THE INCIDENCE OF THREE DIASPID SCALES ON KIWIFRUIT IN NEW ZEALAND

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SUMMARY

A survey was carried out to investigate the distribution and relative abundance of three of the species of armoured scale insects found on kiwifruit fruit crops: greedy scale (*Hemiberlesia rapax* (Comstock)), latania scale (*Hemiberlesia lataniae* (Signoret)) and oleander scale (*Aspidiotus nerii* Bouché). A total of 2,630 insects from 13 geographical areas were identified; of these 72.4% were greedy scale, 27.3% were latania scale and 0.4% were oleander scale. In 10 of the 13 areas, greedy scale made up over 96% of the sample. In the remaining areas, the proportions of latania scale were: Auckland 31.6%, Kerikeri 93.2% and North Gisborne 88.6%. Thus the distribution of latania scale appears to be highly localised at present.

INTRODUCTION

Three species of armoured scale (Diaspididae) commonly occur on kiwifruit: greedy scale (*Hemiberlesia rapax* (Comstock)), latania scale (*Hemiberlesia lataniae* (Signoret)) and oleander scale (*Aspidiotus nerii* Bouché).

Greedy scale was first reported in New Zealand by Maskell (1879). It now occurs in most parts of the country on a wide range of host plants (Dale 1983) and is a pest of economic importance with a nil allowance for export. It is currently considered to be the second most important pest on kiwifruit crops (Steven 1989).

Latania scale was first intercepted in quarantine on avocados from Australia in 1951 (Morales 1988) and has been recorded on avocados and casimiroa grown in "open quarantine" in Gisborne since the mid 1960s (MAF files). The first record outside quarantine was on potted plants along the Auckland Airport terminal in 1972 (D. Manson, pers. comm.). The first field record was from *Hypericum* plants at Papatoetoe in 1979, and latania scale was first reported on kiwifruit in 1987 in Gisborne (Morales 1988). Since then latania scale appears to have become established in several localities in New Zealand, and has been recorded from a variety of hosts (Steven 1989).

Oleander scale has been widely recorded as a pest of kiwifruit in New Zealand (Lo and Blank, in press).

All three species are closely related, and greedy scale and latania scale are almost indistinguishable in the field. Separation is based on microscopic examination of slide-mounted mature female specimens to show the perivulvar pores which are present in latania scale but absent in greedy scale (Morales 1988).

The purpose of this survey was to discover the distribution and relative abundance of the three common species of armoured scale insects on kiwifruit at harvest.

METHOD

Samples of infested fruit were collected in packhouses from lines on which scale insects were found. Enough infested fruit was requested to provide 50 mature scale insects from each orchard and these were dispatched in a separate bag. Packhouse staff were asked to fill out a survey form for each sample and to return both to DSIR.

Each sample was examined under a binocular microscope and up to 50 mature scale insects per orchard were removed and prepared for identification. After identification approximately two-thirds of the specimens were retained as voucher specimens in the New Zealand Arthropod Collection, while the remaining specimens were discarded.

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For ease of handling, specimens were grouped into geographical zones (Table 1) following the system proposed by Crosby *et al* (1976). In some cases these zones were further subdivided (Table 2) to investigate the localised distribution of latania scale.

RESULTS AND DISCUSSION

Geographical distribution

Table 1 shows the numbers of scale insects identified from each zone and numbers and percentages of each scale insect species. A total of 3075 scale insects received from 191 growers representing all major kiwifruit-growing areas were examined. Of these 2630 were identified to species, the remaining 445 (or 16.9%) were either immature or too badly decomposed for identifications to be made.

Of all the scale insects identified 72.3% were greedy scale, 27.3% were latania scale and 0.4% were oleander scale. These proportions give an indication of the relative importance of the three scale insect species infesting kiwifruit in insecticide-treated orchards throughout New Zealand. However, it should be remembered that they are proportions from fruit samples only, and may not reflect the relative proportions of scale insect species on other parts of the vine or in other plants in the orchard.

TABLE 1: Number and percentage of greedy scale, latania scale and oleander scale in twelve kiwifruit-growing areas in New Zealand.

	Total scale	Total id'd	Greedy scale		Latania scale		Oleander scale	
			%	no.	%	no.	%	no.
NORTHLAND	613	468	49.7	(229)	50.3	(232)	1.5	(7)
AUCKLAND	262	234	68.4	(160)	31.6	(74)	0.0	
WAIKATO	117	107	100.0	(107)	0.0		0.0	
COROMANDEL	28	21	100.0	(21)	0.0		0.0	
BAY OF PLENTY	928	747	99.2	(741)	0.5	(4)	0.3	(2)
GISBORNE	504	493	18.3	(90)	81.7	(403)	0.0	
HAWKES BAY	282	252	99.2	(250)	0.8	(2)	0.0	
TARANAKI	154	134	97.8	(1231)	1.5	(2)	0.7	(1)
WANGANUI	26	25	100.0	(25)	0.0		0.0	
WELLINGTON	94	88	100.0	(88)	0.0		0.0	
NELSON	67	61	100.0	(61)	0.0		0.0	
TOTAL	3075	2630	n = 1903		n = 717		n = 10	

Figure 1 shows the primary areas into which the country was divided for the purposes of the survey, and the relative population composition of latania scale and greedy scale in each area. The proportion of greedy scale varied from 5.6% to 100%. However in the majority of areas (8 of 13) greedy scale made up over 96% of the sample and latania scale were present in only one or two orchards. Further subdivision of these areas would not have provided useful information about localised scale insect populations.

Distribution of latania scale

Two of the three areas with mixed latania and greedy scale populations (Northland and Gisborne), were divided into smaller units to determine whether populations of latania scale were localised within these areas. Northland was divided into Kerikeri (north of a line running through Kaikohe and Kawakawa) and Whangarei (south of the same line). In this area, latania scale was entirely limited to samples from the northern (or Kerikeri) region (93.2%), but not found in samples from the Whangarei region (100% greedy scale) (Table 2).

In another study, Lo and Blank (in press) found latania scale in both regions, but they confirmed our finding of its dominance in Kerikeri (c. 80% of samples). However they also located it at one of our sites in Whangarei (c. 10% of samples).

The Gisborne area was subdivided into north and south Gisborne along a line running through Lake Waikaremoana and Young Nicks Head. In north Gisborne

Fig. 1: Proportions of greedy scale and latania scale in thirteen kiwifruit-growing areas in New Zealand.

88.6% of the scale insects in the samples were latania scale, while in south Gisborne none of this species was found (Table 2). However, only 10% of the samples were from south Gisborne. In the Hawkes Bay area, directly south of Gisborne, samples indicate that the scale insect population is almost entirely greedy scale (99.2%). More samples from the Gisborne area would be useful in determining the extent of the pocket of latania scale.

The latania scale samples from the Auckland area were mainly from Kumeu or Riverhead, with a small number from further north (Parakai) and south (Pokeno). These sampling locations are all located near the centre of the Auckland area so further samples from the north and south of this area would be needed to detect localisation of latania scale insect populations.

TABLE 2: Numbers and percentage of scale populations in subdivisions of Northland and Gisborne areas.

	Total scale	Total id'd	Greedy scale		Latania scale		Oleander scale	
			%	no.	%	no.	%	no.
NORTHLAND:								
a) KERIKERI	328	249	5.6	(14)	93.2	(232)	0.2	(3)
b) WHANGAREI	285	219	98.2	(215)	0.0		1.8	(4)
GISBORNE:								
a) NORTH	465	455	11.4	(52)	88.6	(403)	0.0	
b) SOUTH	39	38	100.0	(38)	0.0		0.0	

Three explanations for the observed distribution of latania scale species are suggested:

1. Climatic differences.
2. Host plant distributions — particularly shelter species.
3. Latania scale is still spreading from foci of infestation, possibly centred around nurseries.

1. Climatic differences.

A subjective analysis of Meteorological Services records of long-term rainfall, frosts and temperature data from areas with and without latania scale does not show any clear-cut differences to support the hypothesis that climate is affecting the distribution of this insect. There are no obvious climatic parameters which are common to both Gisborne, Auckland and Kerikeri but are absent from the rest of the North Island. However, the temperature responses of greedy and latania scale would need to be investigated to preclude the idea that the observed distribution resulted from differential responses to microclimatic effects.

Latania scale is widely distributed in tropical and sub-tropical areas (Anon. 1976). Observations in the Middle East (Gerson and Zor 1973; Salama and Hamdy 1974) suggest that some populations of this species have high optimal temperature preferences. A possible explanation in relation to climate both for latania scales' relative obscurity in New Zealand over the last 20 years and for its localised distribution, is that it has only recently adapted to living under more temperate conditions compared with its original source climate. Such adjustments of aphid and aphid parasitoid temperature responses according to latitude have been observed in North America (Campbell *et al* 1974).

2. Host-plant distribution

Although both greedy and latania scale are polyphagous insects they have different host preferences and can reach different levels of abundance on the same host plant. A good example is avocado in Israel, Australia and California, where latania scale is a common pest but greedy scale is far less abundant. It is thus possible that the observed distribution of latania scale is related to the distribution of particular types of shelter species or other host plants.

This scenario parallels that reported by Blank *et al* (1987) who showed that invasion of greedy scale into orchards from certain types of native shelter trees in Northland can lead to a serious scale insect problem on fruit. It is also supported by the discovery this year of very heavy infestations of latania scale on Lombardy poplar in the Gisborne region, where about 80% of the shelter is of this species.

3. Spread of latania scale from foci of infestation

It is likely that latania scale was introduced to New Zealand on imported plant stock. In particular, it is known to be a common pest of avocado. In the mid 1970s, imported avocado stock was usually grown in "open quarantine", i.e. post-entry quarantine on a fenced off section of the growers property, and checked by MAF inspectors until the quarantine was lifted. Latania scale was found on avocados grown in this situation many times in Gisborne and occasionally in Tauranga (MAF files). In

1978/79 the Plant Health Diagnostic Station of MAF (Auckland) conducted a limited survey of kiwifruit and avocado nurseries for pests including latania scale. Most nurseries were clean, but one in Hastings was found to have had recurring infestations of latania scale over several years. Other incidences of this scale insect on Hawkes Bay kiwifruit and avocado could be traced to plants originating from this nursery.

It is conceivable that infested stock plants could have been moved to nurseries in the Gisborne, Kerikeri and Auckland areas, and that the present distribution of latania scale reflects this. This hypothesis would imply that latania scale is probably expanding its range away from these foci, and may end up with the same universal distribution as greedy scale.

CONCLUSION

In 10 of 13 geographical areas surveyed, greedy scale was the dominant armoured scale insect species present. In the remaining three areas, the proportions of latania scale ranged from one third (Auckland) to approximately 90% (Kerikeri and Gisborne). The results of this survey indicate that populations of latania scale are currently highly localised.

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