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Effects of sticky banding of custard apple tree trunks on ants and citrus mealybug, Planococcus citri (Risso) (Pseudococcidae (Hem)) in south-east Queensland

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Summary

Trials were carried out at Beerwah and Palmwoods in 1979–80 to investigate the effects of sticky banding of custard apple tree trunks on ants and on *Planococcus citri* (Risso). Sticky banding reduced ant numbers in the trees and resulted in lower, though still unacceptably high, levels of *P. citri* infestation. Natural enemies were ineffective.

1. INTRODUCTION

Citrus mealybug, *Planococcus citri* (Risso), is the most important pest of commercially grown custard apples in south-east Queensland. Mealybugs cluster on the fruit and produce copious amounts of honeydew. Sooty mould, which grows on the honeydew, and the mealybug masses lower fruit quality. Infested fruit are normally cleaned by brushing or using compressed air before marketing.

Control by insecticide sprays is difficult because the dense, large leaved canopy of the tree hinders penetration of the spray. Additionally, mealybugs tend to form colonies in folds or crevices in the skin of the fruit where spray droplets do not reach. Consequently, most infestations of *P. citri* are left unsprayed.

Despite the presence of several natural enemies of *P. citri* in south-east Queensland, severe outbreaks occur every year on custard apples. Interference with these natural enemies by coastal brown ant, *Pheidole megacephala* (Fabricius), may contribute to the outbreaks. The disruptive effects of ants on the natural enemies of the mealybugs and scale insects have been well documented, especially on citrus in the United States (De Bach 1970). In South Africa *Coccus hesperidum* L. persisted for longer in orchards on trees where *P. megacephala* was present (Annecke 1959). In Australia there is no information published on the effect of ants on *P. citri* and its natural enemies. The purpose of this study was to investigate the effects of sticky banding of custard apple tree trunks on ants, and on *P. citri* and its natural enemies.

2. MATERIALS AND METHODS

Experiments were carried out on 10-year-old custard apple trees, variety Pinks Mammoth, at Beerwah and Palmwoods in south-east Queensland during 1979–80. The trials used a 3 × 7 completely randomized design with single tree plots. Two of the three treatments aimed at preventing ants gaining access from their nests in the ground to the mealybugs on the tree,

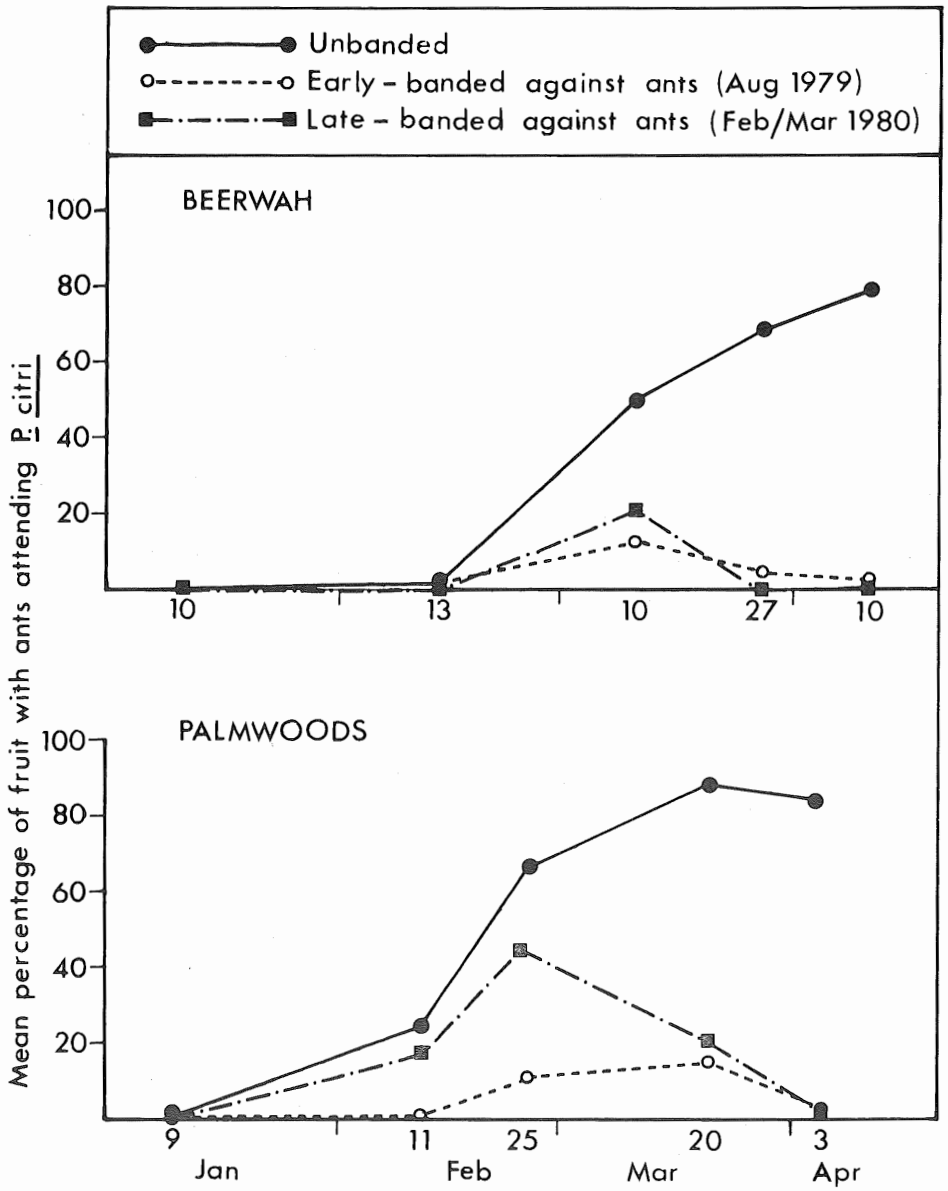

Figure 1. Fluctuations in the mean percentage of fruit on which ants attended *P. citri* on sticky-banded and unbanded trees at Beerwah and Palmwoods, 1980. (Means based on sample size of 350 fruit.)

while in the third (control) treatment ant activity was uninterrupted. The first treatment aimed at full season ant exclusion from the time before fruit set in December to fruit harvest in April. The second treatment aimed at late season ant exclusion during February or March, about 1 month before harvest.

Ants were excluded by applying a 30 mm wide sticky barrier of polyisobutylene (Bird Stop (R)) around the trunk of each tree. The bottom of each barrier was 300 mm above the ground. For full season ant exclusion (early banded trees), barriers were applied at both trial sites on 31 August 1979. For the late banded trees barriers were applied on 10 March 1980 at Beerwah, and 25 February 1980 at Palmwoods. On all trees except those of the untreated controls, low branches within 0.5 m of the ground were pruned and grass under the trees was mown regularly to prevent ants bypassing the sticky bands. Ant nests found in branches of the banded trees were controlled with a drench of 0.1% chlorpyrifos.

During 1980, from January to the beginning of harvest in April, the presence or absence of ants was recorded on 50 randomly selected fruit per tree. The *P. citri* population on each fruit was given a rating from 0 to 5, as below.

0 — no *P. citri*, fruit clean and undamaged.
1 — 1 to 10 *P. citri*, very light infestation, fruit virtually undamaged.
2 — 11 to 20 *P. citri*, light infestation, fruit slightly damaged.
3 — 21 to 50 *P. citri*, moderate infestation, fruit moderately damaged.
4 — 51 to 100 *P. citri*, heavy infestation, fruit severely damaged but marketable.
5 — more than 100 *P. citri*, very heavy infestation, fruit severely damaged and unmarketable.

For each tree a *P. citri* infestation index was obtained by adding the ratings for each of the 50 sampled fruit. Immature stages and adults of natural enemies of *P. citri* were also recorded on the sampled fruit.

3. RESULTS AND DISCUSSION

Ants

P. megacephala was the only species of ant recorded attending *P. citri* in these studies. On unbanded trees worker ants were seen carrying nymphs and adult female *P. citri* up tree trunks and also between fruit.

Figure 1 shows that trunk banding reduced ant numbers in the trees, as judged by the percentage of fruit on which ants attended *P. citri*. However, ants were not completely excluded by the banding. Occasionally, twigs or grass bridged the sticky barrier, or broken branches made contact with the ground, and thereby allowed the ants temporary access to *P. citri* on the trees. While there were some differences in ant populations during the course of the season in respect of the early and late banding treatments such differences at the final pre-harvest assessment in April 1980 were insignificant.

Mealybugs

Analysis of the relationship between the *P. citri* index for 50 fruit and the percentage of fruit infested with *P. citri* showed a good fit of data to the following quadratic curve:

$$y = 1.694x - 0.00761x^2$$

where x is the *P. citri* index for 50 fruit and y is the percentage of fruit infested with *P. citri*.

From this relationship it appears that the percentage of fruit infested can be taken as a simple and reliable index of the level of mealybug infestation.

In these studies a *P. citri* index of 29, or 42.7% of fruit infested, was regarded as the maximum tolerable level of infestation. If infestation exceeded these levels it was considered uneconomic to clean heavily infested fruit before marketing.

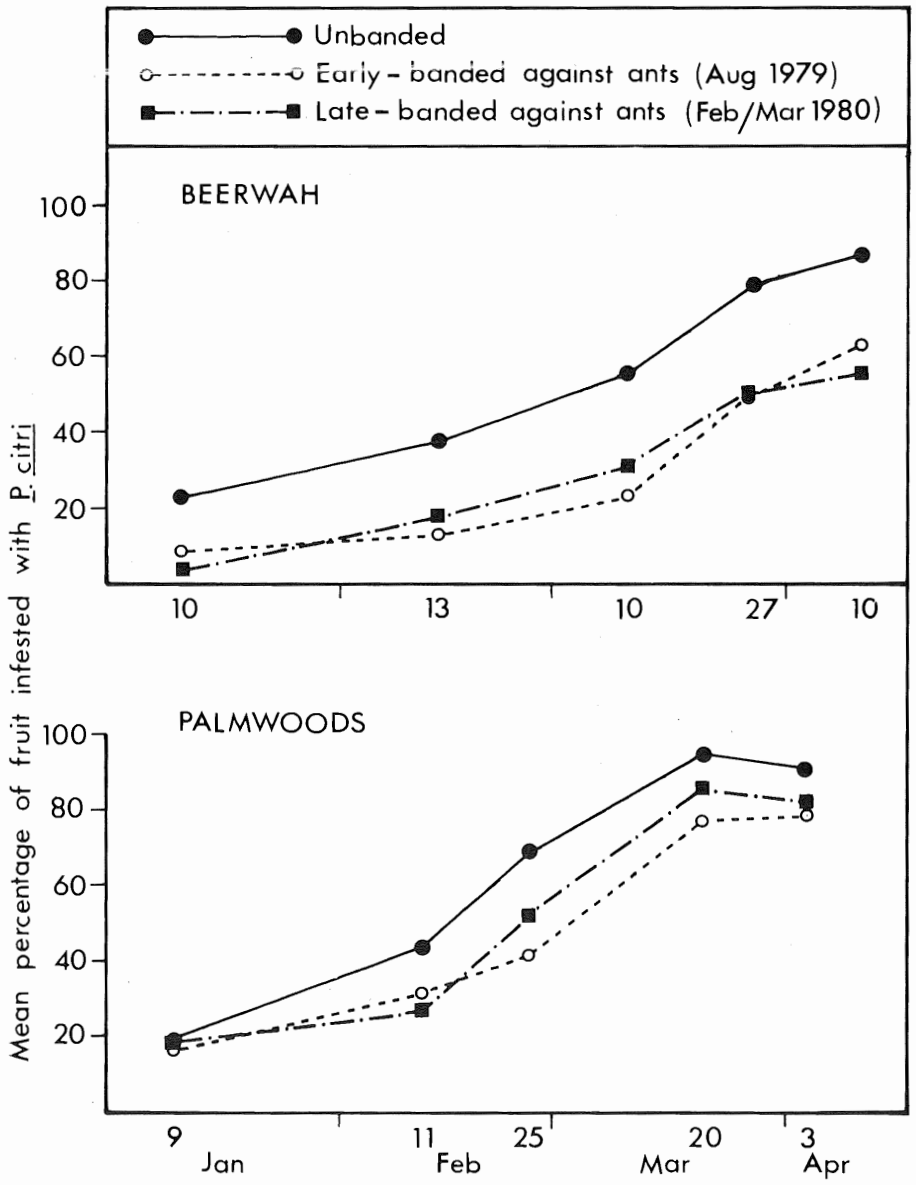

Figure 2. Fluctuations in the mean percentage of fruit infested with *P. citri* on sticky-banded and unbanded trees at Beerwah and Palmwoods, 1980. (Means based on sample size of 350 fruit.)

Reference to Figure 2 shows that while some reduction of *P. citri* was obtained following banding against ants, nevertheless mealybug populations remained too high. One possible reason for this is that existing natural enemies are ineffective against *P. citri* on custard apples in south-east Queensland. The results of my concurrent studies of predators and parasites of *P. citri* support this argument.

Mean predator numbers on unbanded trees were low at both sites, but more so at Beerwah than at Palmwoods. The mean totals for all predator species are shown in Figure 3. Of the

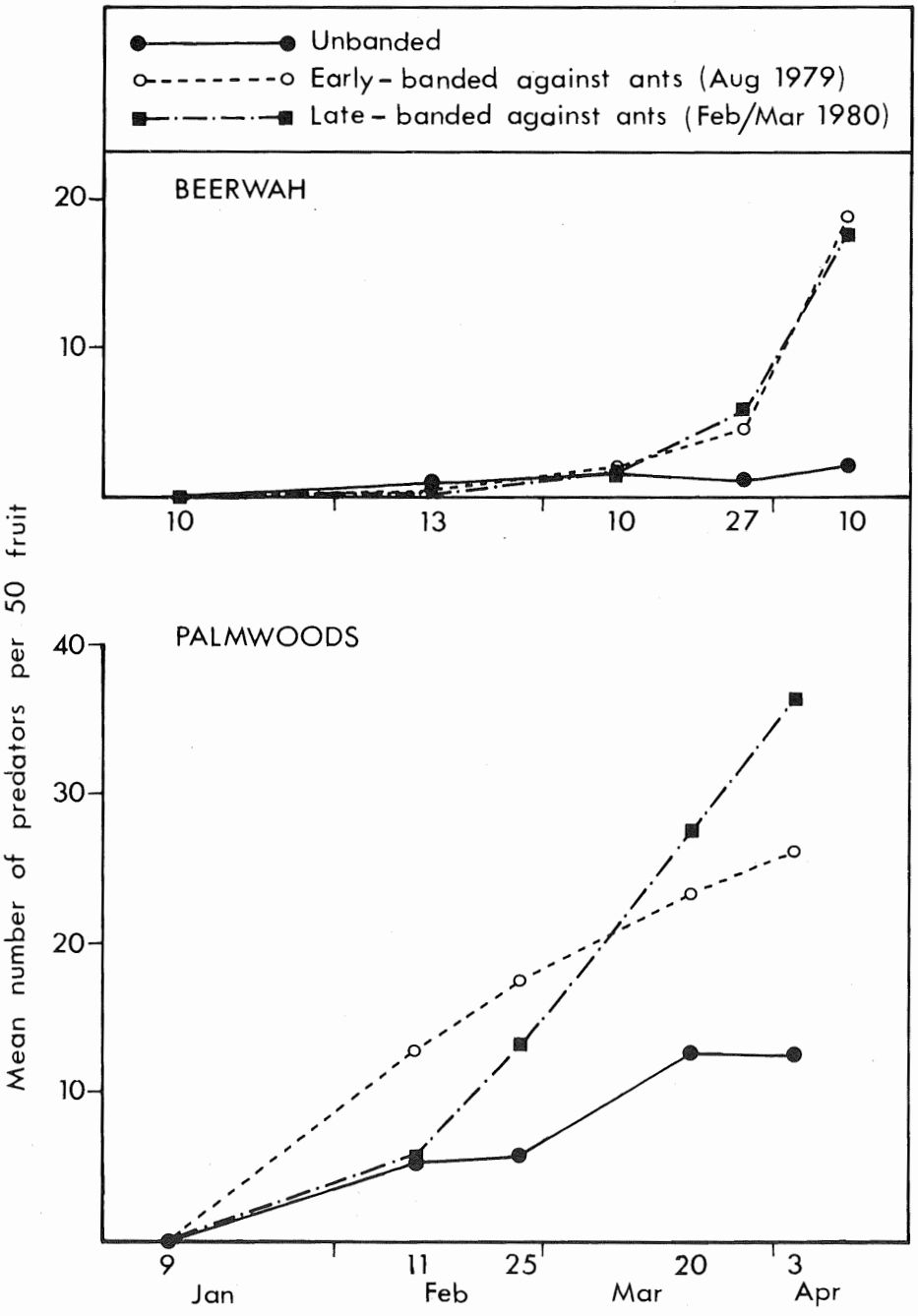

Figure 3. Fluctuations in the mean number of predators per 50 fruit on sticky-banded and unbanded trees at Beerwah and Palmwoods, 1980.

predators encountered, the chrysopid, *Oligochrysa lutea* Esben-Peterson, was the most common. The mealybug ladybird, *Cryptolaemus montrouzieri* Mulsant, and a hover fly, *Syrphus* sp., were also present. Since there were more predators on sticky-banded trees than on unbanded trees, it seems that the role of ants in disrupting predators of mealybugs may also be important.

Parasitism was at a low level, as shown in Table 1. This gives mean numbers of adults and puparia of the most common parasite, *Leptomastidea abnormis* Girault, found on the fruit. Parasite numbers were not affected by the treatments.

Table 1. Mean number of citrus mealybug parasite, *Leptomastidea abnormis* Girault, on 50 custard apple fruit at the final pre-harvest assessment, at Beerwah and Palmwoods, 1980

Treatment	Beerwah		Palmwoods	
	Adults	Puparia	Adults	Puparia
Untreated	0.1	0.4	1.7	1.4
Early-banded against ants (Aug 1979)	0.4	1.3	1.1	2.1
Late-banded against ants (Feb–Mar 1980)	0.4	3.1	0.6	3.3

The finding that predators and parasites of *P. citri* on custard apples in south-east Queensland are ineffective indicates that benefit may result from the introduction of additional natural enemies. Since considerable reduction of ants on the tree can be obtained by trunk banding, it may be that such banding would be necessary to allow introduced natural enemies as much uninterrupted access to *P. citri* as possible.

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