

Toxicity of different fungicides to adult *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae)

T. RAMESH BABU* AND K. M. AZAM**

*Seed Technology Research Project, Rajendranagar, and **A.P. Agricultural University, Rajendranagar, Hyderabad-30, India

ABSTRACT. Toxicity and persistence of eight fungicides (carbendazim, tridemorph, mancozeb, captafol, triadimefon, Bordeaux mixture, sulphur w.p. and sulphur dust) to *Cryptolaemus montrouzieri* Mulsant adults was assessed by calculating the median lethal time (LT) values in days, following probit analysis. While tridemorph 0.05% was the safest, triadimefon 0.05% was most toxic with greater persistence. Hence the spraying of tridemorph 0.05% and the release of the predator could be simultaneous.

Introduction

Serious outbreaks of mealybug, *Maconellicoccus hirsutus* (Green) were reported to depress the grape yields up to 90% in Ranga Reddy and Anantapur areas of Andhra Pradesh, India (Manjunath, 1985). In spite of the transient effectiveness of the insecticides used, resurgence of the pest was reported, due to elimination of predators (AICFIP, 1982). Fungicides are frequently applied to control mildews and anthracnose infections, but the influence of these fungicides on the predator adults appears to have been little studied, apart from the work of Anand (1942) using sulphur, Sysoev (1953) using Bordeaux mixture and Hassan *et al.* (1983) using triadimefon. The present study aimed to establish the safe periods for various fungicides to facilitate the introduction of *C. montrouzieri* adults for the biological control of mealybug pest.

Materials and methods

Rooted Thomson seedless grapevine cuttings were planted in earthenware pots and maintained in the greenhouse at an average maximum and minimum ambient temperature of $28 \pm 1^\circ\text{C}$ and $24 \pm 1^\circ\text{C}$ respectively. Foliar sprays of the fungicides using a compression sprayer with cone nozzle were applied. The common, trade and chemical names of the fungicides at the concentrations used (and their sources) are listed in Table 1. The leaves while attached to the vine were sprayed on both surfaces and held subsequently in individual Petri dishes. Grape mealybug egg masses were provided as food for the predator. At each of the

periods studied, 10 adults of *C. montrouzieri* were released on to the leaf and covered with muslin cloth. Three replicates were maintained for each of the treatments.

The mortality of the beetles was recorded 24 hours subsequent to their release. Leaves together with mealybug egg masses and predators were replaced at daily intervals until post-spraying day 3 and at intervals of 48 hours until post-spraying day 7. From then on the experiment was repeated at 4-day intervals until post-spraying day 26 or earlier if no dead beetles were detected. The data obtained were summarized in the form of time-mortality regression lines. The LT_{50} , LT_{90} and LT_{10} were calculated following probit analysis (Finney, 1971).

Results and discussion

Of the eight fungicides used, tridemorph 0.05% may be considered as safe for adult *C. montrouzieri*; the mortality of the predator is higher with all the other fungicides. Triadimefon 0.05% was found to be highly toxic with longer duration of persistence (Figure 1). The safety of tridemorph established in this study could not be corroborated, because of lack of previous reports. The toxicity was found to be maximal with triadimefon, followed by carbendazim, captafol, mancozeb, sulphur dust, sulphur w.p., Bordeaux mixture and tridemorph. The toxicity of sulphur to *C. montrouzieri* reported by Anand (1942) and Sysoev (1953) is in agreement with the results obtained in this experiment. Hassan *et al.* (1983) showed triadimefon to be harmless, in contrast to

TABLE 1. Details of the test fungicides

Common name (Trade name)	Concentration	Chemical name	Formulation	Source of supply
Carbendazim (Bavistin)	0.05%	Methyl benzimidazole-2-ylcarbamate (MBC)	50% w.p.	BASF India Ltd.
Tridemorph (Calixin)	0.05%	2,6-dimethyl-4-tridecylmorpholine	75% e.c.	BASF India Ltd.
Mancozeb (Dithane-M-45)	0.25%	Manganese ethylenebis(dithiocarbamate)(polymeric) complex with zinc salt	75% w.p.	Indofil Chemicals
Captafol (Foltaf)	0.15%	N-(1,1,2,2-tetrachloroethylthio)cyclohex-4-ene-1,2-dicarboximide	80% w.p.	Rallis India (P) Ltd.
Triadimefon (Bayleton)	0.05%	1-(4-chloro-phenoxy)-3-3-dimethyl-1-(1H-1,2,4-triazol-1-yl)-2-butanone	50% w.p.	Bayer India (P) Ltd
Bordeaux mixture	1%	Copper sulphate + calcium hydroxide + water	—	—
Sulphur w.p. (Thiovit)	0.2%	Inorganic sulphur fungicide	80% w.p.	Sandoz (India) Pvt Ltd
Sulphur dust	@ 25 kg/ha	Inorganic sulphur fungicide	50%	Purchased from market
Untreated control				

TABLE 2. Toxicity (expressed as lethal time in days) of fungicides to adult *C. montrouzieri*

Treatment	LT ₅₀ (days)	Fiducial limits (days)	d.f.	Heterogeneity χ^2	Regression equation	LT ₁₀ (days)	LT ₉₀ (days)
Carbendazim	5.64	4.67; 6.82	5	3.39	$y = 9.15 - 2.37x$	19.59	1.62
Tridemorph*	—	—	—	—	—	—	—
Mancozeb	4.04	3.28; 4.98	4	1.36	$y = 8.57 - 2.22x$	15.21	1.07
Captafol	5.24	4.28; 6.42	5	1.77	$y = 8.70 - 2.15x$	20.62	1.33
Triadimefon	7.68	6.58; 8.96	7	4.76	$y = 10.60 - 2.97x$	20.70	2.85
Bordeaux mixture	1.52	1.16; 1.99	3	1.45	$y = 7.94 - 2.49x$	4.98	0.46
Sulphur	3.12	2.51; 3.89	4	0.85	$y = 8.20 - 2.14x$	12.35	0.79
Sulphur dust	3.91	3.15; 4.87	4	0.41	$y = 8.36 - 2.11x$	15.81	0.97

* The mortality at 24 hours with tridemorph was 13.33%, hence LT values were not calculated

observations recorded in this experiment, possibly because of differences in technique.

The persistence of toxic deposits was greatest with triadimefon, followed by captafol, carbendazim, sulphur dust, mancozeb, sulphur w.p., Bordeaux

mixture and tridemorph (Table 2).

This study indicated that adult *C. montrouzieri* may be released simultaneously after spraying of tridemorph 0.05% and three days after application of 1% Bordeaux mixture, but field trials are needed to confirm this.

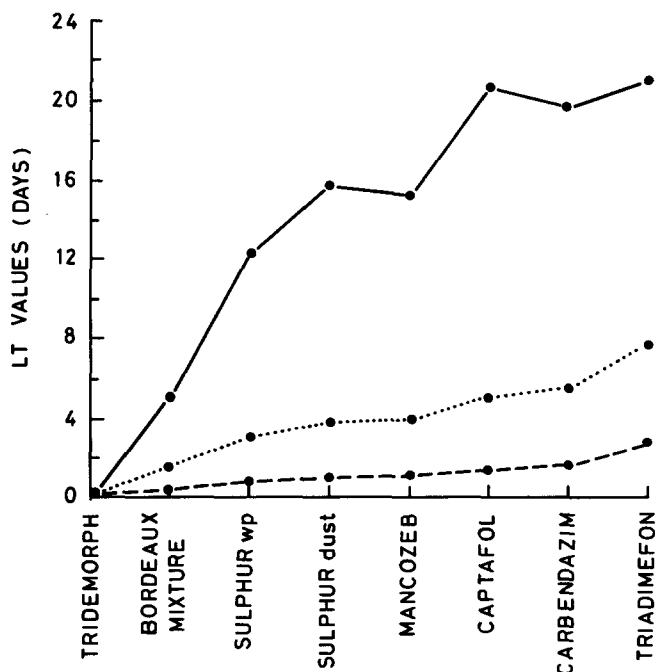


FIGURE 1. Persistence of toxicity of fungicides against adult *C. montrouzieri*. ●—● LT₁₀; ●·····● LT₅₀; ●---● LT₉₀.

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