

# Biological Control Strategies for the South American Tomato Moth (Lepidoptera: Gelechiidae) in Greenhouse Tomatoes

TOMAS CABELLO,<sup>1,2,3</sup> JUAN R. GALLEGO,<sup>1</sup> FRANCISCO J. FERNANDEZ,<sup>1</sup> MANUEL GAMEZ,<sup>1</sup> ENRIC VILA,<sup>1</sup> MODESTO DEL PINO,<sup>4</sup> AND ESTRELLA HERNANDEZ-SUAREZ<sup>4</sup>

J. Econ. Entomol. 105(6): 2085–2096 (2012); DOI: <http://dx.doi.org/10.1603/EC12221>

**ABSTRACT** The South American tomato pinworm, *Tuta absoluta* (Meyrick) has been introduced into new geographic areas, including the Mediterranean region, where it has become a serious threat to tomato production. Three greenhouse trials conducted in tomato crops during 2009 and 2010 explored control strategies using the egg-parasitoid *Trichogramma achaeae* Nagaraja and Nagarkatti compared with chemical control. The effectiveness of the predator *Nesidiocoris tenuis* (Reuter) was also tested. In greenhouses with early pest infestations (discrete generations), periodic inundative releases (eight releases at a rate of 50 adults/m<sup>2</sup>, twice a week) were necessary to achieve an adequate parasitism level (85.63 ± 5.70%) early in the growing season. However, only one inoculative release (100 adults/m<sup>2</sup>) was sufficient to achieve a comparatively high parasitism level (91.03 ± 12.58%) under conditions of high pest incidence and overlapping generations. Some intraguild competition was observed between *T. achaeae* and the predator, *N. tenuis*. This mirid species is commonly used in Mediterranean greenhouse tomato crops for the control of the sweetpotato whitefly, *Bemisia tabaci* (Gennadius). Tomato cultivars were also observed to influence the activity of natural enemies, mainly *N. tenuis* (whose average numbers ranged between 0.17 ± 0.03 and 0.41 ± 0.05 nymphs per leaf depending on the cultivar). This may be because of differences in plant nutrients in different cultivars, which may affect the feeding of omnivorous insects. In contrast, cultivar effects on *T. achaeae* were less apparent or possibly nonexistent. Nevertheless, there was an indirect effect in as much as *T. achaeae* was favored in cultivars not liked by *N. tenuis*.

**KEY WORDS** *Tuta absoluta*, *Trichogramma achaeae*, release strategy, *Nesidiocoris tenuis*, cultivar

Biological control programs in greenhouse tomato crops in Spain have depended on the use of *Eretmocerus mundus* Mercet (Hym.: Aphelinidae) and *Nesidiocoris tenuis* (Reuter) (Hem.: Miridae) to control the sweetpotato whitefly, *Bemisia tabaci* (Gennadius) (Hem.: Aleyrodidae) (Stansly et al. 2005, Gabarra et al. 2008). Releases of *Diglyphus isaea* (Walker) (Hym.: Eulophidae) are used to control the leaf miners *Liriomyza bryoniae* (Kaltenbach) and *L. trifolii* Burgess (Dip.: Agromyzidae). Aphid control of the potato aphid *Macrosiphum euphorbiae* (Thomas) (Hem.: Aphididae) is based mainly on releases of *Aphidius ervi* Haliday (Hym.: Braconidae). *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae) is released to control the twospotted spider mite (*Tetranychus urticae* Koch) (Acari: Tetranychidae) and other spider mite species in early hot spot infestations (Robledo et al. 2009).

*Tuta absoluta* (Meyrick) is an invasive pest native to South America that was first detected in eastern Spain toward the end of 2006 (European and Mediterranean Plant Protection Organization [EPPO] 2008). Since then, this species has extended its range to other European countries and northern Africa, where it has become a serious threat to tomato production both in greenhouse and in open field.

The rapid geographical spread of this pest species has completely altered its pest status worldwide, transforming it from a localized South American tomato pest to a worldwide threat to tomato production (Desneux et al. 2011). Current knowledge on its biology, ecology, and control has been recently reviewed (Desneux et al. 2010). However, the exact origin of *T. absoluta* and its invasive epidemiology still remain unknown (Desneux et al. 2011).

In Spain, *T. absoluta* quickly became a serious impediment to biocontrol programs in greenhouse tomato production. The dynamics of the *T. absoluta* population and its consequent damage differ depending on its presence in greenhouse or outdoor crops, the transplant time, and so forth (Cabello 2009), creating significant challenges to the successful development and application of biocontrol methods.

<sup>1</sup> Center for Agribusiness Biotechnology Research, University of Almería, Ctra. Sacramento s/n, ES 04120 Almería, Spain.

<sup>2</sup> Current address: Department of Applied Biology, University of Almería, Ctra. Sacramento s/n, ES 04120 Almería, Spain.

<sup>3</sup> Corresponding author, e-mail: tcabello@ual.es.

<sup>4</sup> Department of Crop Protection, Instituto Canario de Investigaciones Agrarias, P.B. 60, ES 38200, La Laguna, Tenerife, Islas Canarias, Spain.