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Ovicidal tests with insecticides against tomato grub, Heliothis armiger (Hübner)

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Summary

Commercial formulations of 11 insecticides currently used on tomatoes were evaluated in the field for ovicidal activity against the tomato grub, *Heliothis armiger* (Hübner). The highest ovicidal effect was shown by methomyl while acephate and DDT were not ovicidal.

1. INTRODUCTION

Tomato grub, *Heliothis armiger* (Hübner), is a serious pest of tomatoes in south-east Queensland. Smith (1978) and Hargreaves and Cooper (1979) showed that a programme of weekly insecticide spray was effective for control. Recent experience in the Redland Bay district of south-east Queensland has demonstrated, however, that during *H. armiger* plague conditions, control obtained with such schedules is inadequate.

A potential exists for the use of ovicides during the short periods of intense egg laying associated with these plagues (Smith and Salkeld 1966). Methomyl and permethrin have been shown to be ovicidal for *Heliothis zea* (Boddie) (Nakano, Marchini and Yokoyama 1975; Tysowsky and Gallo 1977) and, although Waite (personal communication) showed methomyl to be ovicidal for *Heliothis* spp. on cotton in central Queensland, the ovicidal effects of other insecticides commonly used on tomatoes were unknown.

The studies reported here were conducted at Ormiston in the Redlands area near Brisbane, during the 1980 plague of *H. armiger*. The ovicidal effects of a range of insecticides currently used on tomato were compared over a concentration range from full to one quarter normal usage strength.

2. MATERIALS AND METHODS

The insecticides used, percentages of active constituent and types of formulations were as follows:

Acephate	75% w/w soluble powder
DDT	25% w/v emulsifiable concentrate
Deltamethrin	2.5% w/v emulsifiable concentrate
Endosulfan	33% w/v emulsifiable concentrate
Fenvalerate	7.5% w/v emulsifiable concentrate
Methamidophos	58% w/v emulsifiable concentrate
Methomyl	22.5% w/v emulsifiable concentrate
Monocrotophos	40% w/v emulsifiable concentrate

Permethrin	50% w/v emulsifiable concentrate
Prothiophos	72% w/v emulsifiable concentrate
Sulprophos	72% w/v emulsifiable concentrate

(Deltamethrin is the proposed common name for: (*S*)-α-cyano-3-phenoxybenzyl (*1*R, *3*R)-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropane carboxylate.)

Because of its lack of ovicidal activity, DDT was included as a standard.

Seven trials were conducted at the Redlands Horticultural Research Station, Ormiston, using the cultivar Floradade. Plants were trellised and had set their first hands of fruit when insecticides were applied. Trial 1 was carried out on 17 to 24 September, Trials 2 and 3 on 18 to 25 September, Trial 4 on 22 to 29 September, Trials 5 and 6 on 30 September to 7 October and Trial 7 on 2 to 9 October 1980.

Each plot comprised the plants in a 0.5 m section of row, and treatments were replicated four times in a totally randomized design (details of treatments are given in Table 1). Plants were sprayed to the point of run off using a 'Rega' continuous pressure hand atomizer, after heavy oviposition by *Heliothis* spp. had occurred. The eggs sprayed were not uniform in their embryonic development.

Table 1. Percentages of *Heliothis* eggs which failed to hatch during field trials at Ormiston, September–October 1980

Treatment (% a.i.)		Percentage mortality of eggs						
		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
No treatment		0.0*a* (27.2)	0.8*a* (28.3)	1.0*a* (30.5)	1.3*a* (35.5)	1.7*a* (29.5)	1.0*a* (30.0)	0.7*a* (32.0)
Acephate	0.075	12.4*ab* (30.2)	..	..	..	..	..	..
	0.0375	..	0.0*a* (25.2)	..	..	..	..	..
	0.0188	..	..	3.0*a* (35.0)	..	..	..	..
DDT	0.10	..	..	..	..	..	..	0.7*a* (35.2)
	0.05	..	1.8*a* (49.5)	..	..	13.4*a* (60.5)	..	..
	0.025	..	..	8.7*ab* (47.5)	..	..	5.4*ab* (49.5)	..
Deltamethrin	0.005	..	..	..	..	..	..	12.8*b* (40.5)
	0.0025	..	..	..	..	16.2*ab* (49.0)	..	..
	0.001 25	..	..	..	..	..	16.1*c* (34.0)	..
Endosulfan	0.067	26.4*c* (24.2)	..	..	..	..	..	..
	0.033	..	10.3*ab* (36.7)	..	..	..	..	..
	0.0167	..	..	2.3*a* (31.2)	..	..	..	..
Fenvalerate	0.005	49.0*d* (48.0)	..	..	..	..	..	..
	0.0025	..	22.6*bc* (40.2)	..	..	..	..	..
	0.001 25	..	..	5.8*a* (43.7)	..	..	..	..

Table 1 continued

Treatment (% a.i.)		Percentage mortality of eggs						
		Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
Methamidophos	0.11	18.3*bc* (33.7)	..	..	..	..	..	28.7*c* (46.2)
	0.055	..	18.5*b* (60.2)	..	..	28.2*b* (30.2)	..	..
	0.027	..	..	4.3*a* (64.0)	..	..	15.9*c* (29.7)	..
Methomyl	0.05	91.2*e* (52.5)	..	..	84.1*d* (31.7)	..	..	95.0*d* (42.0)
	0.025	..	98.4*d* (30.5)	..	..	69.7*c* (52.5)	..	..
	0.0125	..	..	79.7*d* (41.5)	..	..	58.3*d* (33.0)	..
Monocrotophos	0.10	26.5*c* (41.7)	..	..	..	..	..	31.1*c* (41.2)
	0.05	..	8.1*ab* (31.0)	..	..	5.3*a* (35.7)	..	..
	0.025	..	..	5.8*a* (42.7)	..	..	3.0*a* (32.2)	..
Permethrin	0.005	..	..	..	15.1*b* (33.0)	..	..	..
	0.0025	..	30.0*bc* (37.0)	..	..	..	..	..
	0.001 25	..	..	16.1*bc* (59.2)	..	..	..	..
Prothiophos	0.10	..	..	..	..	..	..	23.6*c* (49.0)
	0.05	..	..	..	..	21.1*b* (27.2)	..	..
	0.025	..	..	..	..	..	12.3*bc* (45.7)	..
Sulprophos	0.072	..	..	..	44.2*c* (48.0)	..	..	23.1*bc* (44.7)
	0.036	..	33.0*c* (68.5)	..	..	27.5*b* (40.2)	..	..
	0.018	..	..	18.2*c* (78.2)	..	..	12.0*bc* (46.2)	..

Values, within columns, with a common letter do not differ at the 5% level of probability (analysis of variance and l.s.d. test).
The mean number of eggs per leaf is shown in parentheses.

The effects of treatments were determined from counts of hatched and unhatched eggs on leaves examined under a stereo microscope 7 days after spraying (as in Clift (1976), an egg was considered hatched when the chorion was broken). For this purpose, one leaf per plot was removed immediately after spraying and the leaves were then kept with the petiole in water in separate vials in a field screen house until they were examined. Results were adjusted for mortality in the controls by Abbot's formula (Abbot 1925) except for mortality of less than 5% which was not adjusted (Winteringham 1969).

Heliothis larvae from unsprayed plants were reared to the adult stage using the diet of Patana (1969), to allow determination of the species involved.

3. RESULTS AND DISCUSSION

The results are summarized in Table 1. Using the criteria of Mitri and Kamel (1970) for ovicidal action, methomyl had a high ovicidal action at all concentrations. Fenvalerate and sulprophos had medium ovicidal action at their highest concentrations only. Deltamethrin, endosulfan, methamidophos, monocrotophos, permethrin and prothiophos showed only low levels of ovicidal activity. No ovicidal activity was shown by acephate or DDT.

Eighty three larvae were bred to the adult state, all of which were *Heliothis armiger* (Hübner).

A regular schedule of methomyl has been shown to give less control than other cover sprays (Hargreaves and Cooper 1979), possibly due to methomyl's short residual life. However, the results suggest that methomyl's ovicidal effect could be used to advantage either as an adjunct to routine sprays of other insecticides preferred against larvae during plague outbreaks of *H. armiger* or as a population suppressant as indicated by insect scouting.

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