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Investigation of insecticidal control of macadamia nutborer, Cryptophlebia ombrodelta (Lower) (Lepidoptera: Tortricidae)

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Summary

During 1978–79 four insecticides were tested against *Cryptophlebia ombrodelta* (Lower) on macadamia at Nambour. Mean numbers of unmarketable nuts per tree were 10.5, 12.4, 19.5, 35.6 and 293.0 for 0.005% permethrin, 0.05% methidathion, 0.075% acephate, 0.05% omethoate and control treatments, respectively. All insecticides significantly reduced losses; permethrin and methidathion were significantly more effective than omethoate. Permethrin gave the longest protection.

1. INTRODUCTION

Macadamia nutborer (*Cryptophlebia ombrodelta* (Lower)) is a serious pest of macadamias, particularly in urban or closely settled areas where its host plants are plentiful, many having been planted as ornamentals (Ironside 1974, 1978). The insect reduces both yield and quality of macadamia kernels and during severe infestations it can destroy 60% or more of the crop. The larva tunnels through the husk and soft shell and feeds on the kernel. When the shell becomes hard the larva feeds mainly in the husk, but some larvae even penetrate the hard shell. Nuts with damaged kernels and immature nuts that fall because of damage to the husk are unmarketable. While husk damage to mature nuts does not make them unfit to market, it can lower the quality of the processed kernels. Control with sprays is required, usually from late November to February, and relies on killing the eggs or the young larvae before they enter the nuts.

Insecticides which reduced damage by the insect in previous trials (Ironside, unpublished departmental reports) include 0.075% acephate, 0.1% carbaryl, and 0.05% methidathion. Methidathion was the most effective of these, but it is highly toxic to humans and particularly unsuitable for use in urban orchards. The purpose of this work was to compare the effectiveness of alternative insecticides for the control of *C. ombrodelta* with that of methidathion.

2. MATERIALS AND METHODS

The following insecticidal formulations were used along with 0.13 mL L^{-1} of wetting agent Agral 60.

Acephate: 750 g kg^{-1} soluble powder.
Methidathion: 400 g L^{-1} emulsifiable concentrate.
Omethoate: 800 g L^{-1} soluble concentrate.
Permethrin: 500 g L^{-1} emulsifiable concentrate.

The experiment was conducted on 8 year old grafted macadamia trees (*Macadamia integrifolia,*, cultivar H.A.E.S. 246 (Keauhou)) at Nambour using a 5 × 5 randomized block design with single tree plots. Seven sprays were applied with a hand held lance, applying an average of 14 L per tree on the following dates: 28 November, 12 and 21 December 1978, 3 and 24 January and 6 and 19 February 1979.

At the start of the trial on 27 November 1978 the ground under each tree was cleared of all nuts and leaves. Then at weekly intervals until 24 April 1979 all the fallen nuts were collected, counted and assessed for *C. ombrodelta* infestation. Fallen nuts were not included in the trial data until after 11 December when the heavy natural shedding of young nuts had stopped.

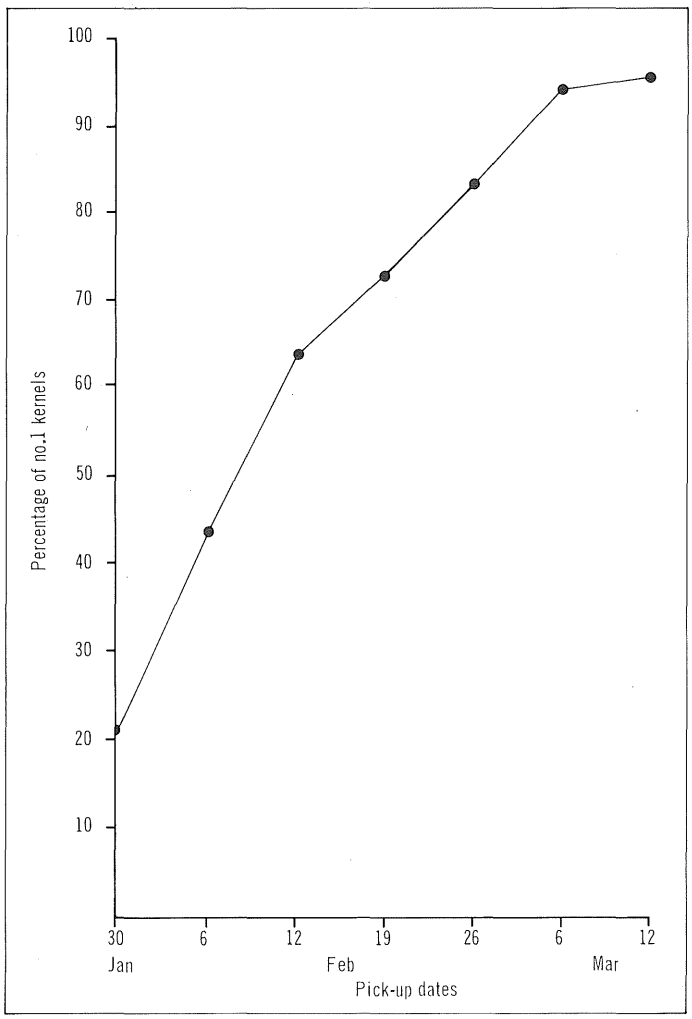

Figure 1. Levels of No. 1 kernel in nuts which fell prematurely due to *C. ombrodelta* damage during the trial period.

To determine when fallen nuts with *C. ombrodelta* husk damage were marketable, tests for maturity were carried out each week from 30 January to 12 March according to the method of Liang and Myers (1975). Random samples of 100 fallen husk damaged nuts were dehusked and dried at 87.7°C for 20 to 24 h before removing the kernels. Dried kernels, with a minimum of 72% oil content, which float in tap water (s.g. < 1) are commonly referred to as No. 1 kernels. The percentage of No. 1 kernels does not necessarily reflect the quality of the processed product and is used only as a guide to kernel maturity.

The efficacy of insecticidal sprays was determined on the basis of the reduction in the fall of damaged nuts compared with that of the untreated control.

3. RESULTS

Levels of No. 1 kernels in the fallen nuts with *C. ombrodelta* husk damage are shown in Figure 1 and the effect of treatments on the number of *C. ombrodelta* damaged nuts is given in Table 1.

Table 1. Effect of insecticide sprays on the mean number of C. ombrodelta **damaged fallen nuts per tree**

Treatments	Unmarketable: damaged fall to 26 Feb plus kernel damage 26 Feb to 24 Apr		Marketable: husk damaged fall from 26 Feb to 24 Apr	
	Trans. mean*	Equiv. mean	Trans. mean*	Equiv. mean
Permethrin 0.005%	2.35	10.5*a*	2.29	9.9*x*
Methidathion 0.05%	2.52	12.4*a*	4.37	78.7*y*
Acephate 0.075%	2.97	19.5*ab*	4.26	71.2*y*
Omethoate 0.05%	3.57	35.6*bc*	4.72	112.4*yza*
Control: untreated.....	5.68	293.0*d*	5.77	319.3*zb*
s.e. of mean.....	0.32		0.31	

*log transformation
Means followed by the same letter do not differ significantly at the 5% (*abcd*) and at the 1% (*xyz*) levels of significance.

4. DISCUSSION

Kernel marketability

The level of No. 1 kernels (floaters in tap water) increased from 21.1% on 30 January to 95.6% on 12 March (Figure 1). Not all nuts damaged by *C. ombrodelta* are unmarketable and in this trial fallen husk damaged nuts were mature enough to be marketable after 26 February when the level of No. 1 kernels was 94%. Damaged nuts which fell before 26 February and fallen nuts with feeding injury to the kernels after that date were unmarketable. The fall of immature nuts was clearly the biggest effect of *C. ombrodelta* on marketable yield. On the unsprayed control, 89.7% of the unmarketable nuts were immature and the remaining 10.3% were rejected because of feeding injury to mature kernels.

Effectiveness of insecticides

All insecticides reduced the number of unmarketable nuts ($P < 0.05$), and permethrin and methidathion resulted in a significantly greater reduction than omethoate ($P < 0.05$). After the final spray on 19 February permethrin gave the longest protection against *C. ombrodelta*. On this treatment, the number of marketable nuts with husk damage from 26 February to 24 April was significantly less than on any other treatment ($P < 0.01$). Permethrin therefore minimized any effects of husk damage on the quality of the processed kernel. Its efficacy against *C.*

ombrodelta and its low toxicity to humans make it an attractive alternative to methidathion for use in macadamias in closely settled areas. Further trials with this insecticide using longer intervals between sprays and fewer applications could be worthwhile. A possible disadvantage of permethrin is that it is highly toxic to many beneficial species, and its use may give rise to an upsurge of pest species not controlled by it, for example citrus mealy bug (*Planococcus citri* (Risso)) and macadamia felted coccid (*Ericoccus ironsidei* Williams). However, during the trial period there was no obvious build-up of these pests.

5. ACKNOWLEDGEMENTS

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