

**THE INFLUENCE OF COMPONENTS OF THE NECTARINE
SPRAY PROGRAMME ON *TYPHLODROMUS OCCIDENTALIS*
(NESBITT)**

G.F. McLAREN and J.A. FRASER

HortResearch, Clyde Research Centre, R.D.1 Alexandra

SUMMARY

Seven pesticides from the recommended spray programme for nectarines were tested for their effects on mites over 2 years. All the pesticides were associated with increases in European red mite (ERM) in the second year, replacing the previously dominant two-spotted spider mite (TSM). Highest numbers of ERM occurred on the fluvalinate treatment, which had been applied four times over flowering. In a second trial, fluvalinate delayed the appearance of the predatory mite, *Typhlodromus occidentalis* (Nesbitt) by 60 days (4 applications), 43 days (3 applications) and 21 days (1 or 2 applications) compared with the untreated control. The appearance of TSM and ERM in leaf samples was not delayed and consequently the predator:prey ratios increased significantly for both species (particularly ERM) in the second year.

Keywords: *Typhlodromus occidentalis*, European red mite, two-spotted spider mite, nectarines, fluvalinate.

INTRODUCTION

The predatory mite *Typhlodromus occidentalis* (Nesbitt) was introduced into the major fruit growing regions of New Zealand between 1976 and 1981, but Central Otago was the only district where it established successfully (McLaren and Thomas 1989). It established particularly well on summerfruit, where few, if any, predatory mite species had occurred previously, even on unsprayed trees. In order to identify pesticides in the summerfruit spray programme which were potentially harmful to *T. occidentalis*, possible candidates were selected based on research in Australia and USA (Field 1978; Hoy and Conley 1987). Each pesticide was tested for its season-long effect on both predatory and pest mites on nectarines. A second trial investigated the effect of up to four applications of fluvalinate on mite populations.

METHODS

Two trials were conducted, both ran for 2 years using adjoining blocks of 'Fantasia' nectarines (5 x 2 m spacing) at the Clyde Research Centre. The trees were 5 years old at the commencement of the first trial in 1990. Treatments were allocated to three-tree plots in a randomised plot design with seven replications in the first trial and four in the second. The same design was used on these trees over two growing seasons. *T. occidentalis* was already present in the block.

Trial 1

Treatments were applied at the times and rates recommended in the Summerfruit Export Council Spray Programme. In the two seasons of the trial, full bloom occurred on 24.9.90 and 18.9.91, and harvest occurred on 15.2.91 and 5.2.92.

The treatments were:

1. untreated control,
2. fluvalinate (Mavrik) 4.8 g/100 litres + Triton B 1956 15 ml/100 litres applied at pink, full bloom, petal fall and 10 days after petal fall,
3. benomyl (Benlate) 20 g/100 litres applied 5 times from pink to late November,
4. chlorpyrifos (Lorsban WP) 35 g/100 litres applied 7 times from pink to early January,

Proc. 46th N.Z. Plant Protection Conf. 1993: 6-10

5. propargite (Omite) 60 g/100 litres applied 3 times from early December to early February,
6. sulphur (SuperSix) 144 g/100 litres applied 4 times from mid-October to mid-December,
7. carbaryl (Carbaryl WP) 80 g/100 litres applied twice prior to harvest,
8. maldison (Malathion WP) 50 g/100 litres applied twice prior to harvest.

Trial 2

Fluvalinate was applied at 4.8 g/100 litres at pink (13.9.91 and 21.9.92), full bloom (18.9.91 and 30.9.92), petal fall (4.10.91 and 8.10.92) and 10 days after petal fall (17.10.91 and 20.10.92). All four of these applications were made to Treatment 5; the first three to Treatment 4; the first two to Treatment 3; the one at pink to Treatment 2, and none on Treatment 1.

In both trials, all treatments were applied with a handgun, using approximately 7 litres per tree. Samples of 50 leaves were collected from the central tree in each plot at 2-weekly intervals between early November and late April. Numbers of *T. occidentalis*, ERM and TSM were recorded under a binocular microscope. Data were analysed using ANOVA on untransformed counts. Significant differences cited are at $P < 0.05$.

RESULTS**Trial 1**

The initial increase of TSM in the untreated control trees in December 1990 was checked as *T. occidentalis* numbers increased. *T. occidentalis* remained on these trees for the duration of the trial in association with low levels of TSM and ERM (Fig. 1). No significant differences were found between mean numbers of ERM in any of the treatments from December to April in both years, except where fluvalinate was used (note scale change for fluvalinate in Fig.1). Trees in this treatment had significantly higher levels of ERM and TSM in both seasons. In the second season, TSM numbers in the carbaryl treatment were significantly higher than those in all the other treatments except fluvalinate. *T. occidentalis* numbers were not significantly different to the control until the second year, when they were significantly lower on the fluvalinate and propargite treatments only (Table 1).

TABLE 1: Mites per leaf averaged for 10 sampling occasions from December to April over two seasons in Trial 1. Numbers followed by the same letter are not significantly different.

Treatment	ERM		TSM		<i>T. occidentalis</i>	
	90/91	91/92	90/91	91/92	90/91	91/92
untreated	0.08a	0.37a	0.99a	0.11a	0.36a	0.16a
fluvalinate	0.39b	4.03b	2.28b	0.69b	0.52ab	0.04b
benomyl	0.09a	0.86a	0.91a	0.07a	0.24a	0.08ab
chlorpyrifos	0.06a	0.84a	1.30ab	0.15a	0.81b	0.20a
propargite	0.15a	0.01a	0.26a	0.00a	0.07a	0.00b
sulphur	0.08a	1.22a	0.92a	0.06a	0.14a	0.07ab
carbaryl	0.03a	1.88a	0.12a	0.76b	0.28a	0.12ab
maldison	0.02a	1.86a	0.14a	0.04a	0.28a	0.15a

The highest numbers of ERM and TSM developed in the fluvalinate treatment where TSM predominated in the first year (maximum = 2/leaf) and ERM in the following year (maximum = 19/leaf). By the second year, predator:prey ratios for the fluvalinate treatment had deteriorated to 1 *T. occidentalis*:101 ERM, which compared unfavourably with the 1:2 ratio in the untreated control. In the benomyl, chlorpyrifos, sulphur, maldison and carbaryl treatments there was a similar pattern of replacement of TSM by ERM in the second year, but they had less effect on the predator:prey ratio.

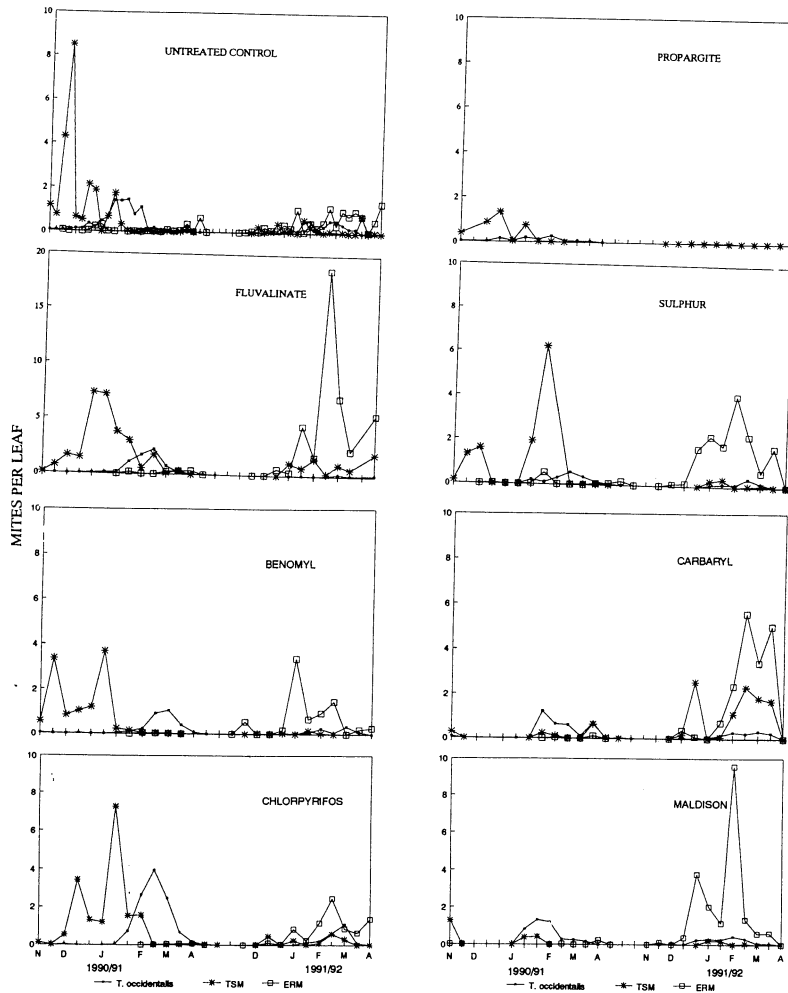


Figure 1: Mites per leaf on nectarine trees treated with seven different pesticides during two growing seasons.

(1:11, 1:4, 1:17, 1:16, 1:12 respectively). The miticide, propargite, effectively reduced the levels of all mites to zero in the second year.

Trial 2

The levels of all three mite species increased with the first two applications of fluvalinate, but declined after three or four applications, particularly in the second year (Table 2).

A positive correlation was found between the mean number of *T. occidentalis* and of both ERM and TSM in each year, suggesting there was little evidence for suppression of *T. occidentalis* by fluvalinate in Trial 2. However, when the time of first appearance of *T. occidentalis* was compared with the untreated control each season, it was evident that four applications of fluvalinate delayed the appearance of the

predator by approximately 60 days in three out of four seasons (62 days 1991, 54 days 1992 (Trial 1) and 58 days 1993 (Trial 2). No delay was evident in the first year of Trial 2 when *T. occidentalis* did not appear on any samples, including the control, until 20 February 1992. There was no comparable delay in the development of ERM and TSM in any year and consequently predator:prey ratios increased (particularly for ERM) with more exposures to fluvalinate (Table 3).

TABLE 2: Mean mites per leaf for 10 sampling occasions from November to April in Trial 2 over 2 years. Means were not significantly different ($P>0.05$).

No. fluv appl'ns	ERM		TSM		<i>T. occidentalis</i>	
	91/92	92/93	91/92	92/93	91/92	92/93
0	0.131	2.15	0.093	0.871	0.080	0.144
1	0.371	13.26	0.231	1.028	0.136	0.516
2	0.684	13.88	0.453	1.538	0.222	0.180
3	0.324	8.96	0.340	1.564	0.191	0.036
4	0.576	4.14	0.687	2.424	0.071	0.078

TABLE 3: ERM and TSM/ *T. occidentalis* over two seasons in Trial 2.

No. fluv appl'ns	ERM		TSM	
	1991/92	1992/93	1991/92	1992/93
0	1.64	14.93	1.16	6.05
1	2.73	25.70	1.70	1.99
2	3.08	77.11	2.04	8.54
3	1.70	248.90	1.78	43.44
4	8.11	53.08	9.68	31.08

DISCUSSION

The change in dominance from TSM to ERM over two seasons on the treated blocks in Trial 1 could be a response to either the pesticides used or different seasonal conditions. However, the results from Trial 2, which commenced one year later, showed a similar increase in the second year, with ERM reaching 80 mites per leaf in one fluvalinate treatment. Despite TSM numbers in the untreated control also increasing in that year, the consistent deterioration in the predator:prey ratios for ERM and TSM with increasing fluvalinate applications confirmed the effect of this chemical on mite populations over two seasons. This effect was more evident for ERM than for the preferred food of *T. occidentalis*, TSM (Croft *et al.* 1992).

Interpretation of Trial 2 was confounded by the increase in numbers of *T. occidentalis* associated with the increase in numbers of either TSM or ERM, particularly where only one or two sprays were applied. However, there was clear evidence in the second season that four applications of fluvalinate delayed the appearance of *T. occidentalis* by two months while one or two sprays (applied before or during bloom) resulted in just three weeks delay. The influence of the time of spray application on this delay cannot be determined from these results.

Holland and Chapman (1990, 1991) demonstrated that fluvalinate caused short term dispersal of TSM and ERM but our trials found no evidence for fluvalinate delaying the establishment of either ERM or TSM.

Although the other pesticides which were tested in Trial 1 may have had some effect on mite numbers, fluvalinate was the only treatment (apart from propargite) to cause significant reductions in *T. occidentalis* numbers. This disruption of *T. occidentalis*

populations was associated with a shift in dominance of the phytophagous mites from TSM to the more damaging ERM. The interactions involved in this reversal are not fully understood, especially as they were observed in most of the other treatments as well.

REFERENCES

- Croft, B.A., McRae, I.V. and Currans, A.G., 1992. Factors affecting biological control of apple mites by mixed populations of *Metaseiulus occidentalis* and *Typhlodromus pyri*. *Exptl. and Appl. Acarol.* 14: 343-355.
- Field, R.P., 1978. Predators keep down two-spotted mites - but watch your spray. *Victorian Horticulture Digest* 74: 17-20.
- Holland, J.M. and Chapman, R.B., 1990. The behaviour and reproductive response of European red mite to fluvalinate. *Proc. 43rd N.Z. Weed and Pest Control Conf.*: 95-99.
- Holland, J.M. and Chapman, R.B., 1991. Effect of fluvalinate on the development and survival of two-spotted spider mite. *Proc. 44th N.Z. Weed and Pest Control Conf.*: 248-251.
- Hoy, M.A. and Conley, J., 1987. Toxicity of pesticides to western predatory mite. *California Agriculture, July- August*: 12-14.
- McLaren, G.F. and Thomas, W.P., 1989. Mites and their management in Central Otago orchards. *Proc. N.Z. Soc. for Hort. Sci. Conf.*: 113-119.