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Mite control in orange fruit after spraying acaricides in mixture with leaf fertilizers

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Summary

Citriculture is one of the most important activities in Brazil, the largest producer in the world. Nevertheless, faces many difficulties in the management of phytosanitary treatment due to the diversity of diseases and pests. The *Brevipalpus phoenicis* (Geijskes) (Acari: Tenuipalpidae) mite is a major pest of citrus crops, because it is the virus vector (Citrus leprosis virus - CiLV) that causes citrus leprosis disease. The principal practice used in their management is based on acaricide applications for vector control, so the use of techniques more accurate and precise in controlling this pest plant, will reduce the cost of production and greater efficiency in the control. Therefore, this study aimed to evaluate the control of *B. phoenicis* after application of different volumes and concentrations of spray liquid mixed with foliar fertilizer.

Key words: *Brevipapus phoenicis*, acaricide concentrated spray liquid, spray liquid deposition, reduction of spray liquid, application technology of pesticide

Introduction

Brazil is the world largest producer of orange, produced about 469 million boxes with 40.8 kg on the 2011 crop (Agrinual, 2013).

In addition to economic issues and market, this sector has faced problems especially related with plant protection due to the large number of pests and diseases.

Among the diseases, highlight the citrus leprosis, considered the viral disease that has the highest economic importance to the Brazilian citriculture due to the expenses required for mite control (Locali *et al*., 2004).

The casual agent of leprosis is the CiLV Citrus Leprosis Virus and is transmitted exclusively in Brazil by the mite *Brevipapus phoenicis*, (Geijskes) (Acari Tenuipalpidae) (Kitajima *et al*., 1972). Oliveira (1986) found mites in citrus trees throughout the year, but his population peak is reached during the dry months, which corresponds to the winter months under tropical conditions. Also, according to the author, found that the occurrence of the mite occurs in greater level on the fruit. Thus, 95.2% of sampled mites are found in fruits, 4.3% in old leaves and 0.5% in young leaves. Leprosis can drastically reduce the production because lesions occasioned can result in premature leaf fall and fruit, dry branches, even kill the plants. (Rodrigues *et al*., 1995).

The application technology is a key factor for the success of the phytosanitary treatment because is based on scientific knowledge for the correct placing of pesticide on target, in sufficient quantity, cost effectively, with safety to the applicator and with minimal contamination of non-target areas. (Matuo, 1990).

The necessity for better understanding the action of acaricides on the target pest is large in order to minimize spending and maximize efficiency of acaricide treatment. The use of different acaricides mixed with foliar fertilizers is a usual practice among growers. Fenolio (2010) observed that the most foliar fertilizer used in mixtures with acaricides is manganese chloride. However, it should be understood that, when added foliar fertilizer is used in spray liquid, it may substantially alter the effect of acaricide on the target pest, primarily due to changes in pH in the liquid spray (Matuo & Matuo, 1995) and the possible incompatibility between the products (Houghton, 1982).

Therefore, this study aimed to evaluate the control of *B. phoenicis* after application of different volumes and concentrations of spray liquid mixed with foliar fertilizer.

Material & Methods

The experiments were conducted in May 2012 in Acarology Laboratory belonging to the Department of Plant Protection, Faculty of Agriculture and Veterinary Sciences, São Paulo State University - UNESP, Jaboticabal - SP.

A creation of *B. Phoenicis* was initiated on citrus fruits of Pera who received no spraying of pesticides. The fruits were placed in plastic trays and kept in a climatic chamber at 25 ± 1°C, RH 60 ± 5% and photoperiod of 14 h to the fruits of creation and to the fruits of the experiments.

The fruits were properly washed with running water to remove impurities, dried under the shade and partially paraffined, leaving an area without paraffin approximately 2.5 cm in diameter, called "arena", which is the place to transfer the mites. This arena was circled with adhesive barrier (tatoo glue®) to stop migration the mites to outside of treated area (Chiavegato *et al*., 1993). The spraying in the arena was done with a Potter tower, calibrated to operate at 8 lbf pol^{-2}.

The acaricide used was the propargite (Omite 720 EC BR), chemical group fenoxiciclohexil, at dose of 100 mL the cp diluted in 100 L of water.

The leaf fertilizer used was Abrafol 14, a source of manganese chloride ($MnCl_2$) which is used in several crops being recommended dosage of 1–2 L of cp to be diluted with 2000 L of water.

Two experiments were conducted. At first, a solution with a concentration of 100% was sprayed in the following volumes: 0.125, 0.250, 0.500 and 1.000 mL. In the second, the smaller volume (0.125 mL) was sprayed at the following concentrations: 100, 150, 200, 300 and 400%.

After application, the spray liquid was dried, and 10 mites were transferred to the arena of each fruit. The evaluations occurred 1–15 days after application with counting of dead mites in the arena and on the adhesive barrier.

The experimental design used was the completely randomized with 18 treatments and control, seven replicates. The data were transformed into ln (x+5), submitted by analysis of variance, F test and comparing means by Scott-Knott test at 5% significance.

Results & Discussion

It is verified that the different volumes and the medium different concentrations mostly promoted death of the mites in the adhesive barrier (Fig. 1 – right).

This fact can be justified by presenting volumes which the mites contaminate little to die in the arena or quantity to cause repellency/irritability, fact was also noted by Andrade *et al.* (2010) and Carvalho *et al.* (2012).

The acaricide application 0.125 mL of spray liquid, with or without foliar fertilizer did not differ from the control at concentrations of 100, 150 and 200%. Spray liquid without foliar fertilizer with 300% concentration did not differ from the control (Fig. 2 – left).

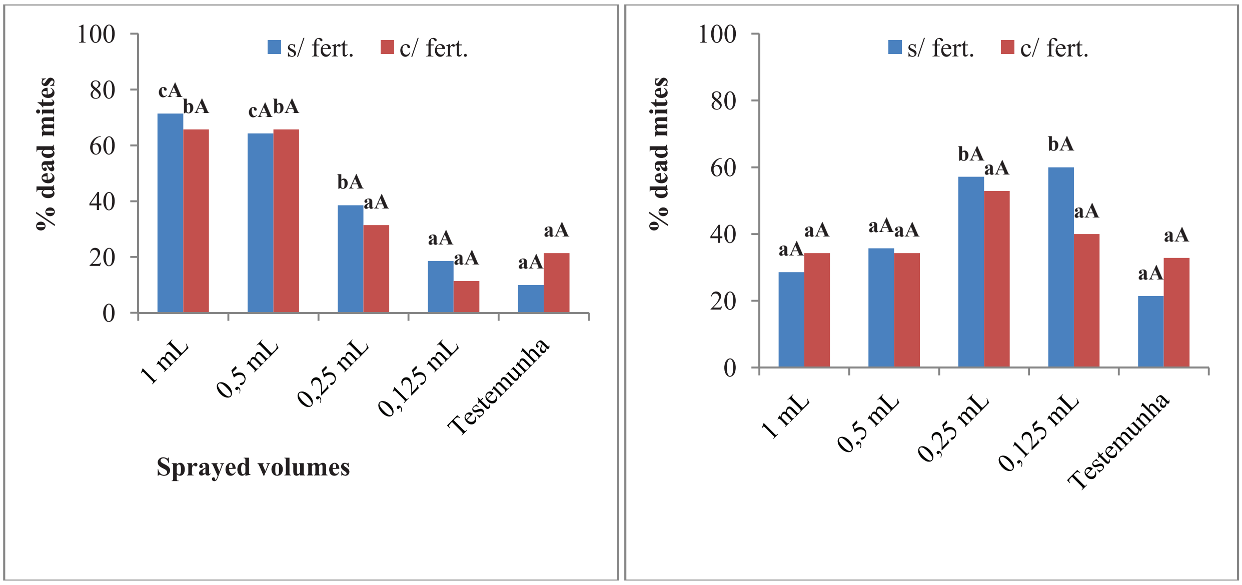

Fig. 1. Mortality of mites in the arena (left) and the adhesive barrier (right) on 15th day after applications of different volumes of pesticides applied at a concentration of 100%. Means followed by the same capital letter (with and without fertilizer) and lower case (spray volumes) do not differ by the Scott-Knott test ($P \leq 0.05$).

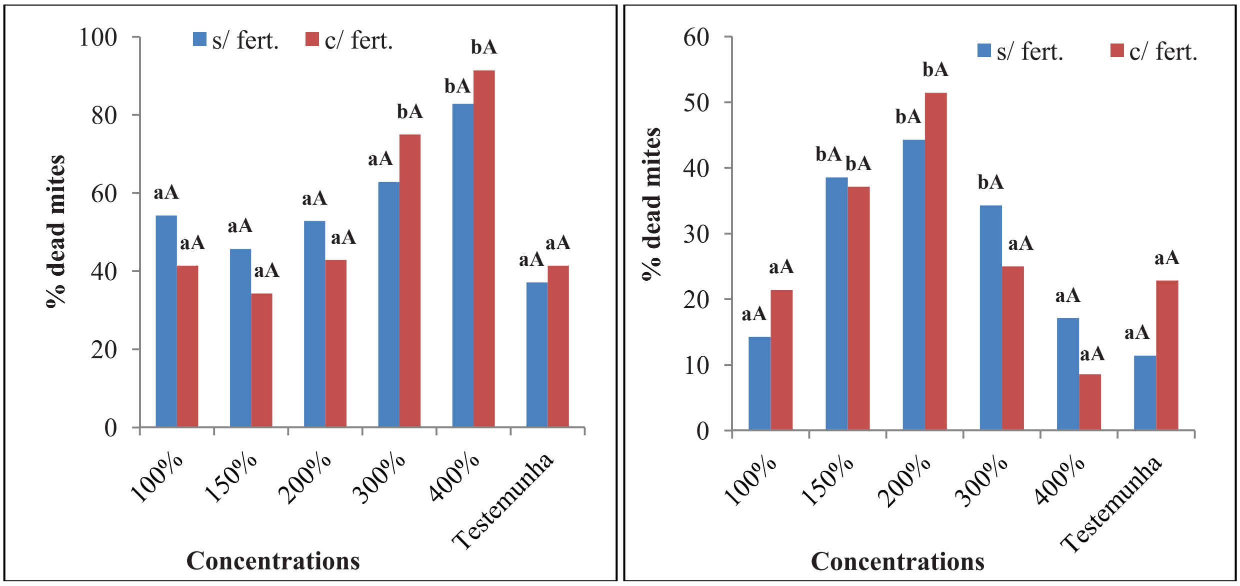

Fig. 2. Mortality of mites in the arena (left) and the adhesive barrier (right) on 15th day after application of 0.125 mL of solution at different concentrations. Means followed by the same capital letter (with and without fertilizer) and lower case (concentrations) do not differ by the Scott-Knott test ($P \leq 0.05$).

The use of 300% with fertilizer or 400% with or without fertilizer were situations that the efficiency differed significantly. No treatment promoted total death of the mites until 15 DAA. The closest was 400% with foliar fertilizer.

We also observed that double the volume application of 0.5 ml to 1 mL at 100% concentration of the acaricide dose, little or not improved the control (maximum 71%). However, when the concentration was doubled from 200% to 400%, it can be said that the control doubled from 53% to 82% (no fertilizer) and 42–91% (with fertilizer).

The manganese chloride when dissolved in water produces an acidic solution. This change in pH of the syrup may or may not alter the effectiveness depending on which is the product mixture.

Within each volume applied or each concentration applied, in both the evaluation in the arena, as the adhesive barrier, there was no significant difference between the spray liquid and the spray liquid + leaf fertilizer (Figs 1 and 2).

Fenolio (2010) observed change of pH when added leaf fertilizer in acaricide spray liquid and caused decreased efficiency. Prado *et al.* (2011) attributed this to high concentrations of H^+ or OH^- that can react and not make available the active ingredient. However, Andrade (1997) observed that the hexithiazox, dicofol and fenbutatin oxide sprayed at pH 3, 6 and 9 did not affected their effectiveness.

Smaller volumes are better retained in the target and dose adjustment can be done by the concentration of acaricide.

The addition of manganese chloride in acaricide spray liquid with Omite EC 750 did not affect the mite control of *Brevipapus phoenicis*.

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References

Agrianual. 2013. *Anuário da agricultura brasileira. Citros-laranja*. São Paulo: FNP Consultoria & Comércio. 458 pp.

Andrade T L C. 1997. *Ação acaricida do hexythiazox, dicofol e óxido de fenbutatin, em três níveis de pH da calda*. 71f. Dissertação (Mestrado em Agronomia) - Faculdade de Ciências Agrárias e Veterinárias de Jaboticabal, Universidade Estadual Paulista, Jaboticabal.

Andrade D J, Ferreira M C, Santos N C. 2010. Efeito da adição de óleos ao acaricida cyhexatin sobre o ácaro Brevipalpus phoenicis e na retenção de calda por folhas de citros. *Revista Brasileira de Fruticultura* **32**(4):1055–1063.

Carvalho G F G, Ferreira M C, Lorençon J R. 2012. Efeito da aplicação de acaricida para controle de *Brevipalpus phoenicis* realzada com pulverizador envolvente. *Anais do ll Simposio sobre Fitossanidade em Citros*, Jaboticabal.

Chiavegato L G, Kharfan P R. 1993. Comportamento do ácaro da leprose Brevipalpus phoenicis G.(Acari: Tenuipalpidae) em citros. *Anais da Sociedade Entomológica do Brasil, Londrina* **22**(2)355–359.

Fenólio L G. 2010. *Efeito de diferentes águas e fertilizantes foliares em caldas acaricidas no controle do ácaro,* Brevipalpus phoenicis *(Geijskes, 1939) (Acari: Tenuipalpidae) em citros*. 69f. Dissertação (Mestrado em Produção Vegetal) – Faculdade de Ciências Agrárias e Veterinárias, Universidade Estadual Paulista, Jaboticabal.

Houghton R D. 1982. Pesticide compatibility: an overview from technical services. *ASTM Special Technical Publication, Philadelphia* **764**:3–10.

Locali E C, Freitas-Astúa J, Machado M A. 2004. Leprose-dos-citros: biologia e diagnóstico do vírus. *Laranja, Cordeirópolis* **25**(1)53–68.

Matuo T. 1990. *Técnicas de aplicação de defensivos agrícolas*. Jaboticabal: FUNEP. 140 pp.

Matuo T K, Matuo T. 1995. Efeito da pressurização com CO2 sobre o pH da água. *Planta Daninha, Botucatu* **13**(1).

Oliveira C A L 1986. Flutuação populacional e medidas de controle do ácaro da leprose *Brevipalpus phoenicis* (Geijskes,1939) em citros. *Laranja, Cordeirópolis* **7**:1–31.

Prado E P, Araújo D, Raetano C G, Dal Pogetto M H F A, Aguiar-Júnior H O, Christovam R S. 2011. Influência da dureza e potencial hidrogeniônico da calda de pulverização sobre o controle do ácaro-da-leprose em frutos de laranja doce. *Bragantia, Campinas* **70**(2):389–396.

Rodrigues J C V, Nogueira N de L, Prates H S. 1995. Leprose dos citros: importância, histórico, distribuição e relações com o ácaro vetor. *Laranja, Cordeirópolis* 15(2)123–138.