First Record of *Zelus obscuridorsis* (Hemiptera: Reduviidae) as a Predator of the South American Tomato Leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae)

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Source: Florida Entomologist, 97(1):295-297. 2014.
Published By: Florida Entomological Society
URL: http://www.bioone.org/doi/full/10.1896/054.097.0144

FIRST RECORD OF *ZELUS OBSCURIDORSIS* (HEMIPTERA: REDUVIIDAE) AS A PREDATOR OF THE SOUTH AMERICAN TOMATO LEAFMINER, *TUTA ABSOLUTA* (LEPIDOPTERA: GELECHIIDAE)

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The tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), is a key pest of tomato in South America. It is a multivoltine species with high reproductive potential and a short life cycle; and it is considered to be oligophagous because it prefers mainly solanaceous species as host plants (Desneux et al. 2010). The crop damage is produced by the larval stage of the pest, which preferentially mines the leaves and fruits. Pupae are formed in the leaves and they can rest in the foliage of wild plants or in the soil after harvesting the crop.

In Argentina *T. absoluta* has been one of the most important threats to tomato production for over 4 decades (Luna et al. 2012). By 2006, this Neotropical species was detected invading southern Spain, and since then it spread rapidly to the major tomato producing countries in the Mediterranean Basin, Western Palearctic, and more recently into Africa (Desneux et al. 2011; Speranza & Sannino 2012; Pfeiffer et al. 2013). This invasion has boosted research on *T. absoluta* control, not only in the invaded countries, but also in its region of origin.

Tomato leafminer control in Argentina is based mostly on the use of synthetic pesticides. The farmers regularly apply insecticides on a weekly-basis schedule, and up to 14 times per growing cycle. Overuse of chemical control has been widely reported as inefficient, because the larvae are concealed in plant tissues, insecticides disrupt the action of natural enemies, and injudicious use tends to induce insecticide resistance in *T. absoluta* populations (see Luna et al. 2012 for references). For these reasons, nonchemical control techniques such as biological control should be developed to effectively manage the pest.

Predatory bugs are commercially produced as biological control agents (van Lenteren 2012). As quite generalist natural enemies, they are also important components of native fauna in agroecosystems (De Bach & Rosen 1991; Koul & Dhaliwal 2003). Thus, they should be preserved or enhanced through conservation biological control tactics. Positive attributes of indigenous generalist predators include their ability to colonize habitats subjected to spatial and temporal disruptions, and their opportunistic feeding habits, which enable them to persist by using different prey items. From an applied point of view, polyphagy allows them to act synergistically to manage several pests at the same time (van Lenteren 2012). A review of manipulative field studies to evaluate candidates for biological control of agricultural pests showed that in 75% of cases, generalist predators reduce pest numbers significantly (Symondson et al. 2002). It is possible though that generalist predators could reduce the efficiency of biocontrol programs by consuming other natural enemies, via intraguild predation and competition (Brodeur & Boivin 2006).

More than 40 species of *T. absoluta* predators occur in South America, including several species of Heteroptera (Hemiptera), such as one species of *Debilia* Stål (Reduvidae), which preys on the larvae in Brazil (Desneux et al. 2010; Bueno et al. 2013). Various native species of predators have already been found feeding on *T. absoluta* in the Mediterranean region, a newly invaded area (Al-Jboory et al. 2012; Zappalà et al. 2012).

Despite the increasing interest to develop biological control and/or integrated management programs for *T. absoluta*, many biological and ecological aspects of native and invasive populations of the pest remain still unknown. Thus, we participated in a joint collaboration project between Argentina and Italy on looking for alternative control methods for the tomato leafminer. We focused mostly on the search, study and selection of potential biological control agents. While monitoring tomato plants infested with *T. absoluta* and corn plants cultivated in household vegetable gardens in San Miguel de Tucumán (Argentina) [S 26° 48' 35.6" W 65° 14'

24.6", 500 m], during middle spring (Oct) 2012, we noted the presence of a native true bug predating diverse mobile insects including aphids and leafhoppers.

We identified this predator as *Zelus obscuridorsis* (Stål, 1860) (Hemiptera: Heteroptera: Reduviidae) a poorly known species already recorded from Argentina (Wygodzinsky 1957) without a certain locality of collection. This identification was accomplished under the leadership of Cecilia Melo by the use of literature and by comparison of field-collected individuals with specimens deposited in the collections of Museo de La Plata (Buenos Aires, Argentina) and National Museum of Natural History, Smithsonian Institution (Washington DC, USA. Representatives of this family are known as assassin bugs because of their predatory feeding habits. They are well known as polyphagous predators of soft-bodied arthropods, and frequently they specialize on a certain group of prey organisms, such as termites, ants, or diplopods (Weirauch & Munro 2009).

In order to study the capability of to *Z. obscuridorsis* to prey on *T. absoluta,* we brought *Z. obscuridorsis* individuals to the laboratory. We exposed laboratory-reared *T. absoluta* individuals at different stages of development to *Z. obscuridorsis* adults in order to verify the latters' predatory actions. *Tuta absoluta* individuals were located in 20 × 4 × 4 cm glass cages opened at both ends, one of them covered with a nylon mesh for aeration, and the other capped with cotton. We confined one predator per cage with a small tomato branch inside for 24 h. The predators were starved for 24 h before trials and were randomly collected from the cages. All tests were conducted in laboratory at 25 ± 3 °C, 70 ± 20% RH and natural photoperiod (near 13:11 h L:D). The number of treatments (assays) with different stages of *T. absoluta* was as follows: a) 4 replicates of 24 eggs each; b) 4 replicates of 5 I or II instars in their mines; c) 4 replicates of 5 free III- IV instars deposited with a brush on leaves at the beginning of the assay; d) 2 replicates of 10 pupae; and e) 2 replicates of 8 adults. After the assays were completed, living *T. absoluta* prey were counted.

No *T. absoluta* specimens were attacked in Treatments "a", "b" and "d". A total of 7 larvae were preyed in "c", and a total of 5 adults were killed in "e". We noticed that this assassin bug is very proficient at capturing specimens in motion like adult moths and mobile larvae, but is not able to detect the pest eggs, and less mobile larvae in their mines, or pupae.

Although *T. absoluta* is categorized as a leaf miner herbivore, it has been reported that the larva habitually abandons frass-contaminated mines and searches for new, clean tomato foliage or fruits (Vargas 1970; Sannino 2012). Mobile prey can be hard to manipulate by relatively small bodied predators (e.g., mirids, anthocorids, coccinelids) and parasitoids (De Bach & Rosen 1991; Koul & Dhaliwal 2003). The preference shown by *Z. obscuridorsis* to attack exposed developmental stages of *T. absoluta* (the free larvae or the adult moths) could indicate that this predator could be a member of a natural enemy complex in tomato crops that exploits a single pest species by partitioning different prey/host niches, and that allows a number of entomophagous species to coexist. In this case, it is expected that only low levels of competition or intraguild predation would occur (Symondson et al. 2002).

Finally, as a result of this contribution, we report for the first time that a species of *Zelus*, can prey on *T. absoluta*. Additionally, we find that the bug attacks free mobile larvae and adults of pest, niches scarcely exploited by parasitoids (Luna et al. 2012). Also, the finding of *Z. obscuridorsis* in Tucumán province is the first record on the distribution of this species in Argentina.

Some authors (Symondson et al. 2002; Desneux et al. 2011) emphasized the key role of generalist predators in managing both local and invasive pest populations. Indeed, in the framework of invasive pest management, generalist predators could be favored by richer prey diversity. Thus, this paper is a starting point to evaluate the potential of Z. *obscuridorsis* as a promising biocontrol agent of the tomato leafminer. Further research is needed to gain more insights of the role of this generalist predator in *T. absoluta* control.

Summary

The South American tomato leafminer *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is a Neotropical key pest of tomato in South America, and in recent years, it has become established in Europe and Africa. Recently we found the native true bug, *Zelus obscuridorsis* (Stål, 1860) (Hemiptera: Reduviidae), predating diverse mobile insects in household vegetable gardens located in northwestern Argentina. We found that *Z. obscuridorsis* preys on mobile stages of *T. absoluta*, i.e., free larvae and adults but not on larvae in their mines, pupae or eggs. This is the first record of a *Zelus* species as predator of *T. absoluta*. We discuss the importance of this predator consuming only mobile items, in terms of using little exploited host niches, and its possible relationships with other antagonistic species of *T. absoluta*.

Key words: Argentina, Reduviidae, Tomato borer, biological control, entomophagous

Resumen

La Polilla del tomate, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), es una plaga neotropical clave para el cultivo de tomate en Sudamérica, que ha expandido su distribución a Europa y África. Recientemente hallamos en una

finca hortícola del noroeste argentino a la chinche *Zelus obscuridorsis* (Stål, 1860) (Hemiptera: Reduviidae) atacando diversos insectos móviles. Verificamos que depreda estados móviles, como larvas libres y adultos, pero no a las larvas en sus minas, huevos y pupas. Este es el primer registro de una especie del género *Zelus* como depredador de *T. absoluta*. Se discute la importancia de este depredador, que solo consume individuos móviles, considerando que explota un nicho poco utilizado por otras especies antagonistas de la plaga.

Palabras Clave: Argentina, Reduviidae, polilla del tomate, control biológico, entomófagos

Acknowledgements

This work was funded in part by a MINCYT-Argentina and MAE-Italy (IT1008/AR11MO7) international research cooperation project.

References Cited

Al-Jboory, I. J., Katbeh-Bader, A., and Al-Zaidi, S. 2012: First observation and identification of some natural enemies collected from heavily infested tomato by *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Jordan. Middle-East J. Sci. Res. 11: 435-438.

Brodeur, J., and Boivin, G. 2006. Trophic and guild interactions in biological control. Springer.

Bueno, V. H. P., Van Lenteren, J. C., Lins Jr J. C., Calixto, A. M., Montes, F. C., Silva, D. B., Santiago, L. D., and Pérez, L. M. 2013. New records of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) predation by Brazilian hemipteran predatory bugs. J. Appl. Entomol. 137(1-2): 29-34.

De Bach, P., and Rosen, D. 1991. Biological control by natural enemies. Cambridge University Press.

Desneux, N., Luna, M. G., Guillemaud, T., and Urbaneja, A. 2011. The invasive South American tomato pinworm, *Tuta absoluta*, continues to spread in Afro-Eurasia and beyond: the new threat to tomato world production. J. Pest Sci. 84 (4): 403-408.

Desneux, N., Wajnberg, E., Wyckhuys, K. A. G., Burgio, G., Arpaia, S., Narváez-Vasquez, C. A., González-Cabrera, J., Ruescas, D. A., Tabone, E., Frandon, J., Pizzol, J., Poncet, C., Cabello, T., and Urbaneja, A. 2010: Biological invasion of European tomato crops by *Tuta absoluta*: ecology, geographic expansion and prospects for biological control. J. Pest Sci. 83: 197-215.

Koul, O., and Dhaliwal, G. S. 2003. Predators and parasitoids. Taylor & Francis. London.

Luna, M. G., Sánchez, N. E., Pereyra, P. C., Nieves, E., Savino, V., Luft, E., Virla, E., and Speranza, S. 2012. Biological control of *Tuta absoluta* in Argentina and Italy: evaluation of indigenous insects as natural enemies. EPPO Bull. 42(2): 260-267.

Pfeiffer, D. G., Muniappan, R., Sall, D., Diatta, P., Diongue, A., and Dieng, E. O. 2013. First record of *Tuta absoluta* (Lepidoptera: Gelechiidae) in Senegal. Florida Entomol. 96: 661-662.

Sannino, L. 2012. Inquadramento sistematico e aspetti morfo-biologici di *Tuta absoluta* (Meyrick) (Lepidoptera, Gelechiidae). Atti Acad. Naz. Italiana Entomol. Anno LX: 67-75.

Speranza, S., and Sannino, L. 2012. The current status of *Tuta absoluta* in Italy. EPPO Bull. 42(2): 328-332.

Symondson, W. O. C., Sunderland, K. D., and Greenstone, M. H. 2002. Can generalist predators be effective biocontrol agents? Ann. Rev. Entomol. 47: 561-94.

Van Lenteren, J. C. 2012. The state of commercial augmentative biological control: plenty of natural enemies, but a frustrating lack of uptake. BioControl 57: 1-20.

Vargas, H. C. 1970. Observaciones sobre la biología y enemigos naturales de la polilla del tomate, *Gnorimoschema absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Idesia 1: 75-110.

Weirauch, C., and Munro, J. B. 2009. Molecular phylogeny of the assassin bugs (Hemiptera: Reduviidae), based on mitochondrial and nuclear ribosomal genes. Mol. Phylogenet. Evol 53(1): 287-299

Wygodzinsky, P. 1957. On the Reduviidae mentioned or described by Carlos Berg (Hemiptera, Insecta). Rev. Brasileira de Biología 17(2): 267-274.

Zappalà, L., Siscaro, G., Biondi, A., Mollá O., Gonzáles-Cabrera, J. and Urbaneja, A. 2012. Efficacy of sulphur on *Tuta absoluta* and its side effects on the predator *Nesidiocoris tenuis*. J. Appl. Entomol. 136: 401-409.