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Search for effective natural enemies of *Tetranychus evansi* (Acari: Tetranychidae) in northwest Argentina

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Abstract The mite *Tetranychus evansi* Baker & Pritchard (Tetranychidae) probably originated in South America. Because of its importance as a tomato pest in Africa, an extensive project has been conducted to detect potentially effective natural enemies in South America for the classical biological control of the pest in Africa. A search for the natural enemies of *T. evansi* was conducted in the Province of Tucumán, northwestern Argentina, in December 2004, and this report describes the results. One hundred predatory mites of the family Phytoseiidae referring to 11 species were collected on 11 examined species of solanaceous plants. The most abundant phytoseiid species collected were *Neoseiulus californicus* (McGregor) and *Euseius concordis* (Chant). Adults and immatures of those species, as well as of *Neoseiulus idaeus* Denmark & Muma, *Phytoseiulus fragariae* Denmark & Schicha and *Proprioseiopsis cannaensis* (Muma) were found in association with *T. evansi*, suggesting that they were developing on the pest. However, because of the possible biological differences between populations of a given species, biological studies evaluating *T. evansi* as a prey for those predators seem desirable.

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Introduction

The spider mite *Tetranychus evansi* Baker & Pritchard (Tetranychidae) was originally described in 1960 based on specimens collected on tomato (*Lycopersicon esculentum* Miller) in Mauritius Island (Baker and Pritchard 1960). However, mites of that species were mistakenly reported as *Tetranychus marianae* McGregor a few years earlier from northeastern Brazil (Silva 1954; Moraes et al. 1987). This suggests that this species could have originated in South America (e.g. Gutierrez and Etienne 1986).

The present world distribution of *T. evansi* was summarized by Furtado et al. (2006). Because of the damage it has caused to tomatoes in some African countries, an international project was initiated a few years ago in order to collect and assay promising natural enemies of this pest in South America for introduction into Africa for its biological control. The first step in that project was to determine priority areas in South America to be surveyed, by a comparison of the prevailing climate in the areas where *T. evansi* is found in Africa as well as in different parts of South America (Fiaboe et al. 2006). The determined priority areas corresponded mainly to large parts of northeast, southeast, south and mid-west Brazil, as well as to parts of Argentina, Paraguay and Uruguay.

The distribution of *T. evansi* and the natural enemies associated with it were investigated in the northeast (Furtado et al. 2005; Rosa et al. 2005; Fiaboe et al. 2007), south and southeast (Furtado et al. 2006) as well as in mid-west Brazil (Furtado et al. unpublished). The objective of the present work was to collect and identify predatory mites of the family Phytoseiidae associated with *T. evansi* on solanaceous plants in northwest Argentina.

Material and methods

A survey was conducted in December 2004 in parts of the Province of Tucumán, in northwest Argentina. Samples of cultivated tomato (*L. esculentum*) and wild solanaceous plants were taken from nine localities along the margins of the main roads crossing the area.

Each sample corresponded to a volume of approximately 0.5 l of leaves of a given plant species. A total of 54 samples were collected; each one was placed in a paper bag that in turn was put in a cool box for transport to the laboratory, where the mites were collected under a dissecting microscope and mounted in Hoyer's medium. After drying, mites were identified under a phase contrast microscope.

Results

One hundred phytoseiid mites belonging to 11 species of the subfamily Amblyseiinae were collected (Table 1). *Euseius concordis* (Chant) was the most abundant phytoseiid species, collected in five localities, on *Brugmansia suaveolens*, *Cestrum parqui*, *Solanum americanum*, *S. muelleri* and *Vassobia breviflora*. *Neoseiulus californicus* (McGregor) was the second most abundant, but it was collected in only two localities, on *L. esculentum*, *Solanum muelleri* and *Salpichroa origanifolia*. The remaining phytoseiids were found in much lower numbers, in 1 or 2 localities, on 1 or 2 solanaceous plants.

Table 1 Phytoseiid mites collected from solanaceous plants in surveys conducted in 9 sites in the Province of Tucumán, northwest Argentina, in December 2004

Phytoseiid species	Nr. specimens	Nr. localities	Nr. solanaceous plants
Amblyseiinae Muma			
Amblyseius herbicolus (Chant)	8	1	1
Euseius citrifolius Denmark & Muma	1	1	1
Euseius concordis (Chant)	37	5	5
Euseius inouei (Ehara & Moraes)	1	1	1
Neoseiulus barkeri (Hughes)	1	1	1
Neoseiulus californicus (McGregor)	35	2	3
Neoseiulus idaeus Denmark & Muma	6	2	2
Neoseiulus transversus Denmark & Muma	1	1	1
Neoseiulus tunus (De Leon)	3	2	2
Phytoseiulus fragariae Denmark & Schicha	2	1	1
Proprioseiopsis cannaensis (Muma)	5	1	2

Salpichroa origanifolia and *L. esculentum* were the solanaceous plants most frequently found in this study. Tetranychidae mites were found in all samples of those plant species (Table 2). These mites were not found on *B. suaveolens*, probably because this plant species was found only once in this study. They were only occasionally found on other solanaceous plants examined.

Despite the fact that the area surveyed was relatively small, *T. evansi* was found in all localities, on *C. parqui*, *L. esculentum*, *Physalis* sp., *S. origanifolia*, *Solanum americanum*, *S. muelleri* and on *Solanum* spp.

The following phytoseiids were collected in association with *T. evansi* in at least one locality: *Euseius citrifolius* Denmark & Muma, *E. concordis*, *N. californicus*, *Neoseiulus idaeus* Denmark & Muma, *Neoseiulus tunus* (De Leon), *Phytoseiulus fragariae* Denmark & Schicha and *Proprioseiopsis cannaensis* (Muma). Of those, *E. concordis*, *N. californicus*, *N. idaeus*, *P. fragariae* and *P. cannaensis* were collected both in the adult and in the immature phases.

Discussion

The detection of only Amblyseiinae in this work is consistent with the much higher diversity of this, as compared to other phytoseiid subfamilies in tropical and subtropical areas (Chant and McMurtry 2006). Furtado et al. (2006) and Fiaboe et al. (2007) discussed the predominance of this group in similar surveys conducted in different parts of Brazil. Eight of the phytoseiid species found in this study were also collected in similar studies conducted in Brazil (Furtado et al. 2005, 2006; Rosa et al. 2005; Fiaboe et al. 2007). However, *Amblyseius herbicolus* (Chant), *E. casearіae*, *Neoseiulus barkeri* (Hughes) and *Neoseiulus transversus* Denmark & Muma were not found in those studies, although they had already been reported from that country on other plant species not evaluated in this study.

The presence of immatures among the specimens of five of the phytoseiid species collected in this study in association with *T. evansi* and the absence of other potential prey

Table 2 Phytoseiids and associated phytophagous mites from each solanaceous species of each sampling site visited in December 2004 in the Province of Tucumán, northwest Argentina

Site	Geographic coordinates	Collection date	Host plant	Phytoseiidae species	Number of Phytoseiidae	Phytophagous mites (Tetranychidae)
Alto Verde	27°22′ S, 65°36′ W	12-XII-04	*Cestrum parqui*	*Euseius concordis*	6♀	*Tetranychus evansi*
				Neoseiulus tunus	1♀	*T. evansi*
				Proprioseiopsis cannaensis	2♀	*T. evansi*
			Lycopersicon esculentum			*T. evansi*
			Physalis sp.			*T. evansi*
			Salpichroa origanifolia	*Phytoseiulus fragariae*	1♀ and 1i*	*T. evansi*
				P. cannaensis	2♀ and 1i	*T. evansi*
Horco Molle	26°47′ S, 65°18′ W	13-XII-04	*Brugmansia suaveolens*	*E. concordis*	1♀ and 1♂	
				N. tunus	2♀	
			C. parqui	*Amblyseius herbicolus*	8♀	
			Cyphomandra betacea			*Tetranychus* sp.
			S. origanifolia			*Tetranychus urticae*
			Solanum americanum	*Neoseiulus idaeus*	3♀, 1♂ and 1i	*T. evansi*
			Solanum granulosoleprosum			*Aponychus* sp.
			Solanum muelleri	*E. concordis*	2i	*T. evansi*
			Vassobia breviflora	*Euseius inouei*	1♀	*Tetranychus* sp.
La Bolsa	26°56′ S, 65°19′ W	11-XII-04	*Cestrum* sp.	*Neoseiulus barkeri*	1♀	
			Cestrum sp.	*Neoseiulus transversus*	1♀	
			S. americanum	*E. concordis*	6♀ and 1♂	*T. evansi*
			S. muelleri	*E. concordis*	4♀, 2♂ and 1i	
			S. muelleri	*Neoseiulus californicus*	1♀	
La Ovejeria Tafí del Valle	26°53′ S, 65°45′ W	09-XII-04	*L. esculentum*			*T. evansi*

Table 2 continued

Site	Geographic coordinates	Collection date	Host plant	Phytoseiidae species	Number of Phytoseiidae	Phytophagous mites (Tetranychidae)
La Reducción	26°56′ S, 65°20′ W	12-XII-04	*L. esculentum*	*N. californicus*	10♀, 4♂ and 3i	*T. urticae*
			S. origanifolia	*N. californicus*	13♀ and 4i	*T. evansi*
			S. americanum			*T. evansi*
Los Sarmientos	27°24′ S, 65°41′ W	12-XII-04	*L. esculentum*			*T. evansi*
			Physalis sp.			*T. evansi*
			S. origanifolia			*T. evansi*
			S. americanum			*T. evansi*
San Miguel de Tucumán	26°47′ S, 65°11′ W	13-XII-04	*S. origanifolia*	*Euseius citrifolius*	1♀	*T. evansi*
			S. origanifolia	*N. idaeus*	1♀	*T. evansi*
	26°50′ S, 65°11′ W	10-XII-04	*Solanum* sp.			*T. evansi*
Vipos	26°24′ S, 65°18′ W	11-XII-04	*L. esculentum*			*T. evansi*
			S. origanifolia			*T. evansi*
			V. breviflora	*E. concordis*	6♀, 1♂ and 2i	
Vipos de Abajos	26°28′ S, 65°19′ W	11-XII-04	*C. parqui*	*E. concordis*	2♀	
				E. concordis	2♀	
			S. origanifolia			*T. evansi*
			Solanum sp. 3			*T. evansi*
			Solanum sp. 4			*T. evansi*

* i, Immatures

on the same plantas suggest that they were developing on *T. evansi*, and could therefore be potentially useful in the control of that pest. However, it is possible that they were consuming other food sources present on the plants. Furtado et al. (2006) also reported *N. californicus* in association with *T. evansi* on solanaceous plants in southern Brazil. However, biological observations showed that despite the fact that this predator could develop and reproduce on *T. evansi*, the latter was not a favorable prey for it (GJN Vasconcelos et al. in preparation). Escudero and Ferragut (2005) obtained similar results when studying a Spanish population of *N. californicus*. *Phytoseiulus fragariae* was also found by Furtado et al. (2006) in association with *T. evansi* in southern Brazil, but laboratory studies of that population produced results similar to those reported for *N. californicus* (GJN Vasconcelos et al. in preparation). Unpublished laboratory studies conducted by the authors of the present paper showed low oviposition rates of *N. idaeus* and *P. cannaensis* (0.15 ± 0.04 and 0.03 ± 0.01 eggs per female per day, respectively) when they were fed *T. evansi*.

The relatively high densities at which *T. evansi* was found in this study suggests that the predators collected may not exert adequate control of that pest in that region. However, this apparent inefficiency may not reflect the intrinsic characteristics of these predators; rather, that could be due to factors prevailing in that area as, for example, the use of non-selective pesticides by growers. The populations of the phytoseiids found in this study may differ from populations of the same species already studied concerning the acceptance of *T. evansi* as prey. Future investigations to evaluate the phytoseiids found in this study as control agents of the pest seem desirable, especially of those whose adult and immature stages were found in association with *T. evansi*.

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