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NOTE

TOXICITY OF FOUR INSECTICIDES TO *PHYTOSEIULUS MACROPILIS* (BANKS) AND *P. PERSIMILIS* ATHIAS-HENRIOT (ACARINA: PHYTOSEIIDAE)

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Abstract

Commercial formulations of dimethoate, methomyl, fenvalerate and endosulfan were tested against a New Caledonian strain of *Phytoseiulus macropilis* and an Australian strain *P. persimilis* using a slide-dip technique. The responses of the 2 species to fenvalerate, methomyl and endosulfan were similar, with fenvalerate being the most toxic and endosulfan the least. In contrast, dimethoate was 50x more toxic to *P. macropolis* than to *P. persimilis* at the LC_{50} level.

Phytoseiulus persimilis Athias-Henriot has been widely used for the control of tetranychid mites and its response to pesticides has been evaluated (Everson and Tonks 1981). Resistance to several organophosphorus compounds has been confirmed in *P. persimilis* (Schulten *et al.* 1976). *P. macropilis* Banks is an effective predator of tetranychid mites (Hamlen and Poole 1980), but there are no data on its response to pesticides.

In the present investigation commercial formulations of 4 insecticides from different chemical groups were tested against a New Caledonian strain of *P. macropilis* and a strain of *P. persimilis* from Sydney.

The test strain of *P. macropilis* was established with several hundred individuals collected from French beans adjacent to a commercial nursery near Noumea, New Caledonia. The culture was maintained at 25°C in continuous illumination on potted French bean plants infested with *Tetranychus urticae* Koch, twospotted mite. A slide-dip technique (Anon. 1974) was used to test the following materials: dimethoate (30% w/v, Rogor®), methomyl (20% w/v, Lannate®), fenvalerate (10% w/v, Sumicidin 10®), and endosulfan (35% w/v, Thiodan®). Twenty gravid females were attached to each slide using double sided adhesive tape and dipped in an aqueous suspension of the insecticide for 5 seconds. Four concentrations of each insecticide were used per test and the tests were replicated 5 times. A water only treatment was included in each replicate as a control. After dipping, excess liquid was removed from around each female with absorbent paper and slides were held at 27 ± 1°C and *ca* 95% RH. Mortality was assessed 48 h after treatment; the criterion for death was failure to exhibit leg movement when gently prodded with a fine bristle. The data were corrected for control mortality, which did not exceed 10%, and analysed by probit analysis (Finney 1971).

The same samples of the insecticide formulations were then tested in Australia against a Sydney strain of *P. persimilis* (Goodwin and Schicha 1979). The rearing conditions and the test method were the same as those described for *P. macropilis*, but only one concentration of each insecticide (that giving 90-99% mortality of *P. macropilis*) was tested against *P. persimilis* using 20 females per test and replicated 5 times. Dose response data were obtained for dimethoate against *P. persimilis* as described for *P. macropilis* after the initial dosage of 50 ppm gave <30% mortality.

The log-dose probability data obtained for *P. macropilis* are shown in Table 1. These data were characterised by low slope values and the χ^2 values for residual between doses (Table 1) indicate significant departure from linearity for dimethoate, methomyl and endosulfan. Low slope values were also reported by Schultan *et al.* 1976) after testing a range of insecticides against a susceptible strain of *P. persimilis*. Both sets of data may indicate that there is considerable inherent variation in the response of *Phytoseiulus* sp. to pesticides, particularly in unselected strains. This problem may be compounded by the test method, although it is widely used for predatory mites (Croft 1977).

The single dosage tests (Table 2) indicated that the relative toxicities of methomyl, fenvalerate and endosulfan were similar for *P. macropilis* and *P. persimilis*. The low toxicity of endosulfan is consistent with

TABLE 1
TOXICITY OF 4 INSECTICIDES TO *P. MACROPILIS* FEMALES

	LC50 ppm (a.i.)	(95% fiducial limits)	Slope value ± SE	χ^2
Dimethoate	7	(3-13)	1.9 ± 0.46	9.7*
Methomyl	39	(27-58)	1.5 ± 0.2	10.5*
Fenvalerate	1	(0.5-1.9)	1.1 ± 0.18	5.1
Endosulfan	1100	(500-2100)	1.8 ± 0.39	9.5*

* Significant departure from linearity ($P < 0.01$)

TABLE 2
RESPONSES OF *P. MACROPILIS* AND *P. PERSIMILIS* FEMALES TO 4 INSECTICIDES

	Concentration ppm (a.i.)	% mortality	
		P. macropilis	*P. persimilis*
Dimethoate	50	97.8	28.6
Methomyl	250	95.9	98.9
Fenvalerate	20	90.4	92.8
Endosulfan	10,000	98.6	79.0

results obtained by Schulten *et al.* (1976). Strickler and Croft (1982) pointed out that pyrethroids are highly toxic to predatory mites and our results for fenvalerate conform to this pattern. It is emphasised, however, that slide dip only gives an indication of the likely effects of pesticides on predators in the field. Dimethoate was considerably more toxic to *P. macropilis* than *P. persimilis* (Fig. 1). The analysis of the data for *P. persimilis* gave an LC_{50} (95% fiducial limits) of 278 ppm (196-379) with a slope value (±SE) of 1.2 ± 0.12, but there was significant departure from linearity - X^2, 17.9 (d.f. = 2). Because of the departure from linearity evident in the data for *P. macropilis* and *P. persimilis*, it is considered more appropriate to estimate the difference in responses to dimethoate graphically from Fig. 1. At the LC50 level dimethoate was 50x more toxic to *P. macropilis* than *P. persimilis* and 80x at the LC_{90} level.

P. macropilis was recorded by Saba (1974) as the most common phytoseiid in southern Florida and it occurs in Hawaii (Prasad 1967), Cook Islands (Collyer 1980) and Fiji (Hinkley 1963). It was first recorded in New Caledonia in 1975 (Chazeau and Gutierrez 1977) while *P. persimilis* has not been found in New Caledonia since 1974, although it was reported to be well established after it was introduced in 1972 (Cochereau 1976). These records and the New Caledonian experience indicate that *P. macropilis* may be better adapted than *P. persimilis* to certain regions of Australia, such as the coastal areas of Queensland and northern New South Wales. However, the apparent susceptibility of the New Caledonian strain to pesticides would seriously reduce its potential in commercial horticultural crops in Australia.

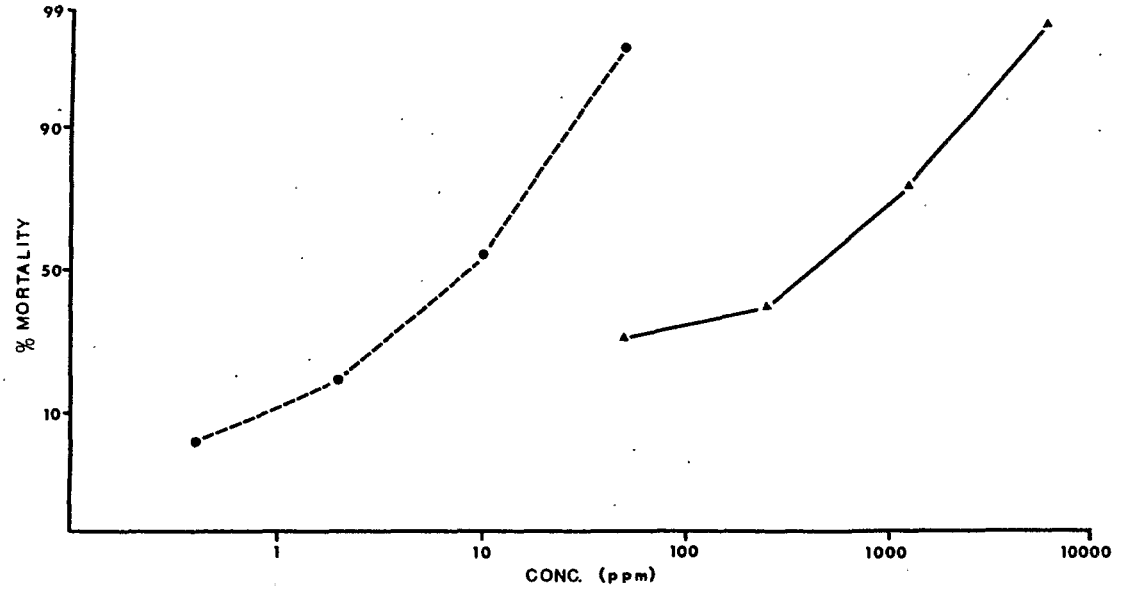

FIG 1—Toxicity of dimethoate to *P. macropilis* (● - - - ●) and *P. persimilis* (▲ ——— ▲).

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