Mites (Acari: Mesostigmata, Sarcoptiformes and Trombidiformes) Associated to Soybean in Brazil, Including New Records from the Cerrado Areas

Authors: José Marcos Rezende, Antonio Carlos Lofego, Denise Návia, and Samuel Roggia

Source: Florida Entomologist, 95(3) : 683-693

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.095.0319
MITES (ACARI: MESOSTIGMATA, SARCOPTIFORMES AND TROMBIDIFORMES) ASSOCIATED TO SOYBEAN IN BRAZIL, INCLUDING NEW RECORDS FROM THE CERRADO AREAS

JOSÉ MARCOS REZENDE1,*, ANTONIO CARLOS LOFEGO2, DENISE NÁVIA3 AND SAMUEL ROGGIA4

1UNESP – Programa de Pós-Graduação em Biologia Animal, Rua Cristóvão Colombo, 2265, Jardim Nazareth, 15054-000, São José do Rio Preto, SP, Brazil
2UNESP – Departamento de Zoologia e Botânica – Rua Cristóvão Colombo, 2265 – Jardim Nazareth – 15054-000 – São José do Rio Preto, SP – Brazil
3Embrapa, Recursos Genéticos e Biotecnologia – Parque Estação Biológica, final W5 Norte, Cx. Postal 02372 – 70.770-900 – Brasília, DF – Brazil
4Embrapa, Soja – Rodovia Carlos João Strass, Cx. Postal 231 – 86001-970 – Londrina, PR – Brazil

*Corresponding author; E-mail: jmrezende@live.com

ABSTRACT

In Brazil, soybean Glycine max (L.) Merril crops are subjected to incidence of several pests, which are mainly insect species. However, the occurrences of other pest species are growing. In this context, outbreaks of phytophagous mites are becoming more frequent. Nevertheless, records of mites in such crop are available only for Maranhão, Mato Grosso, Minas Gerais and Rio Grande do Sul states. Thus, this work gathers all information published about the diversity of mites found in soybean in Brazil, and also new records of mite species made on samplings taken from the central Cerrado area. In the whole, occurrence of 44 species of plant mites in soybean has been recorded in Brazil. Data from prior studies and the results of this work present the tetranychid Mononychellus planki (McGregor) as the mite species most frequently occurring in the Brazilian soybean crops. A large portion of Phytoseiidae species has occurred in crops from Rio Grande do Sul state. In addition, spontaneous soybean has hosted almost half of the phytoseiid species sampled in Cerrado region. High diversity of Tarsonemidae has been found in the cultivated soybean. More studies about soybean mites are needed to clarify the damage potential of phytophagous mites and the biological role of predatory mites in this crop.

Key Words: Acari, Glycine max, Brazilian savannah, survey

RESUMO

No Brasil, lavouras de soja Glycine max (L.) Merril estão sujeitas a incidência de várias pragas, as quais são principalmente espécies de insetos. No entanto, a ocorrência de outras espécies-praga tem aumentado. Neste contexto, surtos populacionais de ácaros fitófagos têm se tornado mais frequentes. Apesar disso, os registros de ácaros para esta cultura estão disponíveis apenas para os estados de Maranhão, Mato Grosso, Minas Gerais e Rio Grande do Sul. Assim, este trabalho agrega toda a informação publicada sobre a diversidade de ácaros encontrados em soja no Brasil, além de novos registros feitos através de amostragens na região central do Cerrado. No total, 44 espécies de ácaros foram registradas em soja no Brasil. Dados de estudos anteriores, somados aos resultados deste trabalho, apresentam o tetraniquídeo Mononychellus planki (McGregor) como a espécie de ácaro mais frequente em lavouras de soja brasileiras. Considerável número de espécies de Phytoseiidae tem ocorrido nas lavouras amostradas do Rio Grande do Sul. Além disso, a soja espontânea abrigou quase metade das espécies de fitoseídeos amostrados na região central do Cerrado. Por sua vez, uma elevada diversidade de Tarsonemidae foi encontrada na soja cultivada. Mais estudos sobre ácaros em soja são necessários para esclarecer o potencial de dano dos ácaros fitófagos e o papel biológico dos ácaros predadores nesta cultura.

Palavras-chave: Acari, Glycine max, savana brasileira, levantamento faunístico

Soybean Glycine max (L.) Merril (Fabaceae) is one of the most important agricultural crops, and Brazil is ranked as one of the top producers with approximately 75 million tonnes during the 2010/2011 harvest (Conab 2011). In addition, soybean is grown in most states, and is economically
significant in the Brazilian economy (Corrêa-Ferreira et al. 2000). The soybean crop is especially important in the Cerrado region, which provides the largest portion of domestic production (Embrapa 2000). The Cerrado occupies almost one-fourth of Brazilian territory, or about 200 million ha (Rezende et al. 2005). However, this biome has been severely degraded by agricultural practices, and agriculture, especially soybean production, is responsible for much of the fragmentation (Durigan et al. 2007).

Many pests associated with soybean in Brazil (Embrapa 2008), but arthropods are responsible for most of the yield loss. In recent years, population outbreaks of phytophagous mites have been observed in soybean (Guedes et al. 2007) and some authors believe that such outbreaks result from the improper use of pesticides (Corrêa-Ferreira et al. 2010; Salvadori et al. 2007). In any case, mites (especially phytophagous species) have become important soybean pests because of the lack of basic knowledge about them. There is a need to know the mite species associated with soybean, in order to appropriately manage their populations on this crop. Thus, in this work we have attempted to gather the already published data on mites found in soybean cultivated in Brazil, and also to include new records from cultivated and spontaneous soybean plants from the central region of the Brazilian Cerrado.

**Material and Methods**

Records of mites associated with soybean in Brazil were obtained from reports in the literature (Guedes et al. 2007; Leite et al. 2003; Návia & Flechtman 2004; Neto et al. 2008; Oliveira et al. 2007; Roggia et al. 2008, 2009; Oliveira 2010; Vivan et al. 2011 (Fig. 1, Table 1), and also by new samplings carried out in the Cerrado region (Fig. 1, Table 2). The new records were obtained by 2 samplings carried out in 10 fields during part of the rainy season in Brazil (Nov and Dec/2009, and Jan/2010). In these areas, the surrounding landscape consisted of a Cerrado fragment and others soybean fields. Also, samplings dates coincided with the inflorescence (sampling #1-40 d after sowing) and ended at the pod formation (sampling #2-80 d later) (Table 3). One additional sampling was made in June/2010 (during the dry season), along highway margins in 3 other areas of spontaneous soybean.

The mites were extracted in the field by washing the soybean leaves with 30% ethyl alcohol. The washing was done in plastic buckets with 5 L of the same alcohol. The collected leaves were immersed and stirred for some seconds to dislodge the mites. The washed leaves were withdrawn from the bucket and the alcohol was filtered through nylon micro-sieves with 25 μm porosity. Subsequently, both sides of the mesh were sprayed with 67% ethyl alcohol to dislodge the retained material. Such material was transferred into flasks each containing 80 mL of the same alcohol for temporary preservation and transportation.

In the laboratory, the preserved material was examined under stereoscopic microscopes. The mites were assembled on microscopic slides, using Hoyer’s medium (Moraes & Flechtman 2008). Subsequently, the slide borders were sealed with transparent nail polish. Identification of the specimens was done under an optical microscope with phase contrast in accordance with Lindquist et al. (2009a).

In the species listing, the following data have been presented for the new records: collection site, date of collection (month in Roman numerals, and year in Arabic numerals) and the number of individuals in parenthesses. In case of former records, the presented data are: collection site, year in Arabic numerals, and the number of individuals in parentheses. In case of former records, the presented data are: collection site, year in Arabic numerals, and the number of individuals in parentheses.

The voucher material of the samplings is deposited with the Acari collection (DZSJRP) - http://www.splink.cria.org.br, of the Zoology and Botany Department, Universidade Estadual Paulista (UNESP), São José do Rio Preto, São Paulo.

**Results**

The samplings yielded 2,732 mites, belonging to 29 species. Phytoseiidae and Tarsonemidae presented the largest species richness (8 species each). The tetranychid, *Mononychellus planki* (McGregor), was the species most frequently collected in all sampled areas (Table 3). Such data, added to the prior results, result into 44 species found in soybean in Brazil, according to the list subsequently presented.

**Order Mesostigmata**

**Ascidae**

*Asca* sp. 1

*Asca* sp. 2

*Asca* sp. 3

**Blattisociidae**

*Lasioseius* sp.

*Asca* sp. 1

**Order Mesostigmata**

**Ascidae**

*Asca* sp. 1

*Asca* sp. 2

*Asca* sp. 3

**Blattisociidae**

*Lasioseius* sp.

*Asca* sp. 1

*Asca* sp. 2

*Asca* sp. 3

**Blattisociidae**

*Lasioseius* sp.
al. 2009b), but no information is available specifically about the diet of *Lasioseius* sp.

*Incertae sedis*

*Africoseius* sp.


*Melicharidae*

*Proctolaelaps* sp.

Origin: Goiás: Rio Verde (1): XII-09 (1). Diet: Basically they are predators, but they may be facultatively pollenophagous or saprophagous (Krantz 2009).

*Phytoseiidae*

*Euseius alatus* De Leon, 1966

Origin: Minas Gerais: Araporã: VI-10 (21). Diet: Generalist predator that also feeds on pollen (McMurtry & Croft 1997).

*Galendromus (Galendromus) annectens* (De Leon, 1958)

Origin: Minas Gerais: Araporã: VI-10 (1). Previous records in Brazil: Rio Grande do Sul: Santa Maria (Roggia et al. 2009). Diet: Selective preda-
Origin: Minas Gerais: Tupaciguara: XII-09 (1). Diet: Predator, but also feeds on pollen (Reis & Alves 1997).

**Neoseiulus californicus** McGregor, 1954

Previous records in Brazil: Rio Grande do Sul: Cruz Alta, Nonoai, Santa Maria, Victor Graeff

**Neoseiulus benjamini** (Schicha, 1981)

Origin: Minas Gerais: Tupaciguara (1): XII-09 (1). Diet: Unknown for the species. Mites of this genus are considered selective or generalist predators (McMurtry & Croft 1997).

**Neoseiulus anonymous** Chant & Baker, 1965


**Neoseiulus anonymus** Chant & Baker, 1965


**Iphiseiodes zuluagai** Denmark & Muma, 1973.

Origin: Minas Gerais: Tupaciguara: XII-09 (1). Diet: Predator, but also feeds on pollen (Reis & Alves 1997).

**Neoseiulus benjamini** (Schicha, 1981)

Origin: Minas Gerais: Tupaciguara (1): XII-09 (1). Diet: Unknown for the species. Mites of this genus are considered selective or generalist predators (McMurtry & Croft 1997).

**Neoseiulus anonymous** Chant & Baker, 1965


**Neoseiulus californicus** McGregor, 1954

Previous records in Brazil: Rio Grande do Sul: Cruz Alta, Nonoai, Santa Maria, Victor Graeff

**Neoseiulus benjamini** (Schicha, 1981)

Origin: Minas Gerais: Tupaciguara (1): XII-09 (1). Diet: Unknown for the species. Mites of this genus are considered selective or generalist predators (McMurtry & Croft 1997).

**Neoseiulus anonymous** Chant & Baker, 1965


**Neoseiulus idaeus** Denmark & Muma, 1973


**Neoseiulus tunus** (De Leon, 1967)

Origin: Goiás: Edealina: XII-09 (1), I-10 (1). Diet: As *N. benjamini*.

**Phytoseiulus fragariae** Denmark & Schicha, 1983

Previous records in Brazil: Rio Grande do Sul: Canguçu (Guedes et al. 2007); Cruz Alta, Santa Maria, Nonoai, Victor Graeff (Roggia et al. 2009). Diet: Predator and promising control agent of *Tetranychus urticae* (Vasconcelos et al. 2008).

**Phytoseiulus macropilis** Banks, 1905

Previous records in Brazil: Rio Grande do Sul: Victor Graeff (Roggia et al. 2009). Diet: It is considered to be a specialized predator of *Tetranychus* species (McMurtry & Croft 1997).

**Proprioseiopsis cannaensis** Muma, 1962

Previous records in Brazil: Rio Grande do Sul: Santa Maria (Roggia et al. 2009). Diet: This species has been observed feeding on pollen and Tetranychidae, Tenuipalpidae and Eriophyidae mites. However, the data obtained didn’t allow asserting that *P. cannaensis* utilizes these items as principal sources of food in nature (Bellini et al. 2010).

**Proprioseiopsis ovatus** (Garman, 1958)

Origin: Minas Gerais: Unai: I-10 (1). Diet: Same as *P. cannaensis*.

**Typhlodromalus aripo** De Leon, 1967

Origin: Goiás: Rio Verde (2): VI-10 (1). Previous records in Brazil: Rio Grande do Sul: Canguçu (Guedes et al. 2007). Diet: This species can feed on a variety of food items, including mites, pollen, fungal spores and tetranychid mites (Gnanvossou et al. 2003).

**ORDER SARCOPTIFORMES**

**Acaridae**

**Tyrophagus putrescentiae** (Schrank, 1781)

Previous records in Brazil: Minas Gerais: Unai (Oliveira et al. 2007). Diet: Species of this genus are considered to be basically fungivorous or graminivorous. But *T. putrescentiae* has also been found feeding on eggs of the southern corn rootworm *Diabrotica undecimpunctata howardi* Barber (Coleoptera: Chrysomelidae) (Krantz 2009).

**Galumnidae**

**Galumna glabra** Pérez-Iñigo & Baggio, 1991

Previous records in Brazil: Mato Grosso (Oliveira 2010). Diet: Unknown, but commonly mites of this family are mycophagous and saprophagous (Norton & Behan-Pelletier 2009).

### Table 2. Locations sampled for mite fauna on soybean, in the central area of the Cerrado.

<table>
<thead>
<tr>
<th>CODE</th>
<th>STATE</th>
<th>MUNICIPALITY</th>
<th>COORDINATES</th>
<th>CULTIVAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Distrito Federal</td>
<td>Brasília</td>
<td>15° 38' S 47° 44' W</td>
<td>‘BRS Baliza RR’</td>
</tr>
<tr>
<td>B</td>
<td>Goiás</td>
<td>Chapadão do Céu</td>
<td>18° 15’ S 52° 44’ W</td>
<td>‘M-Soy 8001’</td>
</tr>
<tr>
<td>C</td>
<td>Goiás</td>
<td>Cristalina</td>
<td>16° 17’ S 47° 27’ W</td>
<td>‘AN 8843’</td>
</tr>
<tr>
<td>D</td>
<td>Goiás</td>
<td>Edealina</td>
<td>17° 24’ S 49° 45’ W</td>
<td>‘M-Soy 8200’</td>
</tr>
<tr>
<td>E</td>
<td>Goiás</td>
<td>Jataí (1)</td>
<td>17° 51’ S 51° 45’ W</td>
<td>‘ANTA 82**’</td>
</tr>
<tr>
<td>F</td>
<td>Goiás</td>
<td>Jataí (2)</td>
<td>17° 49’ S 51° 41’ W</td>
<td>‘P 98Y11**’</td>
</tr>
<tr>
<td>G</td>
<td>Goiás</td>
<td>Rio Verde (1)</td>
<td>17° 40’ S 51° 02’ W</td>
<td>‘M-Soy 6101’</td>
</tr>
<tr>
<td>H</td>
<td>Goiás</td>
<td>Rio Verde (2)</td>
<td>17° 40’ S 51° 02’ W</td>
<td>—2</td>
</tr>
<tr>
<td>I</td>
<td>Mato Grosso do Sul</td>
<td>Chapadão do Sul</td>
<td>18° 51’ S 52° 35’ W</td>
<td>‘ANTA 82**’</td>
</tr>
<tr>
<td>J</td>
<td>Minas Gerais</td>
<td>Araporã</td>
<td>18° 26’ S 49° 11’ W</td>
<td>—2</td>
</tr>
<tr>
<td>K</td>
<td>Minas Gerais</td>
<td>Tupaciguara (1)</td>
<td>18° 31’ S 48° 54’ W</td>
<td>‘BRS Valiosa RR’</td>
</tr>
<tr>
<td>L</td>
<td>Minas Gerais</td>
<td>Tupaciguara (2)</td>
<td>18° 31’ S 48° 54’ W</td>
<td>—2</td>
</tr>
<tr>
<td>M</td>
<td>Minas Gerais</td>
<td>Unai</td>
<td>15° 59’ S 46° 41’ W</td>
<td>‘BRS Valiosa RR’</td>
</tr>
</tbody>
</table>

1Areas 1 and 2 are in different localities of the municipality.
2Spontaneous soybean.
Table 3. Mite species found on soybean crops located in the Cerrado region. The numbers refer to the date of sampling (1: sampling 40 days after sowing; 2: sampling 80 days later; and 3: sampling on spontaneous soybean). Area codes are defined in Table 2.

<table>
<thead>
<tr>
<th>Mite Species</th>
<th>Area</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asca sp. 1</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
<td>I</td>
<td>J</td>
<td>K</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Asca sp. 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africoseius sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proctolaelaps sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. alatus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. annectens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. zuluagai</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. benjamiini</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. idaeus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. tunus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. ovatus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. aripo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czenspinskia sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neocunaxoides sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. tricholaenae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metapronematus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pronematus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aff. Tarsonemus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neotarsonemoides sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. latus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. bilobatus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. confusus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tarsonemus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tarsonemus waitei</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xenotarsonemus sp.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. planki</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. formosa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Galumna sp.

Previous records in Brazil: Mato Grosso (Oliveira 2010). Diet: Same as G. glabra.

Oribatulidae

Zygoribatula bonairensis (Willmann, 1936)

Previous records in Brazil: Maranhão (Oliveira 2010). Diet: Same as G. glabra.

Zygoribatula translineata (Mahunka, 1985)

Previous records in Brazil: Mato Grosso: Cláudia, Sorriso (Vivan et al. 2011). Diet: Same as G. glabra.

Scheloribatidae

Scheloribates praecincisus (Berlese, 1910)

Previous records in Brazil: Mato Grosso (Oliveira 2010). Diet: Same as G. glabra.

Winterschmidtiidae

Czenspinskia sp.

Origin: Goiás: Jataí (1): XII-09 (4). Diet: This genus is considered to be fungivorous (Krantz 2009).

Order Trombidiiformes

Cunaxidae

Neocunaxoides sp.


Diptilomiopidae

Catarhinus tricholaenae Keifer, 1959

Origin: Goiás: Cristalina: I-10 (1); Minas Gerais: Tupaciguara (1): XII-09 (2), Unaí: I-10 (3).
Diet: All species included in Diptilomiopidae are considered phytophagous (Walter et al. 2009).

Iolinidae

Metapronematus sp.
 Origin: Goiás: Jataí (2); XII-09 (2). Diet: This genus consists of fungivores and predators of eriophyoid and tetranychid mites (O’Dowd & Wilson 1997).

Pronematus sp.

Tarsonemidae

aff. Tarsonemus sp.
 Origin: Goiás: Cristalina: I-10 (1).

Neotarsonemoides sp.

Polyphagotarsonemus latus Banks, 1904

Tarsonemus bilobatus Suski, 1965

Tarsonemus confusus Ewing, 1939

Tetranychidae

Monychellus planki (McGregor, 1950)

Tetranychus desertorum Banks, 1900

Tetranychus gigas Pritchard & Baker, 1955
Tetranychus ludeni Zacher, 1913


Tetranychus sp.


Tetranychus urticae Koch, 1836


Tydeidae

Lorryia formosa Cooreman, 1958

Origin: Goiás: Chapadão do Céu: I-10 (2); Minas Gerais: Tupaciguara (1): XII-09 (1). Diet: Lorryia formosa can be found on some cultivated plants, e.g., rubber trees. However, they were not seen causing evident damage (Hernandes & Fe- res 2006). Therefore, its feeding habit remains unclear.

DISCUSSION

Of the 31 species found in this study, only Galendromus (G.) annectens, M. planki, P. latus and T. aripo had been reported in previous studies. The other collected species are new records of the fauna found in soybean, in Brazil. Furthermore, the 4 above-mentioned species are the only ones, until the present date, commonly registered in the soybean crops of Rio Grande do Sul and in the country’s central region.

The prior data from Montes Claros (Leite et al. 2003) and Unaí (Oliveira et al. 2007), when added to the species recorded in the samplings carried out in this work, show that the species richness of mites associated with soybean in the Cerrado region (31 species) is much higher than observed in the surveys carried out in Rio Grande do Sul (14 species). Twenty seven species of mites have been found exclusively on soybean plants in the Cerrado biome. The lower number of species found thus far in Rio Grande do Sul probably results from the close proximity of the fields analyzed in that state, compared with the samplings carried out more widely in the Cerrado biome. It is known that increased distances between certain sites results in increased β diversity, i.e., the sum of the various species observed in the respective areas (Nekola & White 1999).

Besides the surveys made in Rio Grande do Sul and Minas Gerais, other studies showed that oribatid mites have been found on soybean (G. glabra, Calumna sp., S. praeniceps, Z. bonairensis e Z. translineata) in Maranhão and Mato Grosso states (Oliveira 2010; Vivan et al. 2011). There is a suspicion that these species would be related to a recent plant disorder observed in crops in these states and commonly known as “crazy soybean II”, which is marked by malformation of flowers and pods, resulting in significant reductions of production, in some cases. Up to now, there are records of this disease only in Brazil (Saraiva et al. 2010). None of the studies conducted have confirmed a connection between this disorder and these mites. It is known that most of oribatid species exhibit mycophagous and saprophagous feeding, i.e., they can ingest dead plant material, spores or fungal fragments (Schneider et al. 2005; Norton & Behan-Pelletier 2009; Oliveira 2010). This characteristic, at least, suggests that a direct connection between oribatid mites and the new disorder would be improbable. Although there are some references to oribatid mites feeding on cultivated plants, these reports are isolated and rare. Thus, no oribatid species has reached pest status (A. R. Oliveira, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, personal communication).

Considering only the data attained from the samplings under this study, Phytoseiidae and Tarsonemidae presented the largest richness. However, almost 50% of the Phytoseiidae were found exclusively in spontaneous soybean. According to the farmers’ statements, their crops were treated with several pesticides. Some chemical defensives can suppress populations of non-target species present in the field, i.e., predatory mites (Degrande et al. 2002; Guedes et al. 2007). So, it is possible that the lower diversity of Phytoseiidae, recorded in cultivated soybean, might be related to pesticide application. Anyway, the occurrence of certain phytoseiid species in the field, i.e. E. alatus, G. annectens, I. zuluagai, N. anonymus, P. fragariae and T. aripo must be highlighted because these mites can contribute effectively to the pest mite control (De Vis et al. 2006; Gerson et al. 2003; Ferla & Moraes 2003; McMurtry & Croft 1997; Melo et al. 2009; Reis et al. 2003; Vasconcelos et al. 2003). As for the Tarsonemidae, in contrast to the results of Phytoseiidae, all the species have been recorded exclusively in cultivated soybean. Most of them belong to Tarsonemus genus, which is comprised of fungivorous species (Lindquist 1986).

The results attained from several surveys carried out indicate that M. planki was the mite spe-
cies most frequently found on soybean in Brazil, until the present date, considering the numbers of crops on which it has been recorded. Bolland et al. (1998) mentioned that M. planki is broadly distributed, extended throughout the American continent. In addition, this mite has been recorded on 64 other host plants species (Migeon & Dorkeld 2011). Some works report populations of M. planki as harmful to several crops in Brazil, e.g., cotton, peanut, beans and okra (Flechtmann 1981; Moraes & Flechtmann 2008). Thus, there is no doubt that this mite has relevance for Brazil's national agriculture. Therefore studies about control and biological aspects of M. planki are needed in Brazil.

Polyphagotarsonemus latus (Tarsonemidae) can be considered as another species with potential of being a pest for soybean production in Brazil. This mite species was recorded both in the Cerrado areas and in the surveys carried out by Guedes et al. (2007) and Leite et al. (2003). It is known that this species is present on a large number of host crops (Lindquist 1986). Other potential pests species included in the presented list are mites of the Tetranychus genus. It should be highlighted that none of these species were recorded in the samplings carried out in crops from Rio Grande do Sul. According to Moraes & Flechtmann (2008), all such species are seen as pest mites in certain crops. Guedes et al. (2007) asserted that some of these species were recorded in localized infestations in Rio Grande do Sul state. Furthermore, T. urticae is cited as an important pest mite in soybean in several parts of the world (Abraham 2000; Carlson 1969; Hoda et al. 1986; Shabalta et al. 1992; Singh 1988). Such facts certainly add to the importance of T. urticae as an agricultural pest.

Finally, although the mite densities observed in the samplings did not indicate risks of economic damage, it is necessary to take into account the potential these species to cause economic damage. Hence, the mere occurrence of their populations should be periodically monitored so that infestation of those mites can be properly handled in the future, without great losses in the soybean production chain.

ACKNOWLEDGMENTS

To Fapesp (Fundação de Amparo a Pesquisa do Estado de São Paulo) (Procs. nº 06/57868-9 e nº 08/07835-2) and Capes (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) for financial support. To the farmers who kindly made this work possible by allowing their crops to be used in the study. To Prof. Dr. Aníbal R. Oliveira (UESC), who elucidated the doubts about the relation between oribatid mites and the soybean disease “crazy soybean II”. To Dr. Edson Hirose (Embrapa Soja), Dr. Márcio F. Peixoto (IFET - Rio Verde-GO) and Dr. Luis Adriano Maia Cordeiro (Embrapa Sede), for helping on the selection of the studied areas. To the colleagues Bárbara M. Oliveira, Fábio de S. Tavares, Fernanda M. Silva, Felipe M. Nuvoloni, José César de Souza, Pérola M. Paulon, Peterson R. Demite and Tarciso V. Martins for helping on the samplings and the examination of the sampled material.

REFERENCES CITED


To Fapesp (Fundação de Amparo a Pesquisa do Estado de São Paulo) (Procs. nº 06/57868-9 e nº 08/07835-2) and Capes (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) for financial support. To the farmers who kindly made this work possible by allowing their crops to be used in the study. To Prof. Dr. Aníbal R. Oliveira (UESC), who elucidated the doubts about the relation between oribatid mites and the soybean disease “crazy soybean II”. To Dr. Edson Hirose (Embrapa Soja), Dr. Márcio F. Peixoto (IFET - Rio Verde-GO) and Dr. Luis Adriano Maia Cordeiro (Embrapa Sede), for helping on the selection of the studied areas. To the colleagues Bárbara M. Oliveira, Fábio de S. Tavares, Fernanda M. Silva, Felipe M. Nuvoloni, José César de Souza, Pérola M. Paulon, Peterson R. Demite and Tarciso V. Martins for helping on the samplings and the examination of the sampled material.
