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Field Evaluation of Four Insecticides for the Control of the Mango Leaf-cutting Weevil, *Deporaus marginatus* Pasc.

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RINGKASAN

Di dalam percubaan mengawal serangga pengerat daun mangga, Deporaus marginatus *Pasc., didapati deltamethrin memberikan kawalan paling berkesan diikuti dengan etrimfos, acephate dan akhir sekali dicrotophos.*

Kajian mengenai kekekalan deltamethrin diladang menunjukkan bahawa racun tersebut berkesan sehingga dua minggu.

SUMMARY

In an insecticidal trial for the control of the leaf-cutting weevil of mango, Deporaus marginatus *Pasc., deltamethrin was the most effective insecticide followed by etrimfos, acephate and dicrotophos in that order.*

A persistency study of deltamethrin in the field showed that the insecticide was effective for up to two weeks.

INTRODUCTION

The mango leaf-cutting weevil, *Deporaus marginatus* Pasc., has been recorded as a pest of mango in India (Fletcher, 1914), Burma (Fletcher, 1917), Sri Lanka (Hutson and Alwis, 1934) and Malaysia (Ahmad and Ho, 1970).

Two kinds of damage are inflicted on new flushes of leaves by the adult insect. Feeding damage is caused by both male and female adults. More serious damage is caused by the female when she neatly cuts the leaf blade near the petiole after laying one or more eggs on the leaf lamina which then falls to the ground.

The eggs soon hatch and development of the larva proceeds in the severed leaf. When the prepupal stage is reached the insect burrows into the soil to pupate. Further details concerning the biology and ecology of *D. marginatus* can be found in Ooi (1976) and Chuah (1980).

Deporaus is one of the major insect pests of mango in Malaysia and the control of this and other insects is an important aspect of mango cultivation. Dicrotophos came into widespread use on mango trees when Singh (1980) found that the insecticide, when combined with the fungicide Manzate D[1] and a foliar fertilizer Welgro Standard[2], gave good control of insect pests including *D. marginatus.*

Dicrotophos with an acute oral LD_{50} value of 22mg/kg for rats (Martin and Worthing, 1977) is rated as highly hazardous under the WHO classification (Anon, 1975). The high mammalian toxicity of this insecticide makes it an unsuitable one for use in the home garden on a tree crop. Safety precautions observed by home gardeners are minimal and the danger of spray drift when applying pesticides to trees is great. Furthermore, at the time this paper was written, dicrotophos has not been registered by the Pesticides Board of Malaysia which means its sale and use in the country are prohibited.

[1] Active ingredient is maneb.
[2] N:P:K values are 15:30:15; also included are trace elements.

The main aim of our investigations was to evaluate insecticides of moderate mammalian toxicity for the control of *D. marginatus*. At the same time we deemed it useful to evaluate the impact of these insecticides on non-target pests because one of the well-known undesirable side-effects of insecticides is that they cause outbreaks of secondary pests. After the most effective insecticide was selected we determined its residual effect and hence the frequency of application of the insecticide.

MATERIALS AND METHODS

The experimental area

The experiments were carried out on the Universiti Pertanian Malaysia farm planted with the Bombay Green variety of *Mangifera indica*. This variety puts out new shoots throughout the year under local conditions and, like other exotic varieties of mango, is prone to attacks by *D. marginatus*.

The insecticidal trial

The treatments consisted of four insecticides and an untreated control. The common and commercial names of the insecticides are listed in Table 1 together with their respective acute oral LD_{50} values for rats and the rates of application.

The insecticides were applied at weekly intervals for 20 weeks between July to December 1981. Treatment trees were sprayed to the point of run-off using knapsack sprayers each fitted with a lance of 126 cm length.

The experimental design used was a RCBD consisting of four treatments and the untreated control replicated eight times. Each plot consisted of a single tree.

Evaluation was done at fortnightly intervals by taking 10 new shoots at random and examining these for leaf-cutting damage. New shoots were scarce at certain times so that on some trees there were less than 10 shoots. When this occurred all the available shoots were evaluated.

Early in the trial it was found that there was a very low incidence of attack by *D. marginatus* on all treatments including control. The problem was resolved by collecting leaf blades freshly cut by *D. marginatus* in another area of the farm and distributing these beneath all trees in the experiment. A total of 37 cut leaves was placed under each tree over a four-week period.

For any one replicate in any one treatment the data from all the evaluations were pooled and the percentage of cut shoots was calculated. An analysis of variance was carried out on these percentages and the differences between individual means were tested using Duncan's multiple range test.

Shoots being evaluated for cutting damage by *D. marginatus* were also examined for:

(a) damage by *Mictis longicornis* Westw. (Hemiptera: Coreidae)

(b) damage by *Chlumetia transversa* Wlk. (Lepidoptera: Noctuidae)

(c) presence of mealybugs (Hemiptera: Pseudococcidae)

(d) presence of scale insects (Hemiptera: Diaspididae)

and (e) presence of galls caused by *Procontarinia matteiana* Kieff and C. (Diptera: Cecidomyiidae)

Since mealybugs and scale insects are generally found on mature leaves rather than immature ones, the mature leaves behind the flush selected were examined down to the next joint.

TABLE 1
The acute oral toxicities and rates of application of insecticides evaluated

Insecticide treatments	Acute oral toxicity*	Rate of application (% a.i.)
dicrotophos (Carbicron 24WSC)	22	0.053
etrimfos (Ekamet 50EC)	1800	0.075
acephate (Orthene 75SP)	945	0.082
deltamethrin (Decis 2.5EC)	537	0.0022

*Based on LD_{50} for the rat (mg/kg body weight)

The persistency of deltamethrin

As deltamethrin was found to be the most effective insecticide in the above experiment its persistency was then determined as follows.

The treatments comprised deltamethrin applied at one, two and three week intervals and an untreated control. Each treatment was replicated eight times in a RCBD with each plot being a single tree.

The residual effect of the insecticide was assessed by counting the number of shoots showing cutting damage. Damage assessment was carried out in the manner described in the preceding trial at weekly intervals for six weeks (between 22 November 1981 to 2 January 1982). The data for any one replicate in any one treatment were pooled and the percentage cut shoots calculated. An analysis of variance was carried out on these percentages and the difference between individual means were tested using Duncan's multiple range test.

Rain is an important determinant of the residual activity of most pesticides. Rainfall data were therefore obtained from the University's meteorological station.

RESULTS AND DISCUSSION

The insecticidal trial

Table 2 shows the means of the percentage cutting damage and how the treatments differed.

TABLE 2

Effectiveness of the insecticides tested for the control of *D. marginatus* as measured by the cut leaves

Treatment	*Mean % cut shoots
control	44.9 a
dicrotophos	30.6 ab
acephate	29.1 ab
etrimfos	22.1 b
deltamethrin	4.9 c

*Means not followed by the same letter are significantly different ($P < 0.05$) by Duncan's multiple range test.

It can be seen that all the four insecticides tested did reduce damage by *Deporaus* when compared to the control. Deltamethrin was clearly the best insecticide followed by etrimfos, acephate and dicrotophos in that order. However only two insecticides, namely etrimfos and deltamethrin, gave means which differed significantly from that of the untreated control.

The persistency of deltamethrin

Table 3 shows the means of shoots cut by *D. marginatus* when deltamethrin was applied at 0 (untreated control), one, two and three week intervals.

TABLE 3

Effectiveness of deltamethrin in controlling *D. marginatus* when applied at 0, 1, 2 and 3 week intervals. Effectiveness was measured by the percentage cutting damage

Treatment (weeks between application)	*Mean % cut shoots/ replicate
1	5.3 a
2	12.5 a
3	36.9 b
0 (control)	45.8 c

*Means not followed by the same letter are significantly different ($P < 0.05$) by Duncan's multiple range test.

Least damage was noted when the insecticide was applied at one week intervals and most at three. Even at three week intervals deltamethrin gave better protection than the control. The difference between means for the one and two week treatments is not significant. Thus it may be concluded that deltamethrin gave good protection from *D. marginatus* for at least two weeks.

The following information on rainfall provides some background information on the kind of conditions under which the trial took place. A total of 281 mm of precipitation was recorded over the trial period of 42 days of which 21 days were rain-free.

GENERAL DISCUSSION

The insecticidal trial reported here has shown that the previously widely used dictophos is one of the least effective insecticides together with acephate. Singh (1980) mixed dicrotophos with Manzate D and Welgro Standard and evaluated the mixture for control of insects and diseases. It was therefore the mixture rather than dicrotophos which was being evaluated for control of insects of mango in particular, *D. marginatus*. Synergism between dicrotophos and various fungitoxicants has been suggested (Lim, 1980). A study will have to be carried out to compare deltamethrin + Manzate D + Welgro Standard against dicrotophos + Manzate D + Welgro Standard.

When used by itself deltamethrin was clearly the best of the insecticides tested. Besides being of moderate toxicity, deltamethrin is made even safer because the normal rate of application is extremely low. For example, the rate of application of deltamethrin in this study was 24 times lower than that of dicrotophos.

Although deltamethrin appears to be a desirable insecticide to use against *D. marginatus*, due consideration should be given to its effect on non-target insects. With most insecticides there is always a degree of deleterious effect on parasites and predators. If the insecticide should disturb the ecosystem to the extent that parasites and predators are more adversely affected than the target pest, pest resurgences and outbreaks of secondary pests could result. Under the conditions of our trial no increase in the incidence of secondary pests was noted.

Concerning possible adverse effects on pollinators, field experimentations have shown that the insecticide presents no danger to bees at dosages up to 12.5 g a.i./ha; it has also been noted that bees are repelled when the flower is recently treated with deltamethrin (Delabarre and Yeh, 1981). Mango pollinators are principally dipterans and the above observations may or may not be applicable. Nevertheless deltamethrin has been used against mango hoppers in the Philippines and at 12.5 and 25.0 g a.i./ha gave best control of the hoppers and highest yields compared with fenvalerate, carbaryl and the untreated control (Delabarre and Yeh, 1981). Time of application was 4, 11, 18 and 32 days after flower emergence. So it appears that the application of deltamethrin even during the flowering period did not affect mango pollinators to the extent that yield was reduced relative to the control.

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Mention of a proprietary product does not constitute a recommendation or an endorsement by the authors.

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