

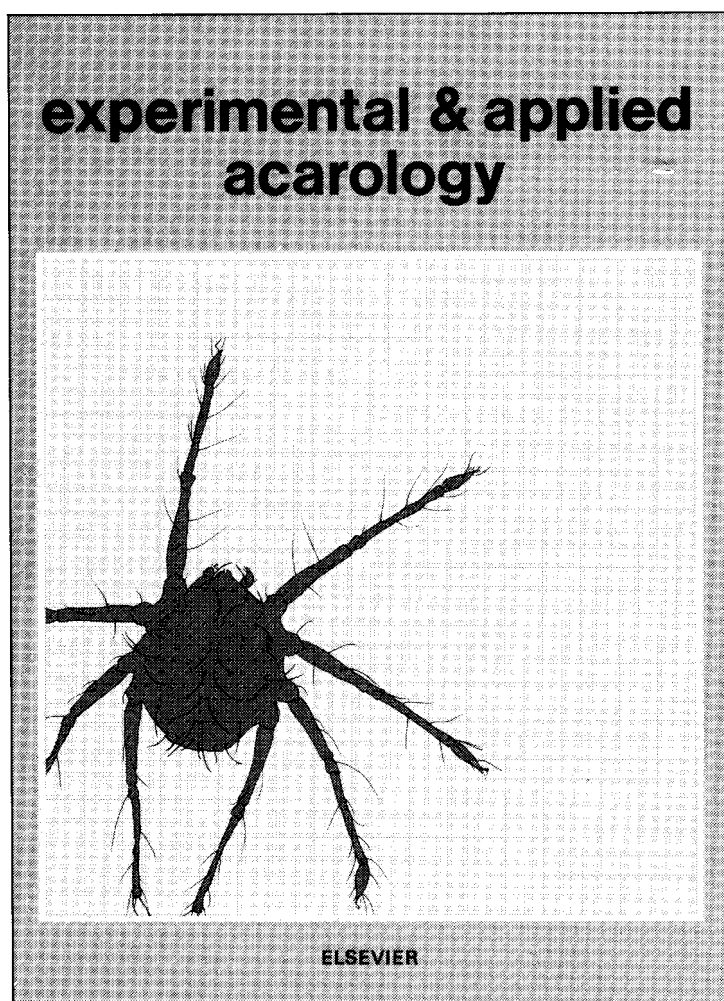
Effects of Three Fungicides on Populations of a Phytophagous and Several Predacious Mites (Acarina) on Apple¹

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Short Communication

**Effects of Three Fungicides on Populations of a
Phytophagous and Several Predacious Mites
(Acarina) on Apple¹**

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ABSTRACT

Hagley, E.A.C. and Biggs, A.R., 1989. Effects of three fungicides on populations of a phytophagous and several predacious mites (Acarina) on apple. *Exp. Appl. Acarol.*, 6: 253-256.

The fungicides captan (Captan 112 g a.i./100 L), mancozeb (Manzate 75% DF and 80% WP 180 g a.i./100 L) and flusilazole (Nustar 20F, 0.7, 1.4 and 1.8 g a.i./100 L) did not affect populations of the phytophagous mite, *Tetranychus (Polynychus) ? canadensis* (McGregor). Populations of phytoseiids *Amblyseius fallacis* (Garman), *A. (Euseius) finlandicus* (Oudemans), *Typhlodromus caudiglans* Schuster, and *Ty. pyri* Scheuten, were significantly reduced by both rates of mancozeb. Flusilazole (0.7 g a.i./100 L) and captan also reduced numbers of the phytoseiids. All fungicides tested adversely affected populations of the stigmatid, *Zetzellia mali* (Ewing).

INTRODUCTION

In a previous study (Biggs and Hagley, 1988), the fungicide, flusilazole (Nustar 400EC and 20F) was shown to suppress numbers of the predacious mite, *Typhlodromus caudiglans* Schuster, on apple foliage at rates of 2.7 and 5.4 g a.i./100 L of spray. Flusilazole was also associated with increased numbers of the European red mite, *Panonychus ulmi* Koch, while captan was associated with increased numbers of both species.

In 1987, the 4-spot mite, *Tetranychus (Polynychus) ? canadensis* (McGregor), was predominant in the same orchard used in the previous study. The effect of flusilazole and two other fungicides, captan and mancozeb, on populations of *Te. P. canadensis*, as well as on those of several predacious mites, was assessed.

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MATERIALS AND METHODS

The orchard in which tests were carried out consisted of 11-year old McIntosh trees on M.26 rootstock, planted in a 2.4 × 4.9-m rectangular pattern.

Captan (Captan 50% WP, 112 g a.i./100 L), flusilazole (Nustar 20F, 0.7, 1.4 and 1.8 g a.i./100 L) and mancozeb (Manzate 75% DF and 80% WP each at 180 g a.i./100 L), were each applied to four 5-tree plots. The fungicides were applied to run-off (ca. 8.0 L/tree) with a handgun mounted on a John Bean plot sprayer at 2760 kPa pressure. Seven 5-tree plots were arranged in four blocks of 35 trees each, using a randomized complete-block design, with guard rows between sprayed blocks to reduce the effect of drift. The fungicides were applied on 21 May, 3 and 16 June, and their effect on numbers of mites determined on 15 July and 13 August. On each sample date the numbers of mites on 10 leaves per tree, on 3 trees per treatment per block (i.e. a total of 120 leaves/treatment), were counted. Data were subjected to analysis of variance and means separated by Duncan's multiple-range test, $P=0.05$ (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

None of the fungicides at the rates used affected numbers of the phytophagous mite, *Te. P.? canadensis* (Table 1). Both formulations of mancozeb reduced significantly the numbers of the phytoseiids (*Amblyseius fallacis* (Garman), *A. (Euseius) findlandicus* (Oudemans), *Typhlodromus caudiglans* Schuster, and *Ty. pyri* Scheuten, present on both sampling dates) which accounted for 43.4% ($n=2081$) of the predator population. The phytoseiids were not separated to species when the counts were made, and it is therefore not possible to assess the effect of the fungicides on individual species. Numbers of the stigmatiid, *Zetzellia mali* (Ewing), which was the predominant predator (55.6%, $n=2081$), were also significantly reduced. Mancozeb was shown to reduce numbers of the European red mite, *Panonychus ulmi*, on grapes (Schruft and Oesterreich, 1973), and on apple (Sørum and Gjaerum, 1973). Meyer (1974) reported that maneb reduced numbers of *P. ulmi* on apple but did not affect numbers of the predacious mite, *Neoseiulus fallacis* (Garman). Flusilazole (0.7 g a.i./100 L) reduced the numbers of phytoseiids on 13 August, and the numbers of *Z. mali* at all rates on 15 July. At the lower rates of flusilazole used in 1987, compared to those used in 1985 and 1986 (Biggs and Hagley, 1988), the fungicide was considerably less toxic to the phytoseiid predators. Applications of captan (112 g a.i./100 L) resulted in reductions in the numbers of phytoseiids on 13 August and in the number of *Z. mali* on 15 July. Although residues of captan have been reported to be repellent to female *A. fallacis* (Hislop et al., 1981), it had a negligible effect on the predator *Phytoseiulus persimilis* Athias-Henriot (Stenseth, 1979), and did not affect populations of *Ty.*

TABLE 1

Effect of fungicides on the number (mean \pm SE) of *Te. P.?* *canadensis* and predacious mites per leaf on McIntosh apple trees on 15 July and 13 August, 1987¹

Treatment and rate (g a.i. 100 L)	Mites per leaf					
	<i>Te. P. canadensis</i>		Phytoseiidae ²		<i>Z. mali</i>	
	15.7.87	13.8.87	15.7.87	13.8.87	15.7.85	13.8.87
Control	0.14 \pm .12 a ³	16.2 \pm 3.61 a	0.18 \pm .05 ab	1.93 \pm .43 a	0.46 \pm .10 a	1.43 \pm .37 ab
Captan (112)	0.35 \pm .18 a	9.64 \pm 3.21 a	0.22 \pm .05 ab	1.01 \pm .27 bc	0.03 \pm .01 c	1.47 \pm .35 ab
Manzate DF (180)	0.13 \pm .06 a	9.26 \pm 3.0 a	0.01 \pm .01 c	0.12 \pm .04 d	0.02 \pm .02 c	0.43 \pm .17 c
Manzate WP (180)	0.18 \pm .11 a	14.64 \pm 3.78 a	0.00 c	0.08 \pm .02 d	0.03 \pm .01 c	0.30 \pm .08 c
Flusilazole (0.7)	0.37 \pm .14 a	12.65 \pm 1.88 a	0.29 \pm .07 a	0.73 \pm .20 dc	0.22 \pm .06 b	2.13 \pm .38 a
Flusilazole (1.4)	0.10 \pm .08 a	17.52 \pm 3.93 a	0.12 \pm .03 bc	1.49 \pm .43 abc	0.20 \pm .03 b	1.88 \pm .42 ab
Flusilazole (1.8)	0.21 \pm .12 a	18.85 \pm 5.43 a	0.22 \pm .09 ab	1.78 \pm .40 ab	0.13 \pm .06 bc	1.26 \pm .39 b

¹Ten leaves per tree, 3 trees per treatment per block (i.e. 120 leaves per treatment) examined on each sample date.

²Phytoseiid species recovered: *Amblyseius fallacis* (Garman); *A. (Euseius) findlandicus* (Oudemans); *Typhlodromus caudiglans* Schuster; and *Ty. pyri* Scheuten.

³Means in columns followed by the same letter not significantly different ($P=0.05$).

pyri, *Ph. macropilis* (Banks), *Mediolata novae-scotiae* Nes. (Sanford, 1967), or *N. fallacis* (Garman) (Meyer, 1974) and *Z. mali* (Karg et al., 1973). As mentioned previously (Biggs and Hagley, 1988), choice of fungicides for control of apple diseases must be carefully made if an integrated system for control of phytophagous mites on apple is to be maintained.

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REFERENCES

- Biggs, A.R. and Hagley, E.A.C., 1988. Effects of two sterol-inhibiting fungicides on populations of pest and beneficial arthropods on apple. *Agric. Ecosyst. Environ.*, 20: 235-244.
- Hislop, R.G., Auditore, P.J., Weeks, B.L. and Prokopy, R., 1981. Repellency of pesticides to the mite predator, *Amblyseius fallacis*. *Prot. Ecol.*, 3: 253-257.
- Karg, W., Burth, U. and Ramson, A., 1973. Der Einfluss von Fungiziden auf das Auftreten von Spinnmilben und anderen blattbewohnenden Milblengruppen in Apfelanlagen. *Nachrichtenbl. Pflanzenschutzdienst DDR*, 27: 169-175 (cited in *Rev. Appl. Entomol.*, Ser. A, 64: p. 596).
- Meyer, R.H., 1974. Management of phytophagous and predatory mites in Illinois orchards. *Environ. Entomol.*, 3: 333-340.
- Sanford, K.H., 1967. The influence of spray programs on the fauna of apple orchards in Nova Scotia. XVII. Effects on some predacious mites. *Can. Entomol.*, 99: 197-201.
- Schruft, G. and Oesterrich, M., 1973. Versuebe zur Analyse von Nebenwirkungen der Fungicide Folpet und Mancozeb auf die Populationsdichte der Obstbaumspeinnmilbe *Panonychus ulmi* Koch (Tetranychidae:Acari) and Reben (*Vitis vinifera*). *Z. Angew. Entomol. Sut.*, 73: 181-196 (cited in *Rev. Appl. Entomol.*, Ser. A, 63: p. 918).
- Sørum, O. and Gjaerum, H.B., 1973. Kan sopp-og middbekjempelse pa frukttraer kombineres. *Gartneryrket*, 63: 416-417.
- Steel R.G.D. and Torrie, J.H., 1980. *Principles and Procedures of Statistics* (2nd edition). McGraw-Hill, New York.
- Stenseth, C., 1979. Viskning av sopp-og skadedyrmidler pa en stamme av rovmidden *Phytoseiulus persimilis* Athias-Henriot resistent mot organiske fosforforbindelser (Acarina:Phytoseiidae) *Forsk. Fors. Landbruket*, 30: 77-83 (cited in *Biocontrol New Inf.*, 2: 343).