SCREENING CHEMICALS AGAINST AN ORIBATID MITE

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SUMMARY

The oribatid mite species *Scutovertex sculptus*, which occupies an arboreal habitat on kiwifruit vines, was largely unaffected by most insecticides and miticides to which it was exposed in a laboratory bioassay. Of the 25 materials used only three caused mortalities greater than 50% (clopythrin, pirimiphos-methyl and oil), but the first two only achieved these kills at extremely heavy application rates. Oil alone showed an ability to kill more than 90% of this mite at a rate commonly used in horticulture.

INTRODUCTION

Mites of the order Cryptostigmata, commonly referred to as oribatid mites, are not generally considered to be pests. The vast majority live in the soil and litter where they feed on fungi and detritus, and function in the cycling of plant nutrients. However, a number are now known to live more or less permanently on trees (Aoki 1973). In New Zealand some of these arboreal species occur on kiwifruit vines and they can be readily found on the fruit at harvest. Until 1986, when the New Zealand inspection standards were modified to distinguish between pest mites (principally two-spotted mite, *Tetranychus urticae*) and harmless species present as contaminants, the occurrence of oribatid mites had caused consignments of fruit to be rejected from export each year. The problem was worse in wetter seasons and areas, such as the Kumeu district in 1985. With the new standards there is a greater tolerance of oribatid mites, but growers are still required to keep the numbers below levels at which consumers would react adversely.

Brushing and blowing techniques are very effective in removing oribatid mites from fruit during the packing operation (Steven and Lofroth unpublished), and now are often sufficient to prevent rejection. However, some growers had attributed a decrease in oribatid numbers from one season to the next to a change in the insecticide sprays used. As a spray trial on feijoas (Steven and Brown unpublished) had indicated that none of the seven miticides or insecticides tested showed much potential in reducing oribatid populations, these claims were investigated using a laboratory bioassay. This technique enabled many chemicals to be screened.

METHODS

Adult oribatid mites of the species *Scutovertex sculptus*, which is the commonest species on kiwifruit vines at the Kumeu Research Orchard, were trapped dorsally on adhesive tape, transferred to microscope slides and dipped with continuous agitation for 30 seconds in solutions of a range of pesticides. After treatment the mites were held at approximately 20°C and 93% relative humidity, and their mortality assessed after 24 and 48 h. Because of the limited availability of mites, only one or two materials were tested on any day, and testing took place over a 4 month period. The average sample size of mites for each dosage tested was 34, with 64 on average for each control. Control slides were dipped in water.

Each product was tested at a base rate, generally the rate recommended for field use, and at one tenth and 10 times this base rate. This bioassay basically tests contact efficacy, and so may seriously under-estimate the effect of pesticides known to act in other ways, e.g. the growth regulators such as buprofezin. However, as oribatids typically have a long life with only one or two generations each year, slow acting pesticides are less likely to find a use, and could not be used for a pre-harvest "clean-up" as desired by growers.

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TABLE 1: The common and trade names of the chemicals tested, and the base rates used (see text).

Common Name	Trade Name	Base Rate (g ai/100 litres)
azinphos-methyl	Gusathion M50	50
bromopropylate	Neoron 500	90
buprofezin	Applaud 50 WP	25
carbaryl	Denapon 85 WP	120
chlorpyrifos	Lorsban 50 W	37.5
clocythrln	Karate 5 EC	2.5
clofentezine	Apollo 50 WP	30
cycloprate	Zardex 25 WP	50
cyhexatin	Plictran 50 WP	20
DDT	DDT 50 WP	80
diazinon	Ispray Diazinon 50 W	50
dicofol	Kelthane 35	35
dimethoate	Rogor E	20
E 268	(15 EC)	20
endosulfan	Thiodan 35 EC	71
fenbutatin oxide	Torque 50 WP	20
maldison	Yates Maldison 50	20
methidathion	Supracide 30 WP	41
mineral oil	Sunspray	(2%)
permethrin	Ambush 50 EC	100
permethrin +	Attack	50
pirimiphos-methyl		
phosmet	Imidan 75 WP	112.5
β -pinene	Wiltpruf	(2%)
pirimiphos-methyl	Actellic 50 EC	75-375
propargite	Omite 30 W	60

The products tested are recorded in Table 1, along with the base rate used.

RESULTS

When determining test procedure, a preliminary run using the insecticide chlorpyrifos was continued beyond 48 h to 96 h. Of 79 mites in the untreated control, four died in the first 24 h, one in the next 24 h and a further two in the next 48 h; of 126 in the three chlorpyrifos treatments four died in the first 24 h, eight in the next 24 h and none in the following 48 h. From this it was decided to conduct each test over 48 h.

In Figure 1 the results are given as the percent killed after 48 h, unmodified to account for control mortalities because in many cases fewer mites died in the low rate treatments than in the controls. The control mortality for each run is also graphed. Table 2 records the corrected mortalities for those materials which caused mortalities greater than 30%.

With some chemicals (e.g. azinphos-methyl and permethrin (Table 2)), there was a considerable increase in mortality between the 24 and 48 hour checks; with others (e.g. endosulfan, clocythrln and oil), most mortality occurred in the first 24 hours.

DISCUSSION

Many of the 25 insecticides and miticides tested caused very little mortality of *S. sculptus*, the oribatid species used here. Others, e.g. endosulfan and carbaryl, did cause some mortality at 10x the base rate, but the kill achieved would not be economically exploitable. Two of the specialist miticides tested (cycloprate and dicofol) were also in this class, while the other 5 were ineffective. Only three materials, (clocythrln, pirimiphos-methyl, and a narrow-cut spraying oil) caused high mortalities, and of these, only oil showed very high toxicity. This occurred even at the rate normally used in orchard spraying. Massee (1932) wrote that a winter application of 5% tar-oil could be

Fig. 1: The effect of pesticides on the oribatid mite, *Scutovertex sculptus*, in a slide-dip bioassay.

TABLE 2: Mortality of the oribatid mite, *Scutovertex sculptus*, 24 and 48 h after being dipped in the six most toxic chemicals. (Mortalities corrected by Abbotts' formula).

Chemical	Rate g ai/100 litres	% Mortality	
		After 24 h	After 48 h
endosulfan	700	30.3	32.0
	70	-2.5	0.8
	7	3.2	1.8
azinphos-methyl	500	5.8	41.4
	50	2.3	17.6
	5	4.6	-0.1
permethrin	1000	9.4	43.6
	100	11.9	27.5
	10	15.7	18.1
clocythrln	25	60.8	63.4
	2.5	33.7	32.8
	0.25	9.7	14.5
pirimiphos-methyl	3750	40.8	72.6
	375	2.1	5.3
	37.5	7.8	14.2
	750	12.5	77.7
	75	5.2	23.1
	7.5	-5.2	1.8
oil	20%	95.6	100.0
	2%	81.9	92.4
	0.2%	61.2	70.1

used to control the oribatid *Euzetes lapidarius*, which could become a nuisance by feeding on split, ripe cherries. However, on kiwifruit, oil can cause serious phytotoxicity when applied during the growing season (Sale 1972), and so its use cannot be recommended.

While some materials were not expected to cause high mortality (e.g. the insecticide buprofezin and the miticide clofentezine), because they are normally mediated in ways that would not show in such a dip test, the inactivity of most of the compounds was quite surprising. The oribatid fauna has been proposed as an indicator group to monitor the impact of agricultural practices on the environment (Rockett 1986), but this study indicates that this may not be appropriate as some species are tolerant of many pesticides.

Both synthetic pyrethroids tested (permethrin and clopythrin) had some impact on the oribatid mite. Clopythrin is a third generation synthetic pyrethroid with both insecticidal and miticidal properties. Pirimiphos-methyl was the most potent organophosphate tested. This product was tried at two base rates; a heavy one as used industrially against spiders, and at a fifth of this which is a rate used in citrus. However, although both permethrin and pirimiphos-methyl caused some kill on their own, the combination product (Attack) had negligible effect even at 10x the field rate. This may be partly due to the lower rate of each active ingredient in the combination product, and does not support the claims of some kiwifruit growers that permethrin/pirimiphos-methyl has reduced the numbers of oribatids on their harvested fruit in the last two seasons.

Because this was a screening trial with the objective of testing as many chemicals as possible, the number of mites used in each run was kept low. This means that variability is greater than it would be for more intensely replicated trials, and too much significance should not be placed on minor differences (e.g. the inverse rate "effect" of DDT). The duration of the testing programme could also have increased the variability. Larger samples were used for control tests, but there was still considerable variation among the runs (Fig. 1).

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