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Two new species of *Daidalotarsonemus* (Acari: Prostigmata: Tarsonemidae) from Brazil

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ABSTRACT — Two new tarsonemid species, *Daidalotarsonemus esalqi* n. sp. and *Daidalotarsonemus savanicus* n. sp., found on both native and crop plants in Brazil are described herein, based on adult females. Biological aspects of these species are briefly discussed. Individuals of *Daidalotarsonemus savanicus* n. sp. have been misidentified as *Daidalotarsonemus tessellatus* De Leon in previous reports of this species from Brazil. A key is provided to distinguish females of the *Daidalotarsonemus* species known to occur in Brazil.

KEYWORDS — Heterostigmata; Cerrado; rubber tree; taxonomy

INTRODUCTION

The genus *Daidalotarsonemus* De Leon (1956) (Prostigmata: Tarsonemidae) currently consists of 37 described species. It has been registered on all continents, except Antarctica, and is considered a plant inhabiting group with apparent preference for humid places, with an abundance of algae, lichen and fungi (Lindquist 1986; Lin and Zhang 2002; Lofego et al. 2005; Sousa et al. 2014; Rezende et al. 2015a; b).

Three species, *Daidalotarsonemus folisetae* Lofego & Ochoa, *D. annonae* Sousa, Lofego & Gondim Jr. and *D. oliveirai* Rezende, Lofego & Ochoa, have been described from Brazil (Lofego et al. 2005; Sousa et al. 2014; Rezende et al. 2015a). In addition, *Daidalotarsonemus fossae* De Leon was reported in the State of Pernambuco (Sousa et al. 2015). Based on an examination of specimens deposited in museum collections, two new Brazilian species of the genus, *Daidalotarsonemus esalqi* n. sp. and *Daidalotarsonemus savanicus* n. sp., found in rubber tree crops and Cerrado sensu stricto habitats, respectively, are described and illustrated.

MATERIALS AND METHODS

Specimens were examined from the mite collections of Departamento de Entomologia, Fitopatologia e Zoologia Agrícola, Universidade de São Paulo, Escola Superior de Agricultura “Luiz de Queiroz” (ESALQ/USP), Piracicaba; and Departamento de Zoologia e Botânica (DZSRP), Universidade Estadual Paulista, São José do Rio Preto, both from State
of São Paulo, Brazil. They were analyzed by two techniques: phase contrast microscopy (PC) and differential interference contrast microscopy (DIC). The specimens were examined, drawn and photographed using an optical microscope Leica® DFC 500.

The terminology used herein mainly follows Lindquist (1986), except for gnathosomal setae dgs and vgs (Magowski et al. 1998; Suski 1967). For each structure, the mean measurements are provided in micrometers (µm), followed in parentheses by the range of the specimens measured (when available), including the holotype. For the diagnoses, comparisons with previously described species were based on the study of the types. The following abbreviations are used for institutions where the types are deposited: DZSJRP, ESALQ/USP and USNM (United States National Museum of Natural History, Smithsonian Institution, at National Insect and Mite Collection at USDA, SEL, Beltsville, Maryland, USA).

RESULTS

Key to the species of Daidalotarsonemus from Brazil (based only on females)

1. Setae c1 inserted near posterior border of tergite C; tegula rounded apically .......................... 2
   — Setae c1 inserted in the middle of the tergite C or near anterior border of this plate; tegula truncated......................................................... 3

   — Posterior dorsal setae d, e and f rod-shaped........ Daidalotarsonemus fossae De Leon

3. No rows of reticula on tergite C ......................... 4
   — At least one row of reticula on tergite C ...... 5

4. Setae c1 setiform; setae e phylliform............................. Daidalotarsonemus folisetae Lofego & Ochoa
   — Setae c1 with rounded tip; setae e cor-
date........................................ Daidalotarsonemus oliveirai Rezende, Lofego & Ochoa

5. Setae e thin (± 3 µm); palps long (± 18 µm).................. Daidalotarsonemus esalqi n. sp. (Figures 1-4)
   — Setae e broad (± 17 µm); palps short (± 10 µm)........ Daidalotarsonemus savanicus n. sp. (Figures 5-8)

Daidalotarsonemus esalqi n. sp.
(Figures 1-4)

Diagnosis — Females of this new species are most similar to Daidalotarsonemus venustus Attiah (1970) by the reticulated ornamentation on tergite C and by the similar length of the dorsal setae v1, sc2, c1, c2 and h. However, they differ by having the ornamentation pattern on tergite D reticulated only between setae d for D. esalqi; by the length of palps, longer for the new species; by pharynx shape, larger for D. esalqi; and by the shape, length and width of the posterior setae d, e and f, all smaller for this new species.

Adult female (three specimens measured).

Gnathosoma — covered by the prodorsum, sub-
triangular in ventral view, length 34 (32 – 36), maxi-
num width 24 (23 – 26); dorsal apodeme distinct.
Setae dgs 10 (9 – 11) and vgs 7 (7 – 8) smooth; palps
long 17 (17 – 18), with one small subterminal seta.
Pharynx fusiform, 14 (13 – 16) long and 8 (7 – 10)
wide at maximum width.

Idiosoma - dorsum (Figures 1 and 4): length 201
(198 – 207), width at level of c1 97 (95 – 102). Stigma
located near lateral notch of prodorsal shield, which
is equidistant to the v1 and sc2 setal bases. Prodor-
sum with regular ornamentation covering it; tergite
C with three transverse central rows of reticula and
irregular ridges around it; tergite D with three cen-
tral rows of reticula and irregular ridges around set-
tae d. Lengths of the setae: v1 25 (22 – 27), sc1 13
(13 – 14), sc2 27 (24 – 30), c1 18 (16 – 21), c2 17 (16 –18), d 25 (24 – 26), e 13 (12 – 14), f 25 (24 – 27) and h
12 (11 – 13). Maximum width of expanded setae: d
FIGURE 1: Daidalotarsonemus esalqi n. sp. (female): Dorsal surface of the idiosoma.
FIGURE 2: *Daidalotarsonemus esalqi* n. sp. (female): Ventral surface of the idiosoma.
FIGURE 3: *Daidalotarsonemus esalqi* n. sp. (female). Legs: A – leg I; B – leg II; C – leg III; D – leg IV.
Figure 4: Daidalotarsonemus esalqi n. sp. (female): Dorsal micrograph of the idiosoma.
Diagnosis — Females of this new species are most similar to Daidalotarsonemus tessellatus De Leon (1956) and Daidalotarsonemus ethiopicus Mahunka (1981) for the ornamentation pattern on tergite C and shape of anterior setae v1, sc2, c1 and c2. They differ from the others by the ornamentation pattern on tergite D, with reticulation all over it including a rhomboid reticulum on the center of the plate; shape of posterior setae d, e, f and h; and shape of the setae pl on tarsus II, which are stout and serrate.

Adult female (eight specimens measured).

Gnathosoma — covered by the prodorsum, sub-triangular in ventral view, length 31 (30 – 33), maximum width 20 (19 – 23); dorsal apodeme distinct. Setae dgs 13 (11 – 14) and vgs 9 (8 – 10) smooth; palps short 9 (9 – 10), with one small subterminal seta. Pharynx fusiform, 17 (15 – 18) long and wide 10 (9 – 12) at maximum width.

Idiosoma - dorsum (Figures 5 and 8) — length 228 (223 – 232), width at level of c1 141 (138 – 142); prodorsal shield with regular ornamentation. Stigma located near lateral notch of prodorsal shield, which is equidistant to the v1 and sc2 setal bases. Tergite C with four transverse central rows of reticula and irregular ornamentation laterally. Tergite D with irregular ridges, including a rhomboid reticulum on the center of the plate. Lengths of the setae: v1 27 (26 – 29), sc1 12 (11 – 14), sc2 38 (36 – 441).
**FIGURE 5:** *Daidalotarsonemus savanicus* n. sp. (female): Dorsal surface of the idiosoma.
Figure 6: Daidalotarsonemus savanicus n. sp. (female): Ventral surface of the idiosoma.
FIGURE 7: Daidalotarsonemus savanicus n. sp. (female). Legs: A – leg I; B – leg II; C – leg III; D – leg IV.
FIGURE 8: Daidalotarsonemus savanicus n. sp. (female): Dorsal micrograph of the idiosoma.
All dorsal setae serrate; except for width of expanded setae: \( d \), \( f \) and \( v' \) tibiotarsus IV 9 (9). Length of leg IV setae: \( II \) 12 (11 – 14), serrate. Femorogenu IV 33 (31 – 34); seta \( \varphi \) proximally inserted, 5 long, stout, wider medially; \( v_1 \) tibia I 13 (12 – 15), serrate. Solenidion \( v_1 \) between dorsal setae: subelliptical, with one lateral vein. Distances between dorsal setae: \( v_1-v_1 \) 28 (26 – 29), \( sc_2-sc_2 \) 53 (50 – 54), \( v_1-sc_2 \) 30 (29 – 31), \( c_1-c_1 \) 56 (54 – 57), \( c_2-c_2 \) 116 (115 – 117), \( c_1-c_2 \) 37 (36 – 39), \( d-d \) 38 (37 – 40), \( f-f \) 14 (13 – 16), \( e-f \) 14 (12 – 15) and \( h-h \) 18 (17 – 20). Setae \( sc_2 \) inserted posterosmedial to \( sc_1 \).

Idiosoma - venter (Figure 6) — setae \( 1a \) 7 (6 – 9), posteriolar of apodemes 1; \( 2a \) 9 (8 – 9), postero-lateral and near middle of apodemes 2; \( 3a \) 16 (15 – 18) near anteriomedial margins of apodemes 3; \( 3b \) 15 (13 – 17) on posterior margins of apodemes 4. Apodeme 1 conspicuous, fused to anterior end of prosternal apodeme. Apodeme 2 not fused to the prosternal apodeme. Prosternal apodeme conspicuous from junction with apodeme 1 to the middle portion of sejugal apodeme, where is fused with it. Sejugal apodeme uninterrupted, with a median furrow. Apodeme 3 with a constriction near its middle, extending diagonally from proximity of base of seta \( 3a \) to anterior margin of trochanter 3; apodeme 4 extending diagonally from the middle of the poststernal apodeme to base of seta \( 3b \). Poststernal apodeme bifurcated anteriorly. Tegula 14 (12 – 15) wide and very short 4 (4 – 5); posterior margin slightly arched. Setae \( ps \) 21 (19 – 22) serrate.

Legs (Figure 7) — lengths (measured from femur to tarsus): \( leg \) I 45 (42 – 46), \( leg \) II 47 (45 – 48), \( leg \) III 85 (83 – 86). Number of setae (solenidia in parentheses) on femur, genu, tibia and tarsus, respectively: \( leg \) I: 3-4-5(2)+7(1), \( leg \) II: 3-4-4-3(1), \( leg \) III: 3-4-4. Tarsal solenidion \( \omega \) of tibiotarsus I 6, stout, wider medially. Sensory cluster of tibia I complete, solenidion \( \varphi \) 3, slender, capitate; solenidion \( \varphi \) 2 2 (2-3), robust, slightly capitate; famulus \( k \) 4 (4 – 5); all inserted at approximately the same level. Seta \( d \) of tibia I 13 (12 – 15), serrate. Solenidion \( \omega \) of tarsus II proximally inserted, 5 long, stout, wider medially; seta \( p'' \) of tarsus II stout and serrate. Seta \( d \) of tibia II 12 (11 – 14), serrate. Femorogenu IV 33 (31 – 34); tibiotarsus IV 9 (9). Length of leg IV setae: \( v' \) F 8 (7 – 9), \( v' \) G 17 (16 – 19), \( v' \) Ti 25 (23 – 26) and \( tc'' \) 59 (58 – 62); all setae smooth, except for \( v' \) G serrate; \( v' \) Ti falcate.

Adult male and larva — Unknown.

Type material — Holotype and eleven paratypes. Holotype from Caryocar brasiliense Camb. (Caryocaraceae). Among paratypes, two from Campomanesia pubescens (DC.) Berg (Myrtaeae), one from Miconia albicans (Sw.) Triana (Melastomataeae), one from Myrtaceae sp., one from Pouteria torta (Mart.) Radlk. (Sapotaceae), 52°35’W 18°51’S, Chapadão do Sul, State of Mato Grosso do Sul, 26/1/2010, J.M. Rezende, A.C. Lofego & P.M. Paulon; one from Bauhinia sp. (Fabaceae), one from Didymopanax vinosum Cham. & Schltdl. (Araliaceae), one from Myrtaceae sp., 52°44’W 18°15’S, Chapadão do Céu, State of Goiás, 02/II/2010; one from Genipa americana L. (Rubiaeae), 51°45’W 17°51’S, Jataí, State of Goiás, 05/II/2010; one from Xylopia aromatica (Lam.) Mart. (Annonaceae), 48°54’W 18°31’S, Tupaciguara, State of Minas Gerais, 10/II/2010; one from Cerrado, a savannah biome in which this species is commonly found.

Etymology — the name savanicus refers to the Cerrado, a savannah biome in which this species is commonly found.

Remarks — Following an examination of voucher specimens, we conclude that individuals of this new species have been recorded as Daidalotarsonemus tessellatus De Leon in previous papers (Busosi et al. 2006, Demite et al. 2009, Feres et al. 2005, Lofego et al. 2005 and Sousa et al. 2015). The observations made by Lofego et al. (2005) regarding the habits for Daidalotarsonemus tessellatus, for which phytophagy was observed, should be confirmed to Daidalotarsonemus savanicus.

**DISCUSSION**

Although Daidalotarsonemus has almost always been found in sites having a humid environment, the record of *D. savanicus* in the Cerrado reinforces
that this genus is not exclusively from such places. The Cerrado biome is very dry weather for at least half of the year (Ribeiro and Walter 1998). Another species, Daidalotarsonemus ethiopicus Mahunka (1981), is also described from a region with similar dry conditions. Such a range of distribution may represent an extraordinary adaptation of this genus to different levels of humidity, which partially explains the worldwide distribution of the taxon. Also, the diversity of host plants for D. savanicus suggests that there is not a host preference for this species; instead, environmental factors might be more important for its occurrence in the Cerrado biome.

The finding of a new species inhabiting rubber trees, a well studied crop around the world, demonstrates how poor our knowledge of the mite fauna of many areas remains. A large number of mite species have already been recorded in association with Hevea brasiliensis in Brazil (Hernandes and Feres 2006; Demite and Feres 2007; Bellini et al. 2008; Daud and Feres 2013; Nuvoloni et al. 2014; 2015). The added record of D. esalqi highlights the importance for a better understanding of host plant inhabiting tarsonemid associations, and their ecological role in natural environments and cultivated areas.

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