WINTER CLEANUP SPRAYS FOR LATANIA SCALE (*HEMIBERLESIA LATANIAE*) ON LOMBARDY POPLAR SHELTER IN KIWIFRUIT ORCHARDS

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SUMMARY

Intermediate oil, diazinon and chlorpyrifos applied as a single dormant season spray, all gave good control of latania scale on Lombardy poplar shelter. Scale under lichen was more easily killed than scale exposed on bark. These results support recent changes to recommendations to control scale on kiwifruit during the dormant period in which insecticides are recommended in early winter and lichen control in late winter.

INTRODUCTION

Latania scale (*Hemiberlesia lataniae* Signoret) is the dominant armoured scale pest in Kerikeri and Gisborne and is responsible for 30% of infested fruit in the Kumeu-Helensville area (Berry *et al* 1989).

Armoured scale insects on kiwifruit at harvest have been an increasing problem in the Gisborne area. A survey of the Gisborne district in January and February 1989 showed that Lombardy poplar (*Populus nigra* var. *italica*) shelter was badly infested with latania scale in several orchards, and that scale was being blown from the shelter onto the adjacent kiwifruit crop in large numbers at some sites (Hill and Allan 1989). Over 80% of kiwifruit shelter in the Gisborne region is Lombardy poplar.

Chemical control trials for greedy scale on kiwifruit have shown that oil, diazinon and chlorpyrifos give adequate control (Ferguson and Wallace 1979; Blank *et al* 1985; Sale 1974; Tomkins *et al* 1986). Blank and Olson (1989) showed that a single application of diazinon gave good control of all stages of latania scale during the dormant period.

Recommendations for dormant season control of armoured scale insects on kiwifruit (Sale 1989) have been changed recently following new information showing that lime sulphur, which is used for lichen control, prevents settlement of scale crawlers for more than a month (Blank and Olson 1989). This has led to the recommendation that insecticides for dormant season scale control be applied after pruning and lime sulphur applied for lichen control in late dormancy (Sale 1989) when it will be of most benefit in retarding settlement of the new season's progeny of scale insects.

The following trial was designed to test the efficacy of two organophosphate chemicals with and without oil, for control of latania scale on Lombardy poplar during the dormant season. It measured both the distribution of latania scale between lichen covered and exposed bark and the effects of insecticides on scale mortality on both substrates.

METHODS

The trial was carried out in a commercial kiwifruit orchard in Gisborne. It was arranged in a randomised block design with five replicates. Each block was a line of shelter trees. There were 10 sample trees within a treatment plot. Chemicals were applied to runoff with a motorised knapsack sprayer (Fox-Motori Poviglio using a cone spray nozzle at 345 kPa).

Treatments were:

1. intermediate oil (D-C Tron), 2 litres ai/100 litres
2. intermediate oil + chlorpyrifos (Lorsban 40EC), 2 litres + 20 g ai/100 litres
3. intermediate oil + diazinon (Diazinon 80 EC), 2 litres + 48 g ai/100 litres

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4. diazinon, 48 g ai/100 litres
5. chlorpyrifos, 20 g ai/100 litres
6. untreated control

Chemicals were sprayed over about a 2 metre length of the trunk of a Lombardy poplar at a height of 3-4 metres. The trees were about 12 years old (diameter at spraying height 15-40 cm) and were heavily infested with laticia scale. Bark samples were taken from each tree on 16-17 May 1989, prior to spraying. Post-treatment sampling was carried out 3 weeks later on 6-7 June. Bark samples were taken from an area adjacent to and usually below the area from which the pre-spray sample was taken.

All bark samples were examined under a binocular microscope in the laboratory. Sixty juvenile (1st and 2nd instar) and 60 adult (3rd instar) scale were examined for each sample tree (1200 insects per plot, 6000 insects per treatment per sampling occasion); half being from positions under lichen and half from exposed areas of bark. They were categorised as being either live or dead by visual inspection, noting body colour and rigidity. This was checked by periodically mounting specimens and checking for external or internal body movements, particularly pharyngeal pumping (the "pump test" (Witherell 1984)).

Preliminary observations suggested that the ratio of scale numbers under lichen compared with numbers on exposed surfaces changed from a high to a low ratio as the overall scale population level increased. This was investigated by measuring the density of scale from exposed surfaces and under lichen from ten subjectively chosen "moderate" and ten "heavy" infestations (minimum area examined was 5 cm²). For the purposes of measuring scale densities, the "under-lichen" environment was further divided into small pieces of lichen, and the middle and the edge of large pieces of lichen.

RESULTS AND DISCUSSION

Densities of scale were greater under lichen than on exposed surfaces (Table 1). The heaviest concentrations of live scale were found near the edge of large pieces of lichen and under small pieces of lichen. The habitat in the middle of large pieces of lichen appeared to be less suitable than the edge, possibly because it appeared prone to waterlogging. The scarcity of scale on exposed surfaces of moderate infestations may be partly due to predation by the beetle *Rhyzobius fagus* (Broun). This predatory ladybird was found commonly in the area and there was much evidence of predation on scales on exposed surfaces.

TABLE 1: Densities of scale under lichen and on exposed surfaces of lombardy poplar bark (n = 10, figures in brackets are standard errors).

	Live scale/cm ²			
	Under lichen		Small piece	Exposed
	Large piece Middle	Edge		
Moderate infestation	2 (0.8)	15 (1.9)	13 (1.9)	1 (1.0)
Heavy infestation	7 (3.3)	23 (5.7)	11 (1.3)	11 (3.5)

The density of scales on exposed surfaces increased considerably between moderate and heavy infestations. This appeared to be due to the buildup of dead scales on the exposed surface which creates a sheltered environment, more favourable to crawler settlement, and possibly protected from predation. In effect, the scale population would in time create its own sheltered environment similar to that found under lichen.

Scale mortality data collected 3 weeks after spraying were transformed (arcsine/square root) and subjected to analysis of variance. The back-transformed mean mortality values corrected for control mortality (Table 2) show that scale under lichen are more easily killed than those on exposed surfaces ($P < 0.05$), and that juvenile scale are more easily killed than adults ($P < 0.05$).

Difference in percentage scale mortality between spray treatments were less well defined, and no treatment gave significantly more control than the others. The average level of control achieved in this trial with diazinon (79%) is comparable with that

TABLE 2: Percentage mortality of latania scale on lombardy poplar (corrected for control and pre-treatment mortality) following single dormant season application of insecticide. Rates are given in the text.

Treatment	% Mortality		Adult	Juvenile
	Under lichen	Exposed		
2% oil	72	76	65	82
2% oil + chlorpyrifos	93	80	82	92
2% oil + diazinon	93	88	88	93
chlorpyrifos	83	75	70	88
diazinon	84	75	76	82
mean	85.0	78.8	76.2	87.4

Approximate 5% LSD for mean values is 5.5%

reported by Blank and Olson (1989) for dormant season latania scale control with the same chemical (82%), and is higher than that reported in a dormant season trial for greedy scale (64% by Tomkins *et al* 1986). This latter study also recorded oil and chlorpyrifos as giving a significantly higher level of control of greedy scale on kiwifruit than diazinon during the dormant period. It is not possible to determine reasons for the differences between the results from that trial and this trial, although it may be due to differences between the armoured scale species. Subjectively, latania scale appears to have a less robust test (armoured covering) than greedy scale.

The findings that latania scale is more easily killed under lichen than on exposed surfaces, and that scale densities are highest under lichen add support to recent changes in dormant season recommendations for scale control on kiwifruit. These suggest that an insecticide be used for scale control after pruning and lime sulphur be used in late winter for lichen control and to prevent crawler settlement (Sale 1989; Blank and Olson 1989). Previous recommendations were to apply lime sulphur in winter, followed by an organophosphate insecticide 10 days later.

On the basis of these results, dormant season control of latania scale on Lombardy poplar shelter can be achieved with either diazinon, chlorpyrifos or oil, applied during the dormant period. Chlorpyrifos is harmful to the two-spotted mite (*Tetranychus urticae* Koch) predator *Phytoseiulus persimilis* Athias-Henriot (Bryham 1985), but application of this material should not affect the biological control of two-spotted mite provided that the standard recommendation for the inoculative release of *P. persimilis* into shelter in January is followed (Sale 1989; J.G. Charles pers. comm.). Suitably designed and tested spraying machinery will be needed to achieve adequate spray coverage to the top of the trees.

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