Efficacy of different treatments against the brown snail, *Helix aspersa* Müller on *Citrus* in South Africa

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Fruits, vol. 47, n°6, p. 657-660.

ABSTRACT - 2 snail species are particularly of economic importance in the *Citrus* producing areas of the eastern Cape Province, namely the brown snail, *Helix aspersa* Müller and the dune snail, *Theba pisana* Müller. These snails can cause extensive damage to *Citrus* leaves and twigs, small green fruits and mature fruits. 10 treatments for the control of *H. aspersa* on *Citrus* were evaluated in a grapefruit orchard at the ITSC Addo Research Station. Each treatment was applied to 10 randomly chosen trees. The treatments included: 1) an untreated control, 2) copper strip around the stem, 3) copper sulphate 990 g/kg WP at 500 g / 10 l water, 4) copper sulphate 990 g/kg WP at 1 kg / 10 l water, 5) Metaldehyde 40 g/l RB was applied around the stem, 6) a strip of Metaldehyde 40 g/l RB was applied on a tile next to the tree, 7) Methiocarb 20 g/kg GB at 20 g per tree sprinkled around the stem, 8) Methiocarb 800 g/kg WP at 167 g / 10 l water, 9) copper oxychloride 850 g/kg WP at 500 g / 10 l water and 10) Chlordane 600 g/l EC at 200 ml / 10 l water. Treatment n°s 3, 4, 8, 9 and 10 were applied by using 300 ml spray mixture per tree. The copper strip around the stem was the only treatment which reduced snails to an average of less than 2 snails per tree after 29 weeks. The copper strip can be recommended as a long-term solution against *H. aspersa* on *Citrus* in South Africa.

Efficacité de différents traitements contre l'escargot brun, *Helix aspersa* Müller, ravageur des agrumes en Afrique du Sud.

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RESUME - 2 espèces d'escargots présentent une incidence économique importante en vergers d'agrumes dans la région du Cap, en Afrique du Sud. Il s'agit de l'escargot brun *Helix aspersa* Müller et de l'escargot des dunes *Theba pisana* Müller. Ces 2 escargots s'attaquent aux feuilles, aux rameaux ainsi qu'aux fruits d'agrumes encore verts ou ayant atteint leur maturité. 10 traitements différents ont été testés dans un verger de pomelos de la station de l'ITSC à Addo. Chaque traitement a été appliqué sur 10 arbres choisis au hasard. Ces 10 traitements ont été les suivants : 1) témoin non traité, 2) anneau de cuivre autour du tronc, 3) sulfate de cuivre 990 g/kg en poudre mouillable à raison de 500 g / 10 l d'eau, 4) identique à 3 mais à raison de 1 kg de poudre mouillable / 10 l d'eau, 5) metaldehyde 40 g/l appliqué autour du tronc, 6) metaldehyde 40 g/l appliqué en appât sur une tuile près du tronc, 7) methiocarb 20 g/kg appliqué à raison de 20 g par arbre autour du tronc, 8) methiocarb 800 g/kg en poudre mouillable à raison de 167 g / 10 l d'eau, 9) oxychlorure de cuivre 850 g/l en poudre mouillable à raison de 500 g / 10 l d'eau, 10) chlordane 600 g/l à raison de 200 ml / 10 l d'eau. Les traitements 3, 4, 8, 9 et 10 ont été appliqués à raison de 300 ml de bouillie par arbre. L'anneau de cuivre autour du tronc a été le seul traitement capable de réduire les pullulations d'escargots à moins de 2 individus par arbre au bout de 29 semaines. Cette technique peut donc être recommandée comme une solution de longue durée pour le controle de *H. aspersa*, en Afrique du Sud.

KEYWORDS: South Africa, *Citrus*, grapefruits, snails, *Helix aspersa*, pest control.

MOTS CLES : Afrique du Sud, *Citrus*, pomelo, escargot, *Helix aspersa*, lutte antiravageur.

Introduction

2 snail species are particularly of economic importance in the *Citrus* producing areas of the eastern Cape Province, namely the brown snail, *Helix aspersa* Müller and the dune snail, *Theba pisana* Müller (BEDFORD, 1978; ANON., 1986). *H. aspersa* is a pest in many parts of the world and occurs on a wide range of crops, including *Citrus* orchards in California where it is the most important snail pest (BEDFORD, 1978; FISHER and ORTH, 1985; DE VILLIERS *et al.* 1987). About 1854, *H. aspersa* was introduced from Europe to southern Africa (BEDFORD, 1978). Both species occasionally occur in pest proportions in the eastern Cape *Citrus* orchards. Up to 200 snails per *Citrus* tree were observed during one season at the ITSC Addo Research Station (ANON., 1986). These snails can cause extensive damage to *Citrus* leaves and twigs, small green fruit and mature fruit. They feed on the rind of fruit, leaves and twigs and leave slime trails. The predatory snail, *Natalina caffra* is distributed in the wetter eastern coastal parts of southern Africa and probably contributes to the biological control of these snails (HERBERT, 1991).

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In *Citrus* orchards in California copper strips are used as snail barriers. Snails do not cross strips placed around tree trunks (KARLIK, 1988). The predatory snail, *Rumina decollata* L. is also used in California for biological control of *H. aspersa* (FISHER and ORTH, 1985). The aim of this study was to evaluate the efficacy of 10 treatments for the control of *H. aspersa* on *Citrus* in South Africa.

Materials and Methods

The trial was carried out in a grapefruit, *Citrus paradisi* Macf., orchard situated at the ITSC Addo Research Station (33°34'S, 25°42'E) in the eastern Cape Province. The trees were 12 years old and cultivated under micro irrigation. The trees were pruned to knee-height and weeds were removed under the drip area of the tree to eliminate all access to the tree except via the stem. This is a standard practice in South African *Citrus* orchards for ant control (BRINK, 1990). All snails were removed by hand from the trees prior to treatments. The experimental period commenced on 9 November when the treatments began. Each treatment was applied to 10 randomly chosen trees. The following ten treatments were used:

1) Untreated control.
2) Copper strip, 0.127 mm thick and 50 mm wide were used. The bottom 20 mm were cut into strips and bent horizontally. The copper strips were placed around the stem 500 mm from the ground and fastened with a paperclip.
3) Copper sulphate 990 g / kg WP at 500 g /10 l water.
4) Copper sulphate 990 g / kg WP at 1 kg / 10 l water.
5) Metaldehyde (Celamerck) 40 g / l RB, a 15 mm strip was applied around the stem 500 mm from the ground.
6) Metaldehyde (Celamerck) 40 g / l RB, a 15 mm wide and 150 mm long strip was applied on a tile next to the tree.
7) Methiocarb 20 g / kg GB at 20 g per tree. The pellets were sprinkled around the stem.
8) Methiocarb 800 g / kg WP at 167 g / 10 l water.
9) Copper oxychloride 850 g / kg WP at 500 g / 10 l water.
10) Chlordane 600 g / l EC at 200 ml / 10 l water.

Treatment n°s 3, 4, 8, 9 and 10 were applied using 300 ml spray mixture per tree. The spray mixtures were applied by knapsack sprayer on the stem 500 mm above ground level. For 2 consecutive weeks (11 November and 20 November) 20 *H. aspersa* snails were released at a distance of 0.5 m from each treated tree. Snails were counted each week (except 9, 11 and 12 weeks after application) until 29 weeks after application. The number of live snails on the branches and stem above the barrier or pesticide were annotated. 5 snails per tree were considered as the economic threshold and counts were discontinued as soon as the average number of snails exceeded the threshold (except for the control).

A randomized experimental design was used and the results were assessed by non-parametric Friedman analysis (P=0.05). Data were analyzed at 4, 7, 14, 21 and 29 weeks after application.

Results and discussion

4 weeks after application, the mean number of *H. aspersa* in the control differed significantly from treatment n°s 2, 3, and 4 (figure 1). The mean number of *H. aspersa* in the control differed significantly from treatment n°s 2, 3, 4 and 5, 7 weeks after application (figure 2). Counts of treatment n°s 5, 6, 7, 9 and 10 were discontinued after 7 weeks. 14 weeks after application, the mean number of *H. aspersa* in the control differed significantly from treatment n°s 2, 3, and 4 (figure 3). Treatment n° 8 did not differ significantly from the control (figure 3). Counts of treatment n° 8 were discontinued after 8 weeks. The mean number of *H. aspersa* in the control differed significantly from treatment n°s 2, 3, and 4, 21 weeks after application (figure 4). 29 weeks after application, the mean number of *H. aspersa* in the control differed significantly from treatment n°s 2 and 4 (figure 5). Treatments n°s 2 and 4 were not significantly different.

The best results were obtained with the copper strip (treatment n° 2) and copper sulphate with 1 kg / 10 l water (treatment n° 4). The copper strip around the stem was the only treatment which reduced the numbers to an average of less than 2 snails per tree after 29 weeks (figure 6). This treatment was still effective 12 months after application. The copper strip is cheap and environment-friendly and therefore can be recommended as a long-term solution against *H. aspersa* on *Citrus* in South Africa.

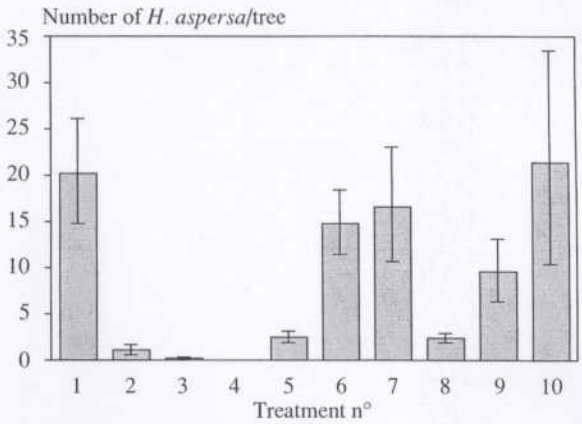

Figure 1. Mean (± SE) number of H. aspersa *per tree of the 10 treatments, 4 weeks after application.*

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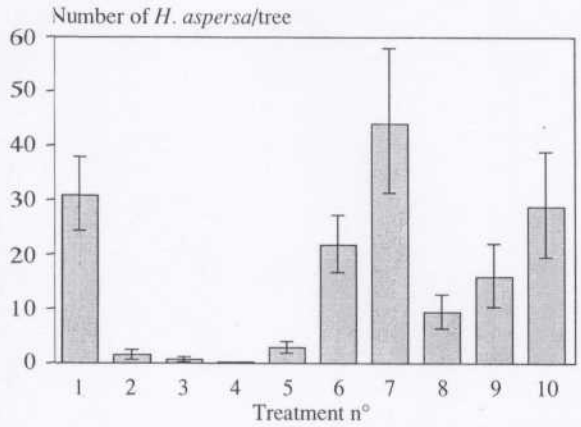

Figure 2. Mean (± SE) number of H. aspersa *per tree of the 10 treatments, 7 weeks after application.*

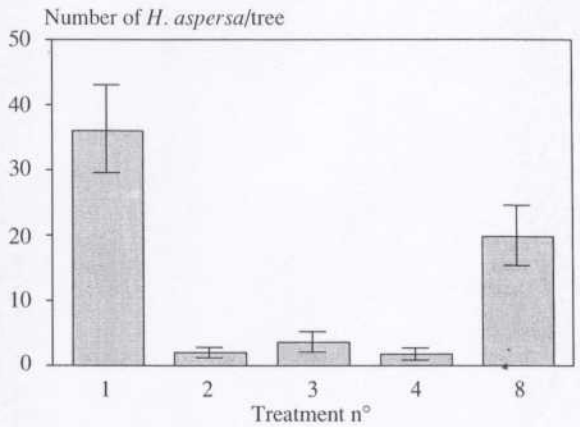

Figure 3. Mean (± SE) number of H. aspersa *per tree of the 5 treatments, 14 weeks after application.*

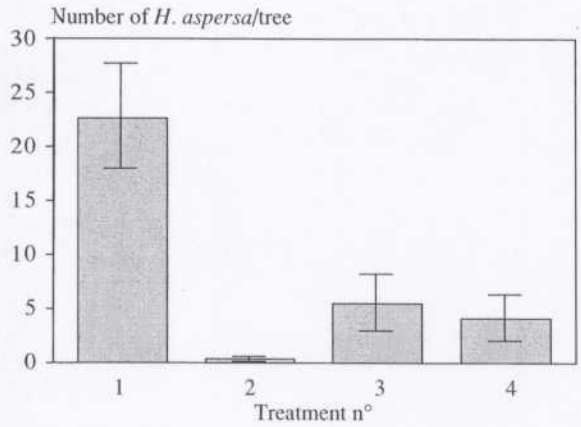

Figure 4. Mean (± SE) number of H. aspersa *per tree of the 4 treatments, 21 weeks after application.*

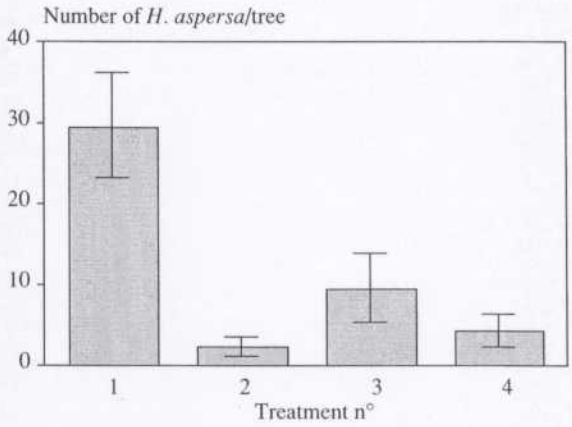

Figure 5. Mean (± SE) number of H. aspersa *per tree of the 4 treatments, 29 weeks after application.*

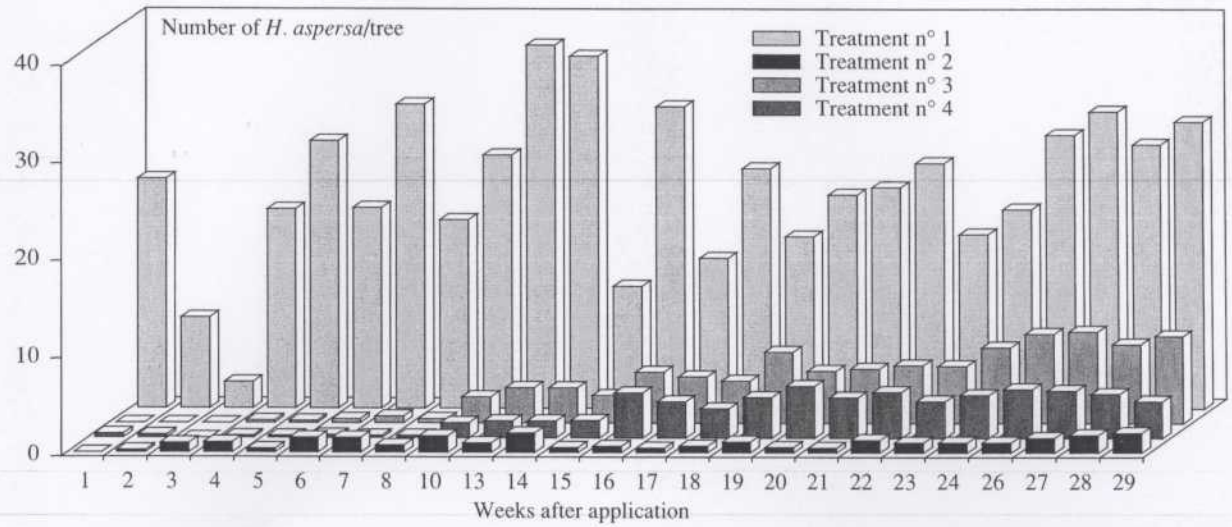

Figure 6. The mean number of H. aspersa *per tree for treatments n°s 1 (control), 2 (copper strip), 3 (copper sulphate with 500 g / 10 l water) and 4 (copper sulphate with 1 kg / 10 l water).*

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Eficiencia de diferentes tratamientos contra el caracol oscuro, *Helix aspersa* Müller, plaga de los cítricos en Africa del Sur.

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RESUMEN - En la región del Cap, en Sudáfrica, 2 especies de caracoles tienen una incidencia económica importante en huertos frutales de cítricos. Se trata del caracol de color oscuro *Helis aspersa* Müller y del caracol de las dunas *Theba pisana* Müller. Estos 2 caracoles atacan las hojas, los tallos y los frutos de cítricos aún verdes o al madurar. 10 tratamientos diferentes fueron sometidos a prueba en un huerto de toronjas de la estación del ITSC en Addo. Cada tratamiento fue aplicado sobre 10 árboles elegidos al azar. Estos diez tratamientos fueron los siguientes : 1) testigo sin tratar, 2) anillo de cobre alrededor del tronco, 3) sulfato de cobre 990 g/kg en polvo humectable a razón de 500 g/10 l de agua, 4) idéntico a 3 pero a razón de 1 kg de polvo humectable / 10 l de agua, 5) Metaldehyde 40 g/l aplicado alrededor del tronco, 6) Metaldehyde 40 g/l aplicado como cebo sobre una teja cerca del tronco, 7) Methiocarb 20 g/kg aplicado a razón de 20 g por árbol alrededor del tronco, 8) Methiocarb 800 g/kg en polvo humectable a razón de 167 g/10 l de agua, 9) Oxycloruro de cobre 850 g/l en polvo humectable a razón de 500 g/10 l de agua, 10) chlordane 600 g/l a razón de 200 ml/10 l de agua. Los tratamientos 3, 4, 8, 9 y 10 fueron aplicados a razón de 300 ml de liquido pulverizable por árbol. El anillo de cobre alrededor del tronco fue el único tratamiento capaz de reducir las pululaciones de caracoles a menos de 2 individuos por árbol al cabo de 29 semanas. Esta técnica se puede así recomendar como una solución de larga duración para el control de *H. aspersa*, en Africa del Sur.

PALABRAS CLAVES : Sudáfrica, *Citrus*, toronja, caracoles de tierra, *Helix aspersa*, control de plagas.