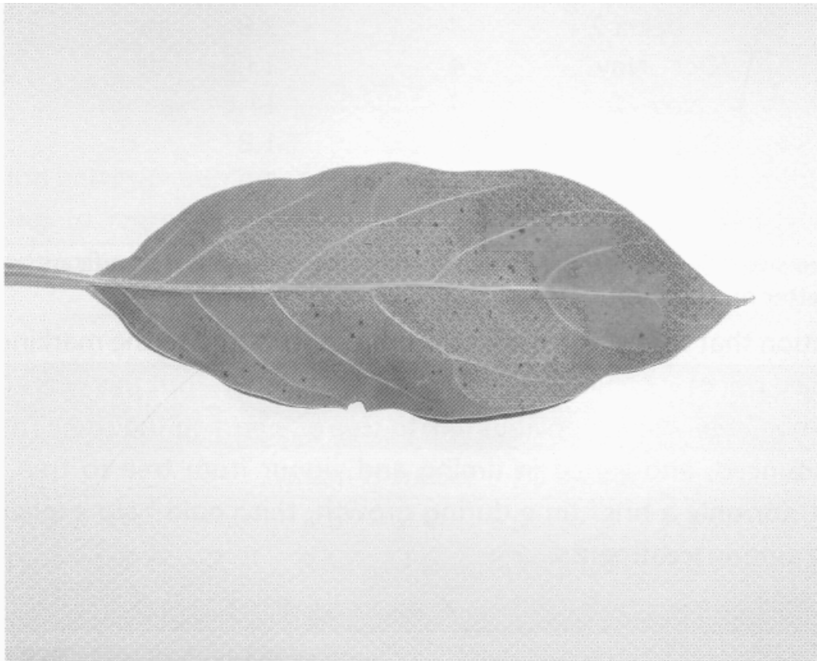

Figure 1. A leaf with about 30 speckle marks, viewed from underside to better show marking.

This type of marking, although not considered to be significant, has not been recorded in previous seasons. Avid, Mit-é-mec and Fenamite are not regarded as damaging to plants, but oil sprays can affect some crops especially when applied under conditions of slow drying or to stressed plants. D-CTron Plus is formulated to prevent plant effects and this marking of avocado leaves has not been recorded in previous research on this product.

Each leaf examined for mites in this sample was scored for speckle marks using the categories 0, 1 -5, 6-25 and >25. A total for each plot was calculated from the number in each category using the weightings of 0, 1, 3 and 5. This took into account that even leaves from untreated trees did have the odd small black mark, but those with greater numbers of marks were more likely to have been affected by the sprays.

Note that the maximum possible score in this system is 100, and that only 2 treatments were statistically different from the untreated. Two analyses are shown in Table 10 because only a single tree (B2) in the October-November sprays of Avid had an elevated speckle score. However, this was the most heavily marked tree found in the trial. Even using a log transformation this data point showed up as a significant outlier in an anova, so results both including and excluding this point are given.

Table 10. The average speckling score for each treatment in January samples.

Treatment		reps	Speckle score all plots		excluding B2	
Fenamite	Oct x 1	6	1.3	c	1.3	c
Mit-é-mec + 0.5% oil	Oct x 1	6	0.8	c	0.8	c
Avid + 0.5% oil	Oct x 1	6	1.7	c	1.7	c
Avid + 0.5% oil	Nov x 1	4	2.0	c	2.0	c
Avid + 0.5% oil	Dec x 1	4	8.5	ab	8.5	ab
Avid + 0.5% oil	Oct x 2	4	3.5	bc	3.5	bc
Avid + 0.5% oil	Nov x 2	4	2.8	bc	2.8	bc
Avid + 0.5% oil	Dec x 2	4	3.8	abc	3.8	bc
Avid + 0.5% oil	Oct Nov	4	13.5	ab	3.0	bc
Avid + 0.5% oil	Nov Dec	4	11.8	a	11.8	a
D-C-Tron Plus 0.5%	Oct Nov	4	1.8	c	1.8	c
D-C-Tron Plus 0.5%	Nov Dec	4	2.8	bc	2.8	c
untreated control	-	6	2.5	bc	2.5	c

Oil used with the mectins was D-C-Tron Plus. Values in the same column are significantly different ($P<0.005$) if they do not have a letter on common.

There is no clear indication that sprays at a particular time contributed to the marking (Table 10). There was possibly an increased risk of leaf speckling with December sprays, but this was not consistent for all sprays applied then. There was also no obvious link to tree position on the site. The growth flush this season was very pronounced, and varied in timing and vigour from tree to tree. If new foliage is susceptible to marking for only a brief time during growth, this could help explain the variability of results both within and among treatments.

Potential predators

A number of insects and mites are predators that may feed on 6SM. Adults and larvae of these were counted, as eggs can be reliably identified. Chief among these predators are the ladybirds, *Stethorus* spp. (Coleóptera: Coccinellidae), which have been seen feeding on 6SM in New Zealand, and mites of the families Phytoseidae and Agistemidae. Although overseas members of these mite groups are recognized as 6SM predators, local research has shown not all feed on 6SM (Stevens and Jamieson, 2002).

In the pre-trial sample few predators were seen on the avocado leaves (Table 12). The data for 6SM are equivalent except that data for all life stages including eggs have been used, as all stages may be fed on. Over the whole trial numbers of 6SM were high to start with and progressively declined. Although part of this drop was caused by the sprays applied, numbers declined even on untreated trees. *Stethorus* ladybirds were the most numerous predator pre-trial (but were still low at 1.7% of leaves infested), but were insignificant subsequently. In contrast, the numbers of phytoseid mites increased over time, to actually be more numerous than 6SM in the January sample (Table 11).

Table 11. The numbers of predatory mites and ladybirds found on avocado leaves, with comparable data for 6SM.

		Sample			
		Pre-trial	**A**	**B**	**C**
	Date sampled	7 Oct	12 Nov	13 Dec	9 Jan
	Sample type	old leaves	old leaves	new leaves	new leaves
	No leaves/plot	5	20	20	20
Stethorus spp.	No	6	2	0	1
	No leaves infested	5	2	-	1
	No plots infested	5	2	-	1
Phytoseidae	No	1	20	87	435
	No leaves infested	1	19	78	355
	No plots infested	1	16	38	58
Agistemidae	No	3	10	1	2
	No leaves infested	1	10	1	2
	No plots infested	1	6	1	2
6SM	*No*	*1080*	*589*	*380*	*217*
	No leaves infested	*133*	*116*	*50*	*35*
	No plots infested	*54*	*43*	*29*	*22*

The lack of correlation between numbers of 6SM and phytoseids suggests that this group of predators in general is not acting to regulate 6SM populations. At a more detailed level, the distribution of phytoseid predators across all treatments regardless of 6SM incidence reinforces this impression (Table 12).

Table 12. The numbers of phytoseid predators and 6SM in each treatment, given in descending order of 6SM populations, January sample.

	Mean Number / 20 leaves												
Phytoseidae	6.5	10.0	7.3	8.5	7.0	4.0	7.5	7.3	11.0	6.0	6.0	8.0	3.8
6SM	11.0	8.2	7.7	4.5	3.5	3.5	1.0	0.8	0.3	0	0	0	0
Treatment	*13*	*2*	*3*	*12*	*6*	*11*	*1*	*9*	*10*	*4*	*5*	*7*	*8*

(Treatment No as given in methods section)

Tydeid mites

The tydeid mites *Orthotydeus californicus* and *O. caudatus* (Acari: Tydeidae) are common on a number of tree crops in New Zealand. Although some authors have considered these mites to be predatory, tydeids are now believed to feed on fungi and detritus. Large numbers can occur on avocado leaves, where they tend to occupy the same sites as 6SM. Tydeids may provide an alternative food for predators which feed on pest species such as 6SM. As well it is difficult to separate the young stages of tydeid species from young 6SM, which is a point that scouts must keep in mind.

At this site tydeids were not particularly numerous (Table 13). Overall numbers were low to start with, increased over the next 2 months, and then remained at a modest level.

Table 13.	The tydeid population on the trial site on each occasion.				
			Sample		
		Pre-trial	**A**	**B**	**C**
	Date sampled	7 Oct	12 Nov	13 Dec	9 Jan
	Sample type	old leaves	old leaves	new leaves	new leaves
	No leaves/plot	5	20	20	20
<u>*Orthotydeus*</u>	No	2	23	68	72
<u>*spp.*</u>	% leaves infested	0.7 %	1.6 %	4.3 %	4.5 %
	No plots infested	2	13	30	23

In spite of the overall low numbers of tydeids there was an effect of the sprays applied (Table 14). Note that not all treatments had been put in place by the November and December samples so that replication varies over time. In previous trials both oil sprays and the mectins have reduced tydeid populations.

Table 14. The average number of tydeid mites (active stages) in each sample.

Treatment		**Number in each sample**					
		Nov		**Dec**		**Jan**	
Fenamite	Oct x 1	0.0	ab	0.3	b	0.3	b
Mit-é-mec + 0.5% oil	Oct x 1	0.2	ab	0.7	ab	4.7	a
Avid + 0.5% oil	Oct x 1	0.0	b	1.5	ab	1.2	b
Avid + 0.5% oil	Nov x 1	-		0.1	b	0.0	b
Avid + 0.5% oil	Dec x 1	-		-		0.3	b
Avid + 0.5% oil	Oct x 2	0.0	ab	1.0	ab	0.3	b
Avid + 0.5% oil	Nov x 2	-		0.3	b	0.5	b
Avid + 0.5% oil	Dec x 2	-		-		0.0	b
Avid + 0.5% oil	Oct Nov	-		0.8	b	0.8	b
Avid + 0.5% oil	Nov Dec	-		-		0.0	b
DCTron Plus 0.5%	Oct Nov	0.0	ab	0.8	ab	0.5	b
DCTron Plus 0.5%	Nov Dec	-		0.8	ab	0.8	b
untreated control	-	0.7	a	2.7	a	3.8	a

Values in the same column are significantly different (P<0.005) if they do not have a letter on common.

CONCLUSIONS

The lower pest pressure this season made it more difficult to obtain good data. Although 6SM numbers were reasonably high when the trial was laid down they declined from this time, even on unsprayed trees. The drop was most marked at the start of the period, between the October and November samples. In contrast, numbers at the same orchard the previous season were higher and peaked much later, about the end of December, at 372 mites/10 leaves and 87% of leaves infested on untreated trees (Steven, 2003). This season untreated trees had only 5.4 mites/ 10 leaves (10.8% of leaves infested) on 13th December and 5.5 mites/10 leaves (5.9% of leaves infested) on 9th January. These figures are for the plots that remained untreated.

Overall, a single mid-October spray of the standard abamectin (Avid), the alternative mectin Mit-é-mec (milbemectin) and the new miticide Fenamite (fenpyroximate) all gave equivalent initial control of 6SM. There was a possible indication that control by Fenamite may be less persistent than by the two avermectins. The low rate of oil that is recommended as an adjuvant with both avermectins had minimal effect on its own when only a single spray was used, but had some impact when two sprays were used.

No significant benefit arose from using two applications rather than one, regardless of the interval between sprays. Greater pest pressure may alter this conclusion. Even a single spray gave a remarkably long period of lowered mite numbers (2 3 months) so that it was not possible to discriminate among the different times of application tested.

Although some black speckling of leaves was observed, this was not isolated to specific treatments so that the likely trigger factors, such as the conditions prevailing at a particular application time, could not be identified.

The predatory ladybird *Stethorus* was more common early and then virtually vanished from the trial area. Last season the trial was later (running from late November to midFebruary), and 6SM numbers were much higher and peaked later in the season. *Stethorus* was the most common predator throughout the previous trial, although it did decline in incidence through that trial. Predator mites were only found in any numbers in the final sample last season, but never reached the abundance found this season.

Tydeid mites were not as common at this site as has been found elsewhere in New Zealand on avocados (unpublished data). In both years the incidence of tydeids increased during the course of the trial to be most numerous in the final samples. At an equivalent time, about mid-January, the incidence was 16% of leaves infested in 2003 and 5% in 2004 (for the untreated control). In both years the mectin sprays significantly reduced tydeid populations.

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