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Biological control of latania scale on avocados in south-east Queensland

G. K. Waite

Maroochy Horticultural Research Station, Department of Primary Industries, PO Box 5083, Sunshine Coast Mail Centre, Nambour, Q. 4560, Australia.

Abstract

Avocado fruit of the varieties Fuerte and Hass were caged to exclude natural enemies of latania scale *Hemiberlesia lataniae* (Signoret), in an unsprayed orchard and an orchard sprayed regularly with endosulfan during 1985 and 1986. Scale infestations at harvest were compared with those on uncaged fruit. On unsprayed trees in 1985, caged fruit were infested with an average of 100.5 adult scales, 82.8% of which were alive. Uncaged fruit were infested with only 4.6 adult scales per fruit of which 24.3% were alive, 30.7% were parasitised and 19.3% were killed by predators. On sprayed trees caged fruit were infested with 101.3 scales per fruit 51.9% of which were alive. Uncaged fruit carried 15.3 scales per fruit of which 17.3% were alive, 19.0% were parasitised and 25.0% were killed by predators. Similar results were recorded in 1986. It was concluded that *H. lataniae* can be controlled by natural enemies in commercially sprayed orchards, provided an integrated approach is pursued.

INTRODUCTION

Latania scale, *Hemiberlesia lataniae* (Signoret), is a cosmopolitan pest and in Queensland has been recorded from a range of fruit and nut hosts (Smith 1973) including avocado, kiwifruit and macadamia. On avocado the scale infests the trunks, limbs and twigs as well as fruit. Heavy infestations on branches and twigs may debilitate a tree but have rarely been implicated in tree death. The most serious problem for commercial growers is the presence of scales on fruit. This is not due to any direct effect of scales on fruit, but is a cosmetic problem associated with quality in the market place.

Infestation levels in individual orchards differ and this is often a reflection of the overall pest control tactics adopted by the grower. Where broad-spectrum insecticides such as dimethoate and synthetic pyrethroids are applied frequently, scale problems tend to be worse than in orchards where pests are controlled under an integrated pest management system, probably because of the elimination of natural enemies.

The aim of this study was to determine the natural enemies of latania scale in south-east Queensland and their impact on the scale under unsprayed conditions, and also in a commercial avocado orchard under an integrated pest management approach.

MATERIALS AND METHODS

The study was undertaken during the 1985 and 1986 seasons at the Maroochy Horticultural Research Station (MHRS), Nambour using the cultivar Fuerte and in a commercial orchard at Mapleton using the cultivar Hass. The MHRS trees received no insecticides while the Mapleton orchard was stablising under an integrated pest management system after previous treatment on a schedule basis with broad-spectrum insecticides which had induced a severe infestation of latania scale.

At the end of January of each year, at both sites, six fruit each infested with one or two mature latania scale were caged with terylene sleeves to exclude natural enemies, and

a similar number of fruit were tagged but left uncaged. This was done on five trees for a total of thirty fruit per treatment. Trees on MHRS received monthly sprays of copper oxychloride only, for anthracnose control. The Mapleton orchard was sprayed every four weeks with copper oxychloride and every two weeks with endosulfan to control fruitspotting bug, *Amblypelta nitida* Stål, from early December until the middle of April each season.

At MHRS fruit was harvested for assessment on 24 July 1985 and 16 June 1986 and at Mapleton on 18 June 1985 and 2 September 1986. All fruit was examined under a stereomicroscope and the number of living and dead scales counted. Where possible a cause of death was assigned. Irregular holes in scale covers were deemed to be caused by predators whereas parasites left neat emergence holes or were still present as eggs, larvae or pupae beneath the cover. Parasites reared from parasitised scales and predators observed feeding on scales were preserved in 70% alcohol for identification.

RESULTS AND DISCUSSION

Uncaged fruit

At MHRS in both years excellent control of latania scale was achieved by a combination of parasites and predators (Table 1). The low incidence of live scale on fruit would allow that fruit to be marketed as first grade fruit. Ideally, no scales should be present on market fruit but up to five scales is commercially acceptable.

Table 1. Infestation levels and causes of death of *H. lataniae* on avocado fruit

	Uncaged				Caged			
	No. scales per fruit	% live	% parasitised	% predated	No. scales per fruit	% live	% parasitised	% predated
Unsprayed trees — MHRS								
1985	4.6	24.3	30.7	19.3	100.5	82.8	9.2	0
1986	0.75	75.0	25.0	0	235.2	90.4	1.7	0.6
Sprayed trees — Mapleton								
1985	15.3	17.3	19.0	25.0	101.3	51.9	16.7	14.9
1986	16.5	25.8	50.9	23.3	127.7	87.7	4.5	0.7

At Mapleton, uncaged fruit were infested with fewer than 20 scales per fruit and most of these were dead (Table 1). Brushing and polishing in the packing shed would remove these and many of the live scales so that each fruit would carry only three to five scales when packed. Parasites and predators were responsible for heavy mortality and while the level of control was inferior to that at MHRS, this was to be expected because of interference by the endosulfan sprays, even though that pesticide is generally regarded as being safe to use in integrated pest management programmes. The base-level of scale infestation throughout the orchard was also higher since it was stabilising under the recently-introduced integrated pest management system after previously being treated regularly with broad-spectrum insecticides. Nevertheless, the average infestation on fruit in non-datum trees was much lower than on uncaged fruit in datum trees.

Caged fruit

In both orchards in both years, each caged fruit was infested with an average of more than 100 adult scales plus innumerable crawlers (Table 1). Most of the adult scales were alive. The large number of scales was attributed mainly to the exclusion of natural enemies. Some parasitism and predation occurred despite the cages probably because parasites and predators were occasionally included when the cages were put into place.

Some of the difference between scale populations on caged and uncaged fruit might also have been caused by the protection afforded against adverse weather, particularly for the crawlers. However, the data indicate that parasites and predators also operated effectively and were responsible for much of the scale control.

Natural enemies

Parasites bred from scales were *Aphytis* sp. *proclia* group and *Encarsia ? citrina* (Craw.) (Aphelinidae), and *Signiphora flavella* Girault and *S. perpauca* Girault (Signiphoridae). Predators observed feeding on scales were *Chrysopa* spp. chiefly *C. oblatis* Banks (Chrysopidae) and *Rhizobius ? satellus* Blackburn (Coccinellidae). The predatory mite *Amblyseius deleoni* Muma and Denmark (Phytoseiidae) was found on many fruit but whether it fed on any of the life stages of the scale or was scavenging on dead scale was not determined.

In Table 1 the total percentage of live, parasitised and predated scales does not always equate to 100% of the scales present on the fruit. This disparity is due to dead scales for which no particular cause of death could be assigned many of which would have died of old age. Some parasitism of scales on caged fruit occurred because fruit were not caged unless one or two mature scales were present and some of these were occasionally parasitised.

CONCLUSION

The results demonstrate that biological control of *H. lataniae* on avocados can be effective, even under a commercial spray regime, provided non-disruptive pesticides are used to control other pests. At Mapleton, fortnightly applications of endosulfan to control fruit-spotting bug did not prevent parasites and predators from effecting good control. In contrast, prior to the adoption of a pest management programme in 1982 when dimethoate was applied every two to three weeks to control Queensland fruit fly (*Dacus tryoni* (Froggatt)), *H. lataniae* had become a severe problem especially on the cultivar Hass. When use of dimethoate was discontinued the incidence of *H. lataniae* in the orchard returned to average infestation levels which were less than those measured on uncaged fruit in this study. The 15 to 16 scales per fruit recorded on uncaged fruit arose from initial infestation levels of one to two scales per fruit, but most of the fruit in the orchard were completely uninfested so that the average was much lower.

Apart from providing control at no cost, biological control eliminates the need to apply highly toxic sprays such as methidathion to control scales. In semi-rural areas such as the major avocado production areas in south-east Queensland, reduction in the use of such chemicals is particularly desirable.

References

Smith, D. (1973), Insect pests of avocados, *Queensland Agricultural Journal.* **99** (12), 645–53.

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