RESEARCH NOTE

Laboratory Evaluation of Toxicity of Registered Pesticides to Adult *Amblyseius addoensis* (Van der Merwe & Ryke) (Acari: Phytoseiidae)

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The toxicity of 23 registered vineyard pesticides to the predaceous mite, *Amblyseius addoensis* (Van der Merwe & Ryke), were examined in the laboratory to obtain information on how to protect this important natural enemy of *Tetranychus urticae* Koch in an integrated pest-management programme. Methods of handling and testing the mites are described. Test results on adult *A. addoensis* are presented. The majority of the insecticides and acaricides were highly toxic, with the fungicides being neutral to moderate in effect. It is recommended that pesticides with a high toxic rating be subjected to field testing before final decisions are made.

The spider mite *Tetranychus urticae* Koch is an important pest affecting table grapes in the Hex River Valley, Western Cape. The mite gained prominence following the intensive use of broad-spectrum insecticides for the control of other key pests, a process which proved to be detrimental to the predaceous mite, *Amblyseius addoensis* (Van der Merwe & Ryke) (Schwartz, 1990a). A large number of chemicals is currently registered for the control of various pests and diseases attacking table grapes and it is possible that some of these can also be disruptive to the predaceous mite. *A. addoensis* was selected as test organism for the present study since it is the most numerous of all the phytoseiids found on table grapes and the principal predator of *T. urticae*. Other factors favouring *A. addoensis* as a general test arthropod are: it is ever-present on vines in the Western Cape; it is omnivorous and it does not possess the mobility for rapid dispersal found in other natural enemies, i.e. Coccinellidae and Hymenoptera.

With the table grape industry set on developing and implementing an integrated pest-management programme (IPM), it is imperative that all registered pesticides be evaluated for their effect on the important natural enemies found in table grape vineyards. The ultimate goal of such a screening programme is to find selective chemicals that can safely be incorporated into a future integrated pest-management scheme.

MATERIALS AND METHODS

Adult *A. addoensis* were collected from mature leaves obtained from an unsprayed Riesling vineyard. The majority of the adult mites used in the tests were female. Discs (20 mm diameter) pressed from vine leaves were used as substrate of confinement for the mites; they were floated (with ventral side up) on water in a petri dish. Each disc was secured by means of a pin pressed into plasticine which was attached to the bottom of the petri dish (Fig. 1).

A mixture of each chemical was prepared with water at the registered concentration and a sticker-spreader (0,03% poly-p-menthene) added. The chemicals comprised insecticides, fungicides and acaricides as listed in Table 1. Vine leaves collected from the unsprayed Riesling vineyard were immersed in the mixture for 5 seconds and allowed to dry. In the case of dust treatments, viz. fenthion, iprodione and sulphur, Riesling shoots in the vineyard were dusted according to recommendations with the aid of a small hand applicator. Discs were pressed from these leaves and floated as described. Five to ten adults of *A. addoensis* were transferred to each disc by means of a sable hair brush and kept at a constant temperature of ca. 25°C. An assessment of mortality was made 24 hours after mite transfers. Four replicates per treatment and an untreated control were used, with some tests being repeated once or twice. In the end the number of replications ranged from 4 to 12, which provided variable numbers of mites per treatment. Invariably mites were lost through straying into the water barrier, but these were disregarded. Only mites able to walk when touched with a fine hair brush were recorded as alive. Abbott's formula was applied to compute percentage mortality. Chemicals were rated highly toxic if more than 50 per cent of the predators were killed, but considered lightly toxic if mortality was below 10 per cent. A medium toxicity rating was given if 11 to 50 per cent of the predators were killed.

RESULTS AND DISCUSSION

Table 1 shows the mortality of *A. addoensis* adults after 24 hours. According to the ratings all insecticides, with the exception of dichlorvos, were highly toxic to the predaceous mite. These included the organophosphates, carbaryl and endosulfan and this result is in agreement with the results obained by Bartlett (1964) for *A. hibisci* (Chant). The low rating recorded for dichlorvos is encouraging since it is recommended as an emergency treatment for the control of vine mealy bug [*Planococcus ficus* (Signoret)]. Fenthion dust, which was highly toxic and is widely used

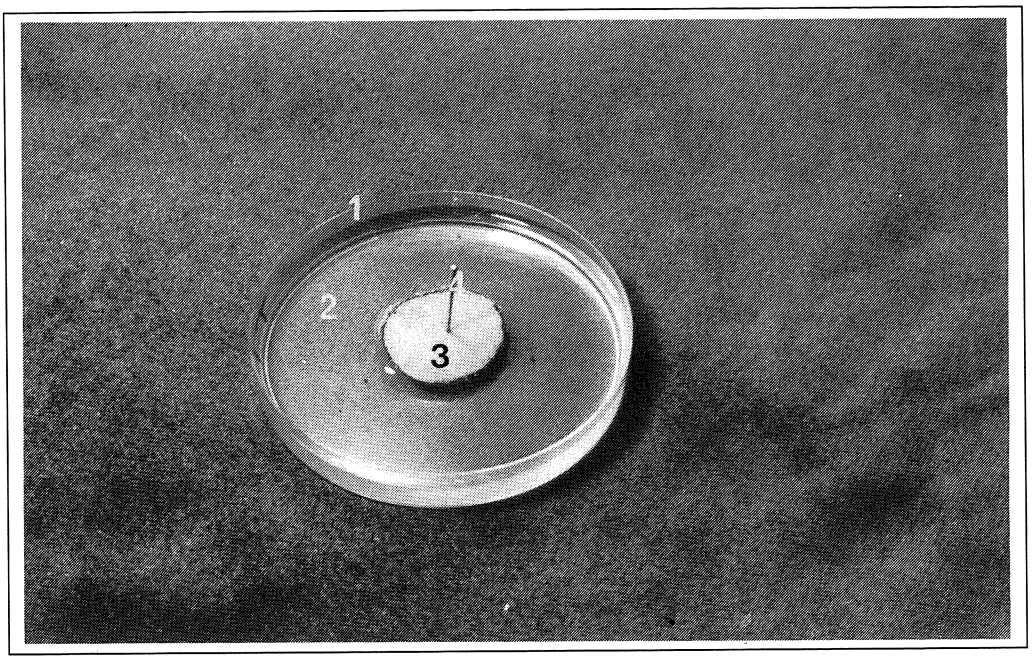

FIGURE 1

Method for evaluating plant protection chemicals on the predaceous mite, *Amblyseius addoensis* Van der Merwe Ryke, in the laboratory: 1 = petri dish; 2 = water; 3 = leaf disc; 4 = pin.

TABLE 1

The toxicity of registered pesticides to adult *Amblyseius addoensis* in laboratory tests.

Chemical	Concentration/ 100 l water[a]	Number of test mites	Mortality	
			%	Rating
INSECTICIDES				
dichlorvos	75 ml	44 (34)[b]	2,3	Light
chlorpyrifos	200 ml	59 (66)	98,2	High
prothiofos	50 ml	90 (86)	100	High
dimethoate	125 ml	35 (45)	100	High
fenthion	dust	20 (21)	100	High
permethrin	15 ml	78 (87)	94,7	High
carbaryl	125 g	37 (28)	100	High
endosulfan	100 g	19 (19)	100	High
methidation	100 g	16 (52)	100	High
ACARICIDES				
propargite	100 ml	43 (40)	13,9	Medium
bromopropylate	50 ml	75 (55)	93,3	High
propoxur	250 ml	26 (21)	100	High
FUNGICIDES				
sulphur	dust	19 (20)	0	Light
triadimenol	25 ml	21 (19)	0	Light
nuarimol	15 ml	23 (20)	0	Light
myclobutanil	20 ml	17 (19)	0	Light
mancozeb	200 g	72 (79)	7,0	Light
copper oxychloride	500 g	20 (20)	0	Light
hexaconazole	20 ml	27 (23)	0	Light
procymidone	200ml	27 (40)	0	Light
iprodione	200 ml	41 (40)	0	Light
iprodione	dust	38 (40)	0,1	Light
pirifenoks	12 ml	60 (69)	15,4	Medium

a = registered concentrations.
b = untreated control.

against fruit fly prior to picking, can, however, be substituted by regular baiting during the summer months as described by Schwartz (1990b).

Of the acaricides bromopropylate and propoxur were highly toxic and propargite moderately toxic. Bromopropylate and propargite were tested on *A. fallacis* (Garman) in the laboratory and similar results recorded (Streibert, 1981). Both bromopropylate and propoxur are registered for bud mite (*Columerus vitis* Pgst.) control on vines; it is therefore important that research be directed towards finding a selective chemical that would be less damaging to *A. addoensis*.

In general, the fungicides tested were safe for *A. addoensis* with the exception of pirifenoks which reacted moderately (Table 1). The results for sulphur dust are especially encouraging as it is traditionally widely utilised for its fungicidal, insecticidal and acaricidal properties.

The fact that some of the pesticides were highly toxic to the predaceous mite should not necessarily indicate an outright condemnation of such, as the described laboratory evaluation method is extremely stringent. Since spray coverage in the field is never complete, it is expected that predaceous mites will be able to survive in safe niches on the vine. It therefore remains a priority to test chemicals with a high laboratory rating under field conditions.

CONCLUSIONS

This study has provided some answers concerning chemicals most likely to be useful in an IPM programme designed to protect *A. addoensis*. The salient finding was that the insecticides and acaricides on the whole were far more damaging to *A. addoensis* than the fungicides. It follows that research should urgently be directed towards finding selective chemicals; in the interim alternative methods, i.e. biological and others, should be utilised to the full for key pests such as *P. ficus, C. vitis* and *Phlyctinus callosus* Boheman. Chemicals with a high toxic rating in the laboratory should also be tested in the field.

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