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Cross resistace of a bromopropylate resistant strain of *Tetranychus urticae* (Acari: Tetranychidae)

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Abstract

A bromopropylate resistant strain (R) of *Tetranychus urticae* Koch showed strong positive cross resistance to Dicofol and a mixture of Dicofol and Tetradifon (Neotox Super), moderate positive cross resistance to Amitraz and low negative cross resistance to Chlorpyrifos. No cross resistance has been observed to Abamectin ,Dinobuton or Triazophos. These results suggest that Dicofol, Neotox Super, and Amitraz should not be rotated with Bromopropylate in a resistance management program, and that the use of Chlorpyrifos in such a program will reduce Bromopropylate resistance in two spotted spider mite population, restoring the activity of this pesticide.

Introduction

Two-spotted spider mite, *Tetranychus urticae* Koch, is considered one of the major pests on different crops in Iraq (AL-Jboory 1987). This mite is under very strong pesticides selection pressure, which leads to the appearance of resistance (Georghiou and Lagunes-Tejeda 1991). Mite resistance seems to be one of the main problem of plant protection may be related to mite high reproduction rate, short life cycle, high genetic plasticity and usually high exposure of all mite stages to pesticide applications (Acaricides and Insecticides) (Cranham and Helle 1985; AL-Jboory 1987; Tanigoshi and Babcock 1990).

Bromopropylate (Neoron 500 EC – Syngenta) is one of the widely used acaricides in Iraq. This product is effective on different mite species due to its physiological selectivity to those organisms and low toxicity to natural enemies (Sechser 1988).

Cross-resistance involving Bromopropylate has been rarely evaluated, but cross resistance between Bromopropylate and Dicofol was observed in Japan and Australia when the effectiveness of Bromopropylate failed to control Dicofol resistant mite (Unwin 1973; Mizukoshi 1989).

This research was conducted in order to determine possible cross-resitance of a Bromopropylate resitant strain of two spotted spider mite to other acaricides.

Materials and Methods

This investigation was carried out in the College of Agriculture, University of Baghdad in 2001. Pesticides used were Bromopropylate, Abamectin, Chlorpyrifos, Dicofol, Dicofol + Tetradifon, Amitraz, Triazophos, and Dinobuton.

A susceptible strain (S) was compared to a resistant strain (R) of two spotted spider mite according to the procedure that used by Fergusson-Kolmes *et al.* (1991). The resistant strain was additionally exposed to selection pressure by using the discriminating concentration of 25mg/L. These mites were reared and treated on kidney bean, *Phaseolus vulgaris*, under laboratory conditions (photophase 16:8 (light: dark), 22±2°C and 60%± 10 RH). The plants were sprayed to the run off stage by using hand sprayer. Seven applications were conducted between June 17th – March 27th, 2001.

Leaf disk dip method has been used to evaluate the susceptibility of mites by using three different concentrations for each pesticide: 10, 100 and 1000 mg/L, except Abamectin, used at 0.4, 0.1, and 1 mg\L. Three replicates each consisting of 20 females were used. The results were analyzed statistically by using confidence limits for percentage mortality (± standard error).

Results and Discussions

No significant differences were observed between Bromopropylate susceptible (S) and resistant (R) strains exposed to Abamectin, Dinobuton and Triazophos (Figs. 1-3), whereas significant differences were observed when the mite was exposed to the other products; the resistant strain showed high positive cross resistance to Dicofol and Dicofol+ Tetradifon (Figs. 4 and 5), medium positive cross-resistance to Amitraz (Fig. 6) and low negative cross- resistance to Chlorpyrfos (Fig. 7). Cross- resistance conferred by Bromopropylate to Dicofol and Dicofol+ Tetradifon was expected, because of the similarity in chemical structures of those compounds. However, it was not expected in relation to Amitraz or Chlorpyrifos, because of the different chemical structures of these pesticides which do not give significant indication for the nature of the metabolic pathway used and it is possible that monooxygenase caused loss of toxicity for Bromopropylate (unpublished data) which resulted in an increase of oxidation for Chlorpyrifos to a nerve analogue which is more toxic because of replacing an oxygen instead of sulfur in its structure (Corbett 1974).

Results of this study indicated important concepts in relation to bromopropylate resistance management in populations of *T. urticae.* 1) Not to include Dicofol or mixture of Dicofol + Tetradifon or Amitraz in any program designed for management of resistance to these pesticides. 2) Using Chlorpyrifos after Bromopropylate in an IPM program for controlling other pests may

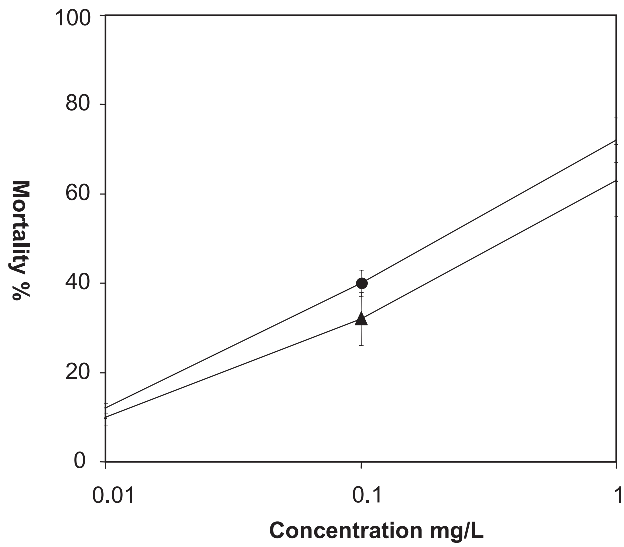

Figure 1. Response to Abamectin in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) strains to Bromopropylate.
- Lines represent percentage mortality (±SEM)

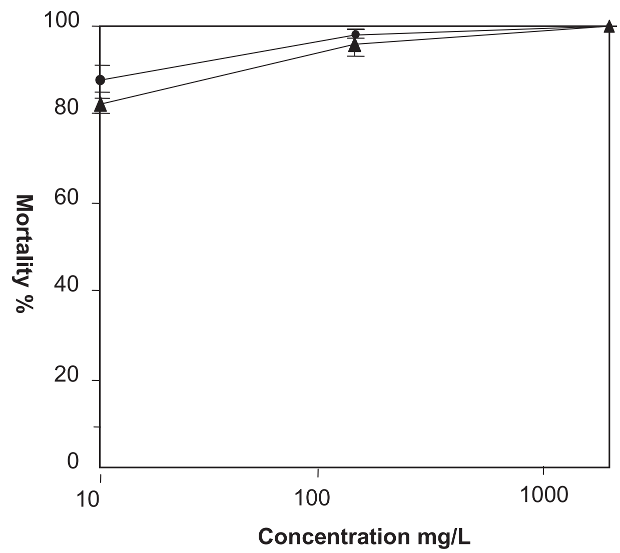

Figure 2. Response to Dinobuton in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM

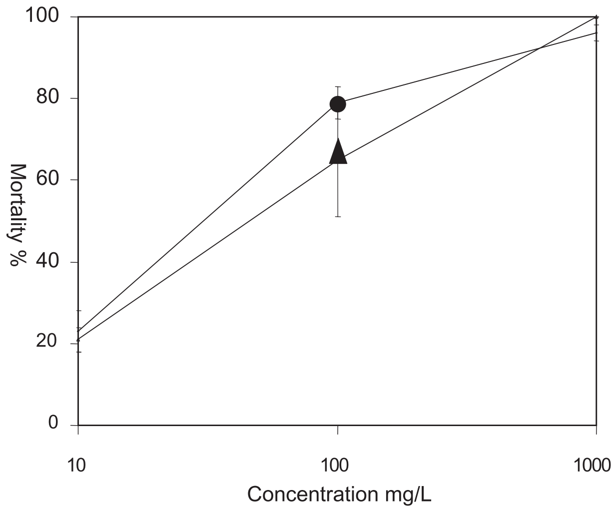

Figure 3. Response to Triazophos in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM)

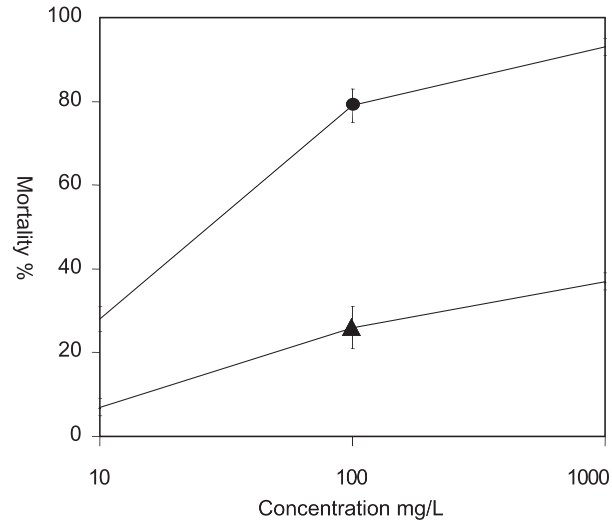

Figure 4. Response to Dicofol in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM)

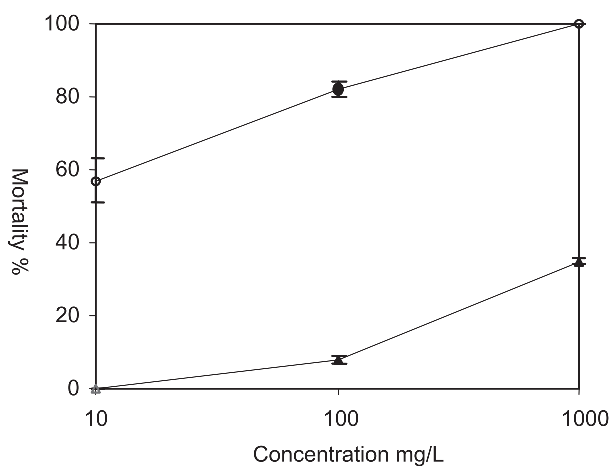

Figure 5. Response to Dicofol + Tetradifon in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM)

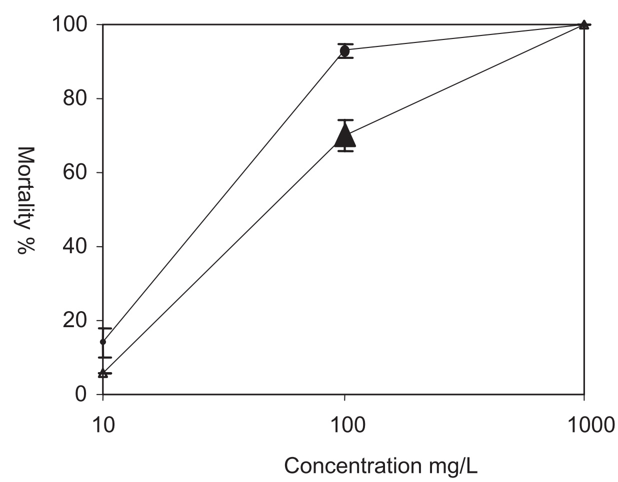

Figure 6. Response to Amitraz in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM)

cause negative selection, which results in reducing the resistance gene frequency of two spotted spider mite strains to Bromopropylate, and might increase its efficacy. 3) The rotation between Abamectin, Dinobuton and Bromopropylate could help maintain the adequate performance of of those acaricides.

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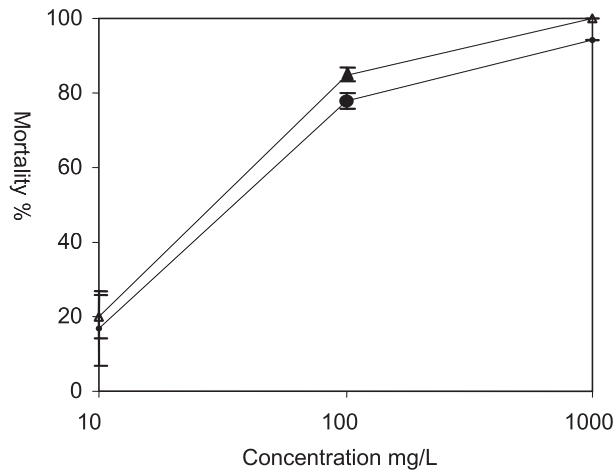

Figure 7. Response to Chlorpyrifos in the two spotted spider mite Tetranychus urticae Koch susceptible (•) and resistant (Δ) to Bromopropylate.
- Lines represent percentage mortality (±SEM)

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