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EFFECT OF FRUIT FLY SPRAYS ON THE ABUNDANCE OF THE CITRUS MEALYBUG, PLANOCOCCUS CITRI (RISSO), AND ITS PREDATOR, CRYPTOLAEMUS MONTROUZIERI MULSANT, ON PASSION-FRUIT IN SOUTH-EASTERN QUEENSLAND*

by D. A. H. MURRAY, M.Sc.

SUMMARY

The effects are reported of three insecticide treatments used against Queensland fruit fly, *Dacus tryoni* (Froggatt), on populations of citrus mealybug, *Planococcus citri* (Risso), and its main predator, *Cryptolaemus montrouzieri* Mulsant. Of the three fruit fly sprays tested only dimethoate is also effective against *P. citri*. Fortnightly sprays of DDT against fruit fly resulted in increased numbers of the mealybug because of the destruction of its predator *C. montrouzieri*. Malathion protein hydrolysate bait sprays appeared to have no appreciable effect on the mealybug or its predator.

I. INTRODUCTION

Citrus mealybug, *Planococcus citri* (Risso), and the Queensland fruit fly, *Dacus tryoni* Froggatt, are two major pests of passion-fruit, *Passiflora edulis* Sims f. *flavicarpa* Degener, grown commercially in south-eastern Queensland (Murray 1976).

Fortnightly sprays of 0·03% dimethoate are applied at the present time by growers during the period from September to May for control of *D. tryoni*. DDT was also used for this purpose until 1976, and as a replacement for DDT, malathion protein hydrolysate bait sprays have been suggested.

I have observed that where DDT was used for *D. tryoni* control on passion-fruit, outbreaks of *P. citri* were more severe than in situations where dimethoate had been used regularly. Additional insecticidal control of *P. citri* was usually necessary in DDT treated plots. Workers in California have demonstrated the disruptive effect the use of DDT has on the biological control of *P. citri* on citrus (Griffiths and Thompson 1947, Bartlett 1957).

The aim of this study was to determine the effects of sprays applied for *D. tryoni* control on the numbers of *P. citri* and its main predator, *Cryptolaemus montrouzieri* Mulsant on passion-fruit in south-eastern Queensland Laboratory studies on the relative toxicity of dimethoate and DDT to *P. citri* were also carried out.

*Based on thesis submitted to University of Queensland for Degree of M.Sc.

II. MATERIALS

The following formulations were used:

dimethoate—40% emulsifiable concentrate

DDT—25% miscible oil

DDT—50% emulsion

malathion—50% emulsifiable concentrate

protein hydrolysate—21·7% protein

III. METHODS

Laboratory studies

Regression lines of mortality probits on concentrations (expressed as logarithms), were determined from three replicates of seven doses of dimethoate and of five doses of DDT. A single excised leaflet of strawberry, *Fragaria* sp., with more than 40 first or second-instar nymphs of *P. citri* on it was immersed for 5 s in the test emulsions. The leaves were allowed to air-dry before being placed in ventilated plastic vials 80 mm long by 35 mm diameter. The vials were held at 25°C for 24 h before mortality counts were made. Corrections for control mortality were made from mortality counts of nymphs on three untreated leaflets.

Field studies

An area of 0·5 ha was divided into six blocks each containing four rows of four vines of passion-fruit. The following four treatments were allocated at random to each row:

1. unsprayed.
2. 0·03% dimethoate as a cover spray applied fortnightly.
3. 0·1% DDT as a cover spray applied fortnightly.
4. 0·55% malathion and 0·5% protein hydrolysate bait spray applied weekly to trellis posts which supported the passion-fruit vines.

Five cover sprays were applied at 14-day intervals between 30 April and 25 June 1975. Spraying was discontinued during the winter months as fruit fly is normally less active from May to September. A further nine sprays were then applied from 18 September 1975 to 27 January 1976. The cover sprays were applied by knapsack sprayer with hand-lance and twin-cone nozzles. Spray was applied to each side of the trellis system to obtain thorough coverage of leaves and fruit. The equivalent of 850 to 1 000 l ha^{-1} of spray was applied. DDT 25% miscible oil was used for all DDT sprays except those on 31 October and 13 November when 50% DDT emulsion was used. Bait sprays were applied to trellis posts in 50 ml doses using a hand sprayer. Applications of bait spray were made every 7 days during periods when cover sprays were applied.

Fortnightly counts of nymphs and adult female *P. citri* and larvae of *C. montrouzieri* were made from 12 March 1975 to 5 March 1976 on a sample of 20 leaves plus 20 stem sections 50 mm long. Details of the sampling method have been described previously (Murray 1978).

IV. RESULTS AND DISCUSSION

Laboratory studies

Mortality—concentration relationships of *P. citri* to dimethoate and DDT were—

	LC 50 (% active ingredient)	Range (P = 0·05)	Slope
dimethoate	0·00135	0·00107–0·00162	2·5224 ± 0·3075
DDT	0·11770	0·08395–0·19507	0·7020 ± 0·1118

The results of the laboratory studies indicate that dimethoate is considerably more toxic than DDT to *P. citri.*

Field studies

Figure 1 shows that there were considerable differences in numbers of *P. citri* according to the time of year. Populations were low in winter and high in summer. The effects of the insecticides are seen clearly. Numbers of *P. citri* in the malathion bait spray plots were very similar to those on the untreated control. However, both dimethoate and DDT sprays resulted in marked differences from the untreated controls. Dimethoate suppressed *P. citri* whilst DDT increased its numbers compared with the controls.

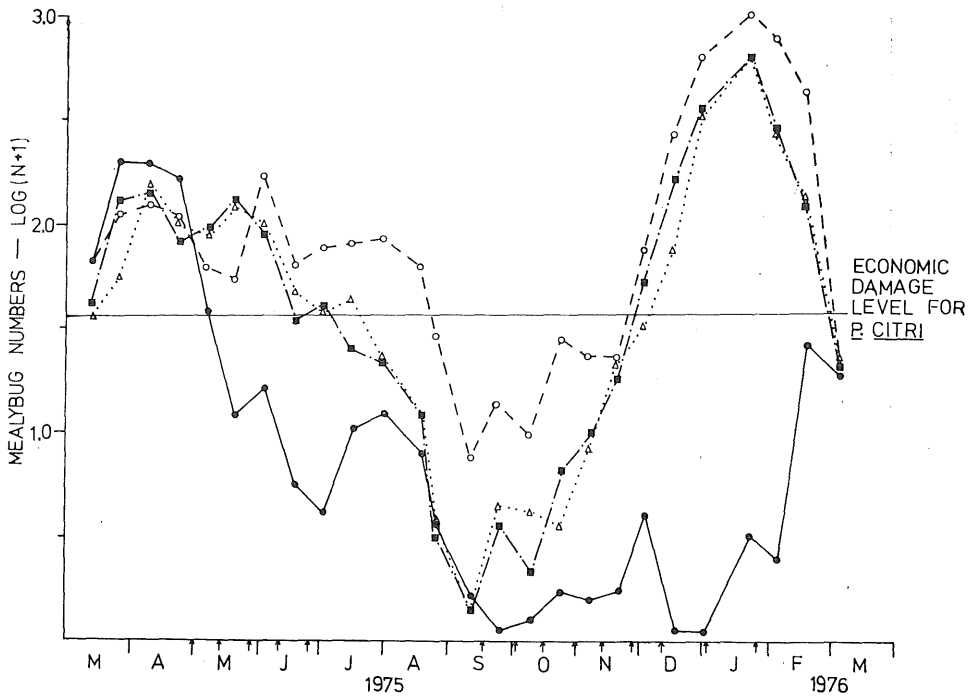

Figure 1. Comparative fluctuations in the mean number of P. citri *nymphs and adult females per plot recorded on untreated (■), dimethoate sprayed (●), DDT sprayed (O) and malathion bait sprayed (△) passion-fruit. ↑ Date of insecticide application.*

Previous observations had indicated that a population of 35 *P. citri* on the standard sample of 20 leaves plus 20 stem-sections results in economic damage. This threshold level was exceeded on all plots, except those sprayed with dimethoate. The superiority of dimethoate compared with DDT sprays is to be expected from the results of the laboratory studies on toxicity. Figure 1 also indicates that dimethoate had brief persistence in the field since increases in numbers were recorded very shortly after spraying was discontinued in June 1975 and January 1976.

The greater numbers of *P. citri* in the DDT sprayed plots compared with the controls were clearly not due to seasonal factors, but they may be correlated with reduced numbers of the main predator, *C. montrouzieri,* during the two periods when DDT sprays were applied (figure 2). Although DDT is highly toxic to *C. montrouzieri* (Bartlett 1963), DDT sprays did not have the devastating effects expected from Bartlett's observations. This may explain why the peak populations of *P. citri* during the two spray periods did not go considerably higher in the DDT sprayed plots compared with the untreated ones. As indicated by the increase in numbers of *C. montrouzieri* after DDT spraying ceased (figure 2), the effect of DDT in the field lasted about 2 weeks.

Populations of *C. montrouzieri* in the malathion bait sprayed and untreated plots were very similar (figure 2), as might be expected from the similarity between the population of *P. citri* for these two treatments.

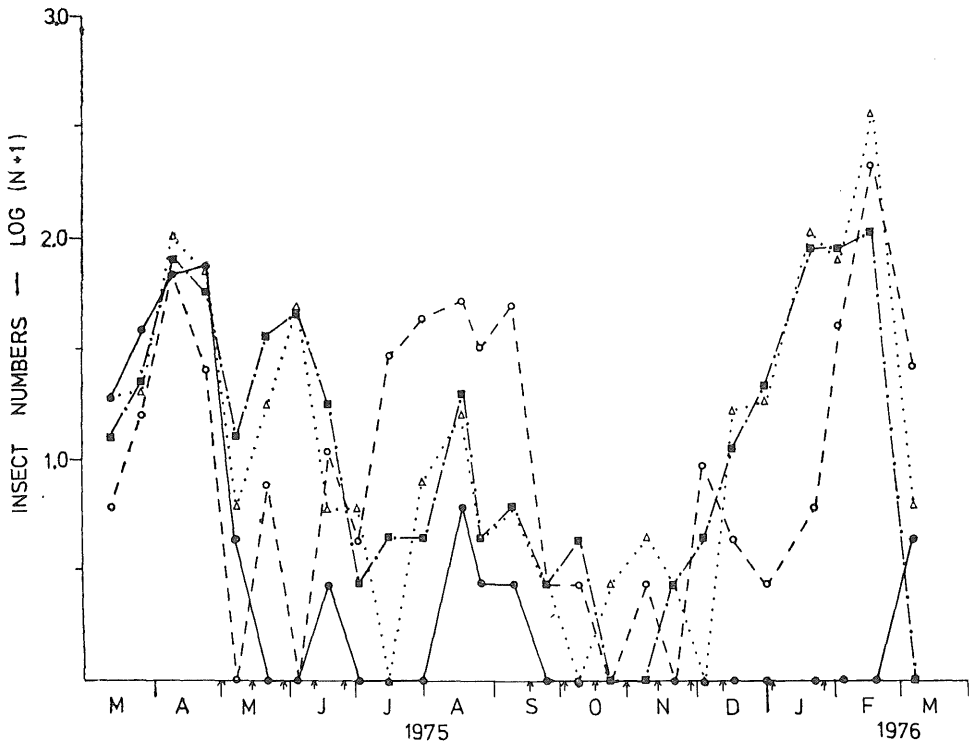

Figure 2. The effect of insecticides on the mean numbers per plot of the mealybug predator, C. montrouzieri *on untreated (■), dimethoate sprayed (●), DDT sprayed (O) and malathion bait sprayed (△) passion-fruit. ↑ Date of insecticide application.*

The differences in *P. citri* populations between treatments are attributed to the direct effect of insecticidal sprays on the mealybug and on the indirect effects resulting from killing its predator, *C. montrouzieri.* Until biological control of *P. citri* is improved and can be relied upon to keep mealybug infestations in check, some additional insecticidal control of *P. citri* is required on passion-fruit. As dimethoate is effective against both *P. citri* and *D. tryoni,* regular use of dimethoate will control both pests. DDT should not be used on passion-fruit because of its interference with the main predator of *P. citri.*

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The author is an Entomologist in the Division of Plant Industry, Queensland Department of Primary Industries and is stationed at Nambour, Q. 4560.