SYNERGISM AND ANTAGONISM OF MIXING SOME ACARICIDES WITH JOJOBA OIL FOR CONTROL OF SPIDER MITE(ACARI: TETRANYCHIDAE) IN EGYPT

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Abstract

In an attempt to reduce the dose of acaricides used for control of the two-spotted spider mite, *T. arabicus* Attiah, the toxicity of some acaricides as well as their joint action with jojoba oil against the mite adult females were investigated. Ortus was the most toxic material among the three tested chemical acaricides followed by M-Pede then Biomite. Only one mixture (M-Pede $LC_{27.5}$ + Jojoba oil LC_{25}) produced a high level of synergism, while all other concentrations of the different acaricides with the LC_{25} of jojoba oil showed additive effects.

Introduction

In order to reduce pesticide hazards and development of resistant populations, pest control should be accomplished with fewer applications at far lower doses. This cannot be fulfilled unless the action of the pesticides is complemented by other chemicals not detrimental to the environment by being highly biodegradable in nature and also give satisfactory control to the target pests (Abdel-Sattar, 1981). Several works were done to study the joint action of different pesticide mixtures against various economic pests, of which El-Guindy *et al*., 1982 and Abdel-Sattar and El-Guindy, 1988 on the pink bollworm; Farrag and Nasr, 1995 on the cotton seed bug; Sawires *et al.*, 1995 on spider mite; and Moein *et al*., 1996 on termites.

Jojoba oil proved to be an effective natural product for control of the two-spotted spider mite *Tetranychus arabicus* Attiah in Egypt (El-Duweini and Sedrak, 1997). A very useful technique may be the initial application of combination of effective direct toxicants with jojoba oil and the biological effects can be predicted to be complementary. This can be achieved by mixing jojoba oil with some acaricides at relatively low doses.

The present work was undertaken to study the efficacy of some relatively new acaricides against the phytophagous mite *T. arabicus*, which is the most economically important mite species of a wide spread nature in Egypt, and the joint action of these acaricides / jojoba oil mixtures on the same pest.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:974-976 (1998)
National Cotton Council, Memphis TN

Materials and Methods

A pure culture of the two-spotted spider mite, *T. arabicus*, was maintained on detached mulberry leaves placed with the lower surface upwards on moist cotton wool pads in Petri dishes (20 cm. in diameter). Four acaricides were chosen to evaluate their toxicity to the mite adult females. These acaricides are:

- Ortus 5% EC (Fenpyroximate),
- M-Pede 49% Liquid (Potassium salts of unsaturated and saturated carboxilic acids),
- Biomite 67.59% EC (Farnesol-Nerolidol-Geraniol-Geropon Dos/PG) and
- Biofly - flowable formulation (*Beauvaria bassiana* $3X10^7$ conidia per millileter).

Twenty *T. arabicus* adult females of the same age were transferred to a mulberry leaf disc (5 cm. in diameter) for studying the toxicity of the prementioned acaricides on the two-spotted spider mite females. Four discs were placed in a Petri dish on moist cotton wool pads (each dish was considered as a replicate). The disc surfaces carrying the individuals were sprayed with the aqueous solution of each acaricide, using a manual glass atomizer. Five concentrations of each acaricide were used to determine slope, LC_{50}=s and LC_{90}=s according to Finney, 1952. The percentage of mortality was corrected by Abbott=s formula, 1925. The relative toxicities were determined according to their toxicity index as indicated by Sun, 1950.

To evaluate the joint action of jojoba oil 96% EC with the above mentioned acaricides, several concentrations of each acaricide were each mixed with the LC_{25} (739200 ppm) of jojoba oil and sprayed as indicated in the toxicity tests. The combined action of the mixtures was recorded 72 hr after treatment. The degree of potentiation was determined by estimating the co-toxicity factor (C.F.) according to Mansour *et al*., 1966 as follows:

$$\text{C.F.} = \frac{\text{observed \% mortality- expected \% mortality}}{\text{expected \% mortality}} \times 100$$

The factor was used to differentiate the results into 3 categories. A positive factor of 20 or more is considered potentiation, a negative of 20 or more meant antagonism, and intermediate value (i.e. between -20 and +20) was considered as only additive. All experiments were carried out at a room temperature of 25 " 2EC and relative humidity of 65 " 5%.

Results and Discussion

The toxicity action of the tested acaricides against *T. arabicus* adult females is presented in table 1. The results clearly show that Ortus was the most toxic compound among the three tested chemical acaricides, followed by M-Pede then Biomite. The LC_{50}=s and LC_{90}=s were 0.0186, 4431.1 & 11037 ppm and 0.1378, 25249.4 & 40090.3 ppm for the three toxicants, respectively. The micobial acaricide

(Biofly) LC_{50} and LC_{90} were 1851236.6 and 4529468.4 conidia per millileter, respectively.

The effect of interaction of jojoba oil (LC_{25}) and different concentrations of the tested acaricides is shown in table 2. Only the mixture M-Pede $LC_{27.5}$ /Jojoba oil LC_{25} produced a high level of synergism (potentiation), with a co-toxicity factor of +42.86. All other mixtures showed additive effects ranging from +18.81 for the mixture with Biofly $LC_{42.5}$ to -12.82 for the mixture with Biofly $LC_{27.5.}$

These results agree with those of El-Guindy *et al*. (1982) which revealed that out of 45 mitures of insecticides tested on the pink bollworm larvae, only three proved to be synergistic, and with those of Abdel-Sattar and El-Guindy (1988) which revealed also that out of 18 insect growth regulator/pyrethroid mixtures tested on the same pest, only one proved synergistic.

On the other hand, Farrag and Nasr (1992) studying the joint action of *B. t.* and chemical insecticide combinations on cotton seed bug, stated that the degree of antagonism varied considerably, and Moein *et al*. (1996) found that *B.t.*/fenvalerate combinations produced antagonistic effects against two species of non-subterranean termites. Sawires *et al*. (1995) studying the efficacy of 12 binary mixtures (plant extracts/acaricides) against the two-spotted spider mite, stated that synergism was found in most cases but the magnitude was not high in some cases.

More research is needed in this field to slow down the rapid development of resistance in pest populations and reduce the contamination of the environment.

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Table 1. Toxicity of acaricides on the adult females of *T. arabicus* Attiah.

Acaricides	LC_{50}	LC_{90}	Slope	Toxicity index
Ortus	0.0186ppm	0.1378ppm	1.4730	100
M-Pede	4431.1ppm	25249.4ppm	1.6937	0.00042
Biomite	11037.9ppm	40090.3ppm	2.2851	0.00017
Biofly	1851236.6 Conidia/ml	4529468.4 Conidia/ml	3.2940	____

Table 2. The joint action of acaricide/jojoba oil mixtures on the adult females of *T. arabicus* Attiah.

Acaricide/ LC_{25} Jojoba oil mixtures	Concentration	Expected %mortality	Observed %mortality	Cotoxicity factor
Ortus (ppm)	0.015	40+25= 65	75	+15.38
	0.030	70+25= 95	85	- 10.53
	0.625	75+25= 100	97.5	- 2.53
M-Pede (ppm)	2450	27.5+25= 52.5	75	+42.86
	4900	60+25= 85.0	100	+17.64
	9800	75+25= 100	100	0.00
	19600	82.5+25=107.5	100	- 6.98
Biomite (ppm)	3379.5	12.5+25= 37.5	40	6.66
	6759	27.5+25= 52.5	52.5	0.00
	13518	60+25= 85	75	- 11.76
Biofly (Conidia/ml)	1500000	37.5+25= 62.5	72.5	+16.00
	1800000	42.5+25= 67.5	80	+18.52
	2100000	52.5+25= 77.5	82	5.81
	2400000	72.5+25= 97.5	85	- 12.82