

## ARMOURED SCALE INSECT INFESTATION ON KIWIFRUIT IN RELATION TO POSITION ON THE VINE

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### ABSTRACT

The infestation of armoured scale insects on kiwifruit at various distances from the leader in a commercial organic cv. Hayward block in the Bay of Plenty was examined at harvest in 2005. This was to test the hypothesis that fruit further from the leader have fewer armoured scale insects than those nearer to the leader. From the 25 pergola-trained vines examined, kiwifruit from directly beneath the leader had a significantly higher probability of being infested with armoured scale insects (26%) compared with fruit sampled from 0.8 m (11.6%) or 1.6 m (6.3%) away from the leader. The orientation of fruit on the vine (west-facing or east-facing) had no effect on armoured scale insect incidence. Individual vines differed significantly in their level of armoured scale insect infestation. *Latania* scale comprised 84% of the scale insects. The implications of these results for growers are discussed.

**Keywords:** armoured scale insects, kiwifruit, pest distribution, diaspididae.

### INTRODUCTION

Armoured scale insects (Hemiptera: Diaspididae) are responsible for most of the post fruit-set insecticide applications to kiwifruit crops and they continue to cause losses and downgrading of fruit at the packhouse. In addition there are consumer demands for low or zero pesticide residues. Thus, improving armoured scale insect management is important for the kiwifruit industry.

Armoured scale insects are resident on the bark of kiwifruit throughout the year. Populations of these insects tend to concentrate on two- to four-year-old wood between the leader and the canes, moving on to leaves and fruit during the spring and summer period.

Some growers have observed that fruit close to the leader have a higher incidence of scale insects compared with those further along the canes. Understanding scale insect distribution on the vine may assist growers to eliminate some scale insect-infested fruit in the field at harvest through selective picking. The following field trial was designed to test the hypothesis that fruit adjacent to the leader have a higher level of scale insect infestation than those further away from the leader.

### METHODS

A single orchard block of commercial organic cv. Hayward kiwifruit (*Actinidia deliciosa* (A. Chev.) C.F. Liang et A. R. Ferguson) grafted onto *A. deliciosa* cv. Bruno seedling rootstocks in Te Puke, Bay of Plenty, was selected. The block had 3-metre row spacings with a north-south row orientation. The vines had previously received four mineral oil (Excel<sup>®</sup>) sprays during the season (22 October 2004, 18 November, 17 December (post fruit set) and 23 March 2005).

Fruit sampling was carried out on 27 April 2005. Twenty-five vines were chosen at random from a population of 92 single-spaced (three-metre intra-row spacing) and

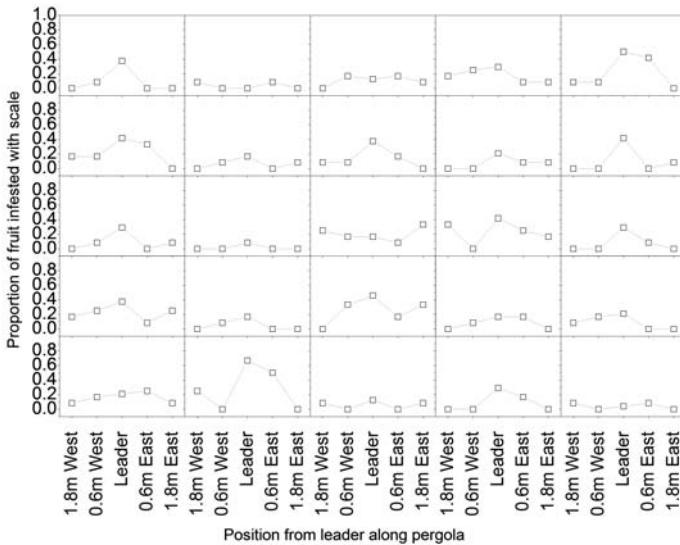
half-spaced (six-metre intra-row spacing) vines, ignoring vines from the two end rows and the last two vines in all rows.

A sample of 24 fruit from each vine was taken adjacent to or directly beneath the leader. Coloured plastic tape was tied at distances of 0.8 metres and 1.6 metres on either side of the leader (east and west) giving five sampling sites per vine. Twelve fruit nearest to or touching the tape were picked at each sampling site and placed in separate bags. In the laboratory, fruit were held at 5°C and assessed within 7-10 days of picking using a binocular dissecting microscope. Each sample was categorised as either infested or not infested with scale insects. Therefore the response variate was the number of fruit with an infestation of scale insects. Adult scale insects were recorded to species using procedures described by Jamieson et al. (2002) (immature scale cannot be determined to species).

The trial was analysed as a randomised block design with each vine as a block, using Genstat 8.1 statistical package. A generalised linear mixed model with binomial errors was fitted to the number of fruit infested with scale insects, with distance from the leader as a fixed effect and vine as a random effect. The null hypotheses were that there was no difference in (1) the average scale insect infestation level at distances away from the leader compared with those at the leader, (2) the average scale insect infestation level on the east and west side of the vines, (3) the average scale insect infestation level at 0.8 and 1.6 metres distance from the leader and (4) the interaction between the average scale insect infestation level at distance from leader and side of vine.

### RESULTS

The proportion of fruit infested with scale insects at each sampling position varied from zero to 0.6 for individual vines (Fig. 1). Position of fruit on the vine had a significant effect upon scale insect infestation level (Wald statistic for positional effect=86.1; df=4; P<0.001), with fruit next to the leader having a much higher probability of infestation



**FIGURE 1:** Armoured scale insect infestation of kiwifruit at positions on either side of the leader of 25 pergola-trained vines. Values are proportion of fruit with scale infestation (n=24 at the leader, n=12 otherwise).

**TABLE 1: The predicted probabilities of fruit being infested with armoured scale insects (%) at different distances from the leader on a pergola trained organic 'Hayward' kiwifruit vine.**

Position of fruit sampled	Probability of infestation (%)
1.6 m west of leader	6.9
0.8 m west of leader	8.1
Leader	26.1
0.8 m east of leader	11.6
1.6 m east of leader	6.3

**TABLE 2: Mean square values and statistical significance of comparisons of armoured scale insect infestation levels within kiwifruit vines.**

Comparison	df	MS	P-value
Leader versus average other positions	1	83.38	P<0.001
East versus west	1	0.82	P>0.10
0.6 m versus 1.8 m	1	4.48	P>0.10
Interaction between side and distance from leader	1	1.72	P>0.10
Residual	120	2.07	

compared with fruit 0.8 or 1.6 m away from the leader (Table 1). There was no effect of vine orientation (east versus west) or increasing distance away from the leader (0.8 m versus 1.6 m) on scale insect incidence (Table 2).

The variance component for the random effect of vine was statistically significant (Wald statistic=0.408, SE=0.165; df=24; P<0.05), indicating that the individual vines differed significantly in their level of scale insect infestation.

Of 463 adult scale insects encountered during the analysis, 387 (84%) were latania scale (*Hemiberlesia lataniae* (Signoret)) and the remainder were greedy scale (*H. rapax* (Comstock)).

## DISCUSSION

These results confirm that fruit in the immediate vicinity of the leader have a substantially higher (three-four fold) risk of scale insect infestation compared with fruit 0.8 m and 1.6 m from the leader on cv. Hayward pergola crops. This block had a relatively high scale insect pressure, and the relationship may be different at lower scale insect densities. However, as armoured scale insects are resident on the bark of the plant throughout the year, and have been shown to be prevalent around the leader, it is likely that this result will be similar on vines with lower scale insect densities.

Differences in the level of infestation between vines (Fig. 1) may reflect random environmental effects or pruning between vines. It might also relate to random differences in rootstock (seedling *A. deliciosa* cv. Bruno plants) effects, leading to different susceptibility of the scion to scale insect attack (Suris 1985). This merits closer investigation.

A recent study of white peach scale (*Pseudaulacaspis pentagona* (Targioni & Tozzetti)) incidence on the kiwifruit cultivar Hort16A in central Italy (Hill et al. 2006) showed that the incidence of the pest at harvest (November 2005) on fruit that had not been sprayed since green-tip (March 2005) was three-times higher within 1 m of the leader than between 1 and 2.5 m from the leader (15.8% cf. 4.8% infested fruit).

If growers know or suspect that there is a high incidence of scale insects on fruit close to harvest they can reduce the risk of high numbers of scale insects being found on fruit in the packhouse by selective crop picking, avoiding fruit immediately below and adjacent

to the leader. This will lower the chance of a market restriction being placed on the fruit or a downgrading (>5% of fruit with scale) during packing. The result also confirms the importance of targeting dormant season scale insect control sprays to cover adequately the leader and older wood in the canopy.

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