Biological Control 59 (2011) 340–347

Contents lists available at SciVerse ScienceDirect

Biological Control

journal homepage: www.elsevier.com/locate/ybcon

Management of chilli thrips *Scirtothrips dorsalis* (Thysanoptera: Thripidae) on peppers by *Amblyseius swirskii* (Acari: Phytoseiidae) and *Orius insidiosus* (Hemiptera: Anthocoridae)

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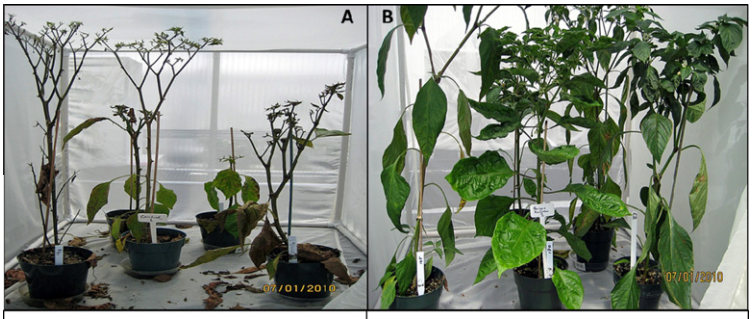
HIGHLIGHTS

- We evaluated two key predators of chilli thrips on five pepper cultivars.
- Both a predatory mite and predatory bug were effective control agents, alone or in combination.
- We observed synergistic interactions between the thrips, predators and pepper varieties.

GRAPHICAL ABSTRACT



A. Chilli thrips damage on control pepper plants | B. Pepper plants receiving predatory mites and bugs

ARTICLE INFO

Article history:
Received 25 January 2011
Accepted 9 September 2011
Available online 16 September 2011

Keywords:
Biological control
Insidiosus flower bug
Intraguild predation
Host plant resistance

ABSTRACT

Chilli thrips, *Scirtothrips dorsalis* Hood, recently established in southeast of the United States, poses an economic threat to a wide-range of ornamental and vegetable plants. In this study, we examined biological control of chilli thrips with a predatory mite, *Amblyseius swirskii* Athias-Henriot, and the insidious flower bug, *Orius insidiosus* Say. Laboratory tests showed that at equivalent rates, *O. insidiosus* was a more effective predator of adult thrips compared with *A. swirskii*, although the same trend was not observed with thrips larvae. At a rate of 20 predators per infested pepper plant, both predator species maintained ⩽0.5 thrips per leaf and <1% foliar damage after 5 weeks on all pepper varieties, compared with up to 13 thrips and >40% damage on control plants. Slightly less effective control was observed in a second study, where a reduced rate of predators (10 per plant) resulted in approximately 20% foliar damage, while damage was > 90% on control plants. Plants treated with *O. insidiosus* alone or in combination with *A. swirskii* had consistently fewer adult thrips and plant damage compared with *A. swirskii* alone. Furthermore, we observed different susceptibilities to thrips among pepper varieties, with damage lowest on 'Trinidad perfume' and 'Brigadier hybrid' compared with 'Large red cherry', and 'Serrano'. Our results show that both predators were effective predators of chilli thrips on pepper and suggest that both species could be used in combination without decreased efficacy through intraguild predation.

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doi:10.1016/j.biocontrol.2011.09.008

1. Introduction

Chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) is an exotic invasive pest recently established in the southern United States and Caribbean (Arthurs et al., 2009; Seal et al., 2006). The pest has been documented to attack more than 150 hosts from at least 40 different plant families (Mound and Palmer, 1981; Chiu et al., 1991; Tatara and Furuhashi, 1992; Tschuchiya et al., 1995; Bournier, 1999). It has been estimated that chilli thrips could eventually cause between $3 and $6 billion crop yield loss annually in the US (Garrett, 2004).

Chilli thrips feeds on all plant parts but prefers young leaves, buds and fruits. Initial damage causes leaf distortion with older damage turning bronze to black (Venette and Davis, 2004). Heavy infestation causes stunted or dwarfed and totally defoliated plants. Chilli thrips is also capable of transmitting peanut necrosis virus, peanut chlorotic fan virus, and tobacco streak virus (Amin et al., 1981; Campbell et al., 2005; Rao et al., 2003).

Like the management of other thrips, insecticides have been used for controlling chilli thrips. Recently, Seal et al. (2006) tested several insecticides on chilli thrips and found limited success with chlorfenpyr, spinosad and imidaloprid. The performance of novaluron, abamectin, spiromesifen, cyfluthrin, methiocarb and azadirachtin failed to provide effective control. Our preliminary tests indicated that chilli thrips is not susceptible to bifenthrin (Doğramaci et al., unpublished data). Although pesticides are important tools to alleviate thrips problems in certain cases, pesticides often do not provide sustainable thrips management due to cost and development of pest resistance to frequently used chemicals. Over reliance on chemical control is also unsustainable due to the rapid generation time and high polyphagy and vagility found in major thrips pests (Herron et al., 2007; Jensen, 2000; Loughner et al., 2005; Morse and Hoddle, 2006).

With the increasing awareness of sustainable agriculture, pest management practices have been conducted in an ecological and integrated fashion. Biological control is a major component of ecologically based and/or integrated pest management (Zehnder et al., 2007). Biological control is environmentally safe and sustainable when the appropriate biocontrol agents are present (Bale et al., 2007). There have been several examples of thrips biological control (Jacobson et al., 2001; McMurtry and Croft, 1997; Van Houten et al., 1995; Williams, 2001) but few studies specifically on chilli thrips. Arthurs et al. (2009) compared the efficacy of two predatory mites, *Amblyseius swirskii* Athias-Henriot and *Neoseiulus cucumeris* Oudemans, against chilli thrips on peppers. They found *A. swirskii* was the more effective of the two species, but did not test for interactions

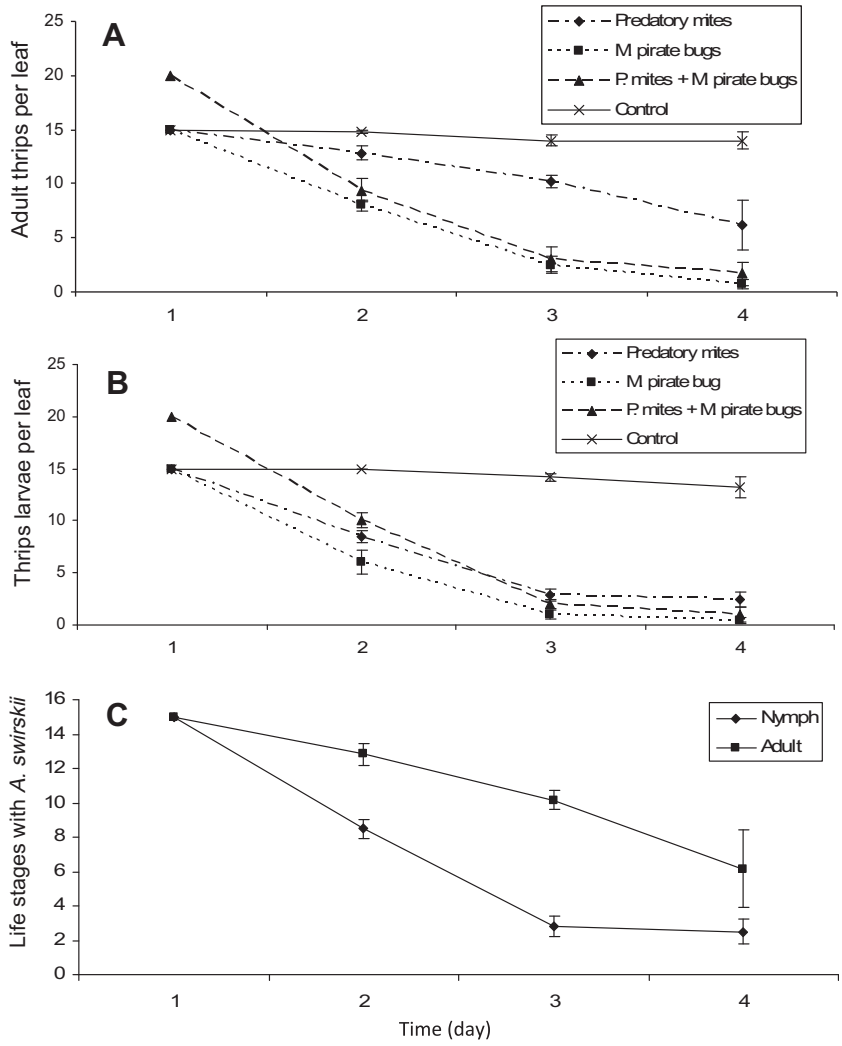

Fig. 1. Laboratory tests comparing numbers of chilli thrips in vials to which *A. swirskii* and *O. insidiosus* were added alone or in combination. Data are mean ± SEM from tests with (A) adult thrips and (B) thrips larvae, (C) comparison of thrips adults and larval mortality by the predatory mites.