

## Three new *Trachyuropoda* (Acari: Uropodina: Trachyuropodidae) species from the Neotropical region

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Received: 19.04.2012 • Accepted: 26.06.2012 • Published Online: 24.12.2012 • Printed: 21.01.2013

**Abstract:** Three new neotropical *Trachyuropoda* species are described and illustrated. A new species (*T. darwini* sp. nov.) from the neotropical *Trachyuropoda arcuata*-group was collected in the Galápagos Islands. Two new species (*T. bali* sp. nov. and *T. extremica* sp. nov.) were collected in Colombia. *T. bali* sp. nov. belongs to the mostly tropical *Trachyuropoda graeca*-group; the other Colombian species (*T. extremica* sp. nov.) is a member of the widely distributed *Trachyuropoda bostocki*-group.

**Key words:** Acari, Uropodina, *Trachyuropoda*, Galápagos Islands, Colombia

### 1. Introduction

Trachyuropodidae is one of the most interesting families within Uropodina mites, which can easily be recognized as their body is strongly sclerotized and the surface of their idiosoma is usually covered by depressions and ridges (Kontschán, 2007; Lindquist et al., 2009; Kontschán, 2011).

Besides their unique morphology, the habitat of trachyuropodid mites is very remarkable; most of the species of this family inhabit anthills. However, we have only limited information about the contact between ants and mites. The European trachyuropodid mite species are associated with characteristic ant species (Mašán, 2001). We know that some species occur only in the nests of 1 or 2 ant species, but most trachyuropodid species can be found in the nests of numerous different ant species (Mašán, 2001). In several cases, they can also live in soil, leaf litter, and moss (Mašán, 2001; Kontschán, 2007).

There are at least 100 described species of trachyuropodids worldwide (Wiśniewski and Hirschmann, 1993), with approximately one-third of the species occurring in the Neotropical region (Wiśniewski, 1993; Kontschán, 2011). During the study of soil samples from the collection of the Biology Centre AS CR, Institute of Soil Biology, České Budějovice, and unsorted soil samples of the Soil Zoology Collection in the Hungarian Natural History Museum, we found a new species from the Galápagos Islands and 2 other new species from Colombia.

### 2. Materials and methods

Specimens were cleared in lactic acid and later stored in alcohol. Preparations were examined with a light

microscope; drawings were made with the aid of a drawing tube (Opton scientific microscope). Photographs were taken with a Nikon CoolPix900 digital camera. All specimens examined were stored in alcohol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest (HNHM), and the Biology Centre AS CR, Institute of Soil Biology, České Budějovice (ISB). Abbreviations: h1–h4, hypostomal setae.

### 3. Results and discussion

#### 3.1. Family Trachyuropodidae Berlese, 1917

##### 3.1.1. Genus *Trachyuropoda* Berlese, 1888

###### 3.1.1.1. *Trachyuropoda darwini* sp. nov.

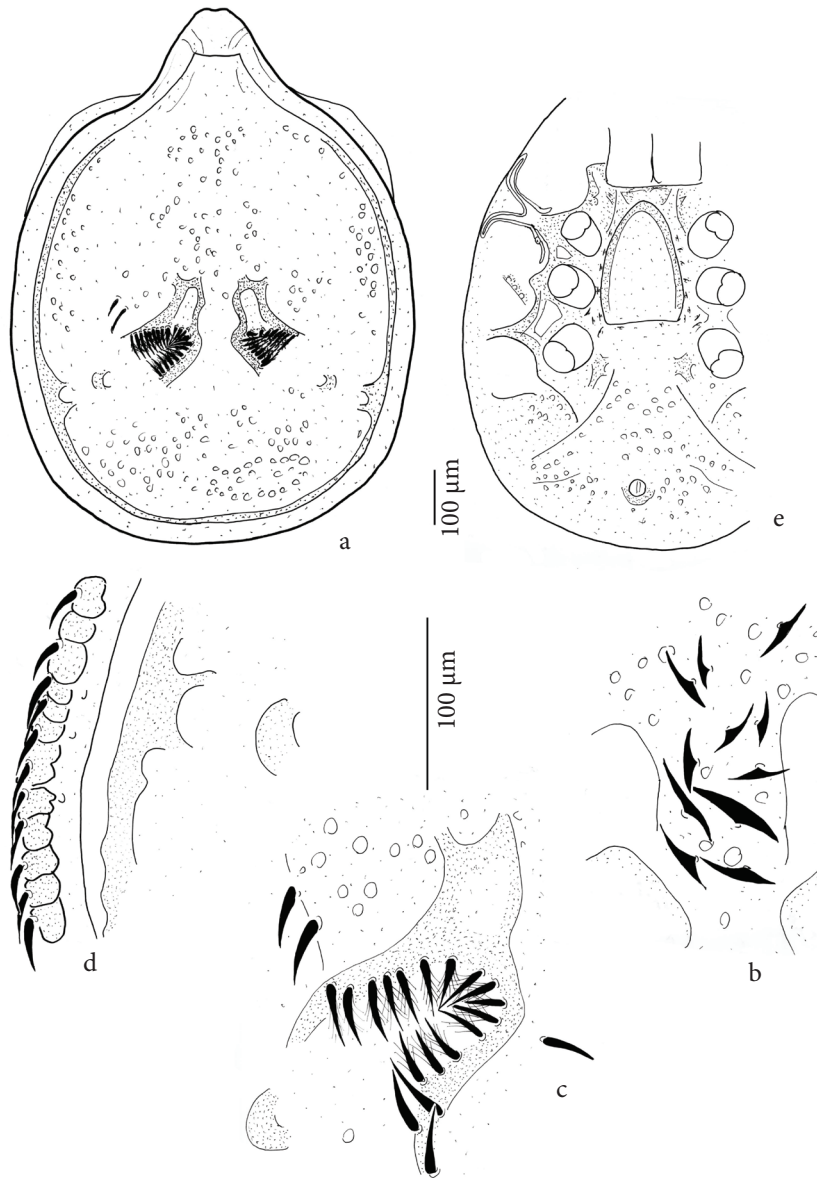
(Figures 1–5)

Material examined: Holotype: Female. Galápagos Islands, Floreana Island, Asilo de la Paz, 17 May 1975, near spring in forest, sample of decaying wood and fern rhizosphere near spring, leg. H. Franz (HNHM). Paratypes: 20 females, 8 males, and 3 deutonymphs, locality and date same as in holotype (ISB).

Description: Female. Length of idiosoma 950–1000 µm, width 750–780 µm (n = 21). Shape oval, posterior margin rounded.

Dorsal idiosoma (Figures 1a and 4a): Marginal and dorsal shields completely separated. Dorsal shield hypertrichous, with 2 different types of setae. One of them is T-shaped, with a short stem and a long and serrate cross-bar (Figure 1b), these setae situated on the central area of dorsal shield. The other type of setae wide and spine-like (ca. 36–40 µm) (Figure 1c); these can be found on the

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**Figure 1.** *Trachyuropoda darwini* sp. nov. female: a) dorsal view; b) T-shaped dorsal setae; c) funnel-shaped pits with setae; d) marginal setae; e) ventral view.

marginal surface of dorsal shield. Dorsal shield bearing 1 pair of deep, U-like transversal furrows bordered with (ca. 28–32  $\mu\text{m}$ ) marginally pilose, spine-like setae (Figures 4b and 4c). Dorsal shield covered by alveolar pits. Margin of dorsal shield strongly sclerotized. Marginal shield without ornamentation, marginal setae spine-like (ca. 22–23  $\mu\text{m}$ ) and situated on platelet-like, strongly sclerotized surface (Figure 1d).

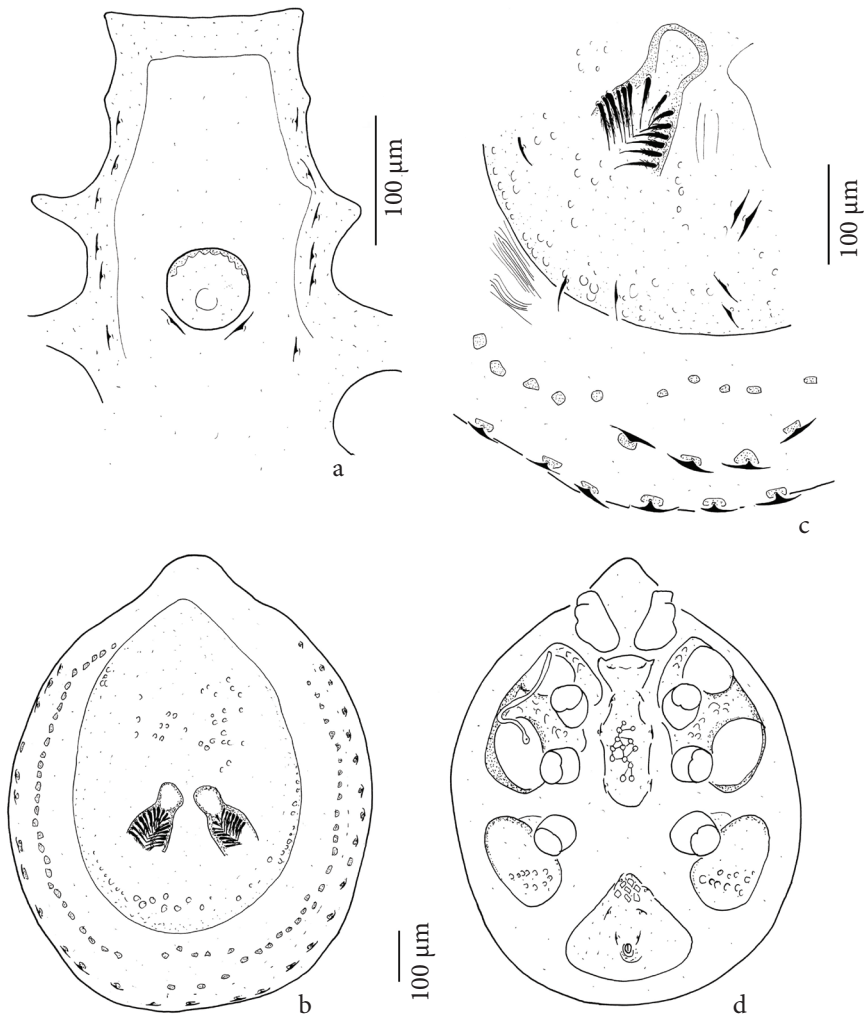
Ventral idiosoma (Figures 1e and 4d): Surface of sternal shield smooth, several T-shaped sternal setae can be observed. Ventral shield covered by alveolar pits and bearing numerous T-shaped setae. Setae around

anal opening similar in shape to ventral setae. Stigmata situated between coxae II and III, peritremes M-shaped. Genital shield linguliform without apical process, and its surface smooth. Base of tritosternum narrow, tritosternal laciniae divided into 4 apically serrate branches (Figure 2a). Pedofossae deep, their surface smooth, except the separated furrows for tarsi IV, which are ornamented by oval pits.

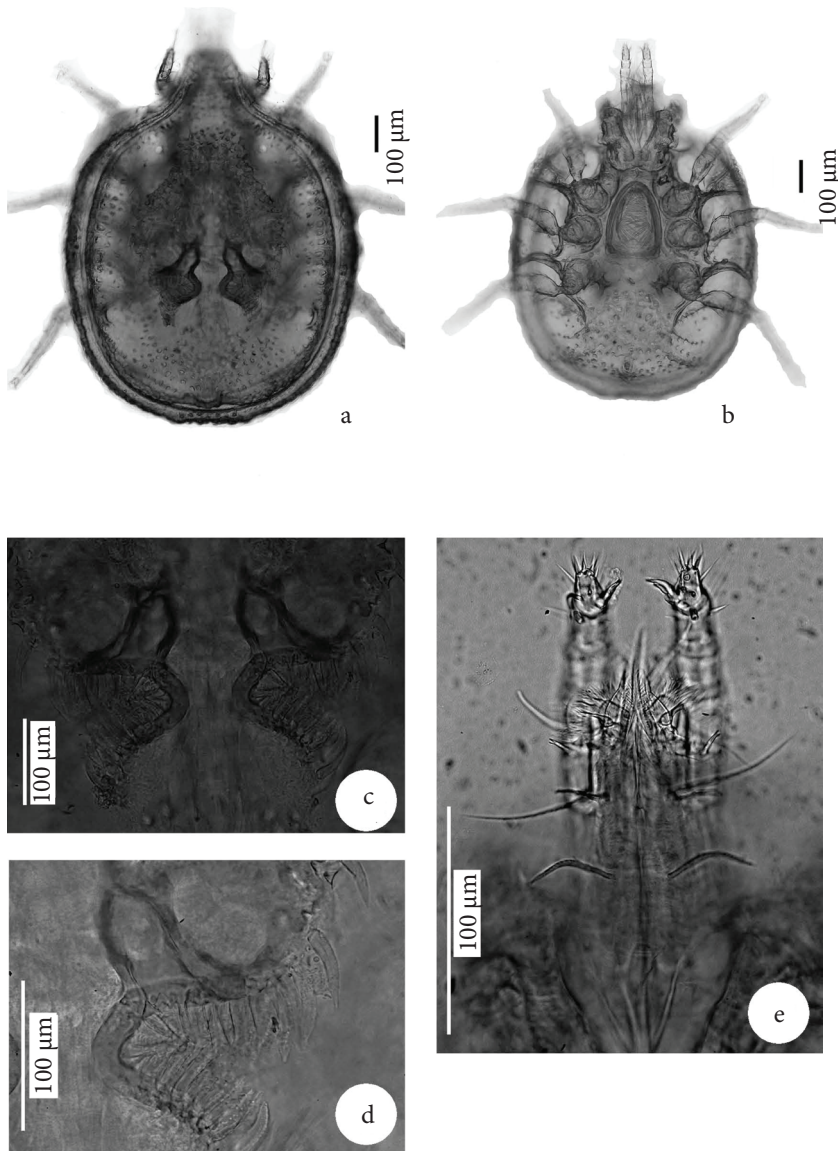
Gnathosoma (Figures 2b and 4e): Corniculi horn-like, internal malae divided into several marginally pilose branches. Hypostomal setae are as follows: h1 smooth and situated near the anterior margin of gnathosoma (not



**Figure 2.** *Trachyuropoda darwini* sp. nov. female: a) tritosternum; b) ventral view of gnathosoma; c) epistome.



**Figure 3.** *Trachyuropoda darwini* sp. nov.: a) intercoxal area of male; b) dorsal view of deutonymph; c) marginal and dorsal setae; d) ventral view of deutonymph.



**Figure 4.** *Trachyuropoda darwini* sp. nov. female: a) dorsal view; b-c) funnel-shaped pits; d) ventral view of body; e) ventral view of gnathosomal area.

clearly visible, covered by branches of internal malae), h2 short (ca. 40 µm), h3 long (ca. 145 µm), and h4 long (ca. 73 µm), each marginally serrate. Epistome subtriangular, margins basally serrate, apically pilose (Figure 2c). Chelicerae not clearly visible. Trochanter of palps bearing a short and a long seta, each smooth. Other setae on palps smooth.

**Male.** Length of idiosoma 980–990 µm, width 710–740 µm (n = 8). Shape oval, posterior margin of idiosoma rounded.

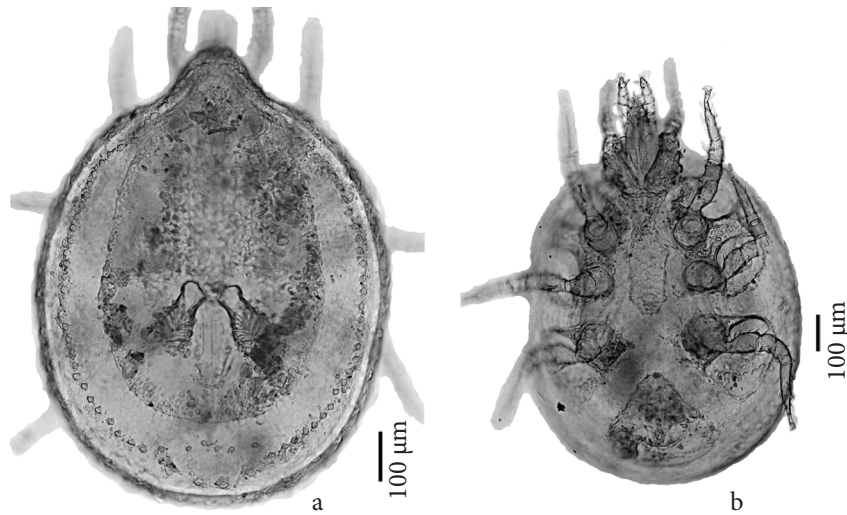
**Dorsal side:** Well-sclerotized ridges and bulges as in female.

**Ventral side:** Sternal region of holo gastric shield strongly sclerotized near anterior margin of genital opening. All sternal setae short, smooth, and T-shaped.

Ornamentation of sternal shield absent (Figure 3a). Ventrianal area of holo gastric shield with several T-shaped setae and with alveolar ornamentation on the anal region. Adanal and postanal setae smooth, short, and T-shaped. Legs and gnathosoma similar to that of female.

**Deutonymph.** Length of idiosoma 880–950 µm, width 640–680 µm (n = 3). Shape oval, posterior margin rounded. Dorsal shield scutiform, bearing maculate ornamentation and T-shaped setae (Figures 3b and 5a), U-like transversal furrow bordered with marginally pilose setae similar to the adults (Figure 3c). Several quadrangular platelets can be observed on submarginal area, none of them bearing setae, several irregular platelets bearing T-shaped setae present on marginal area (Figure 3c), as precursors of marginal





**Figure 5.** *Trachyuropoda darwini* sp. nov. deutonymph: a) dorsal view; b) ventral view of gnathosomal area.

shield of the adults. Sternal shield short, bearing oval pits, its posterior margin reaching to the anterior margin of coxae IV. Ventrianal shield subtriangular and ornamented by maculate sculptural pattern (Figures 3d and 5b).

Protonymphs and larvae are unknown.

**Etymology:** We dedicate the new species to the famous scientist Charles Darwin, who established the hypothesis of evolution based on his observations on the fauna of the Galápagos Islands.

**Notes:** The new species belongs to the *Trachyuropoda arculata*-group (Hirschmann, 1976), which consists of 4 Neotropical species (*Trachyuropoda arculata* Hirschmann, 1975; *Trachyuropoda difoveolata* Hirschmann, 1975; *Trachyuropoda similiarculata* Hirschmann, 1975; and *Trachyuropoda newtoni* Kontschán, 2010). Their common characters are the 2 U-shaped dorsal cavities on the level of coxae IV. The distinguishing characteristics are shown in Table 1.

### 3.1.1.2. *Trachyuropoda bali* sp. nov.

**Material examined:** Holotype: Female. Colombia, near Rio Claro, from leaf litter, 15 May 1984, leg. J. Balogh (HNHM). Paratypes: 2 females, locality and date same as in holotype (1 paratype in ISB, 1 in HNHM).

**Description:** Female. Length of idiosoma 1290–1320 µm, width 1010–1020 µm ( $n = 3$ ). Shape oval, posterior margin rounded.

**Dorsal idiosoma (Figure 6a):** Marginal and dorsal shields completely separated. Dorsal shield hypertrichous, dorsal setae (ca. 70–79 µm) smooth and spine-like (Figure 6b). Dorsal shield bearing 1 pair of L-shaped grooves bordered with long (ca. 57–64 µm), smooth, and spine-like setae (Figure 6b). Dorsal shield covered by alveolar pits. Margin of dorsal shield strongly sclerotized. Marginal shield without ornamentation, marginal setae spine-like (ca. 51–57 µm).

**Ventral idiosoma (Figure 6c):** Surface of sternal shield smooth, except the area anterior to genital shield where reticulate sculptural pattern can be found. Several T-shaped sternal setae can be observed. Ventral shield covered by alveolar pits and bearing numerous smooth and spine-like setae (ca. 31–34 µm). Setae around anal platelets similar in shape to ventral setae, except the short (ca. 15 µm) postanal seta (Figure 6d). Stigmata situated between coxae II and III, peritremes M-shaped, asymmetric, the posterior loop longer than the anterior (Figure 6c). Genital shield linguliform, its surface smooth in central area, but covered by oval pits near its lateral margins. Apical process absent. Base of tritosternum narrow, tritosternal laciniae divided into 4 apically serrate branches (Figure 6e). Pedofossae deep and their surface smooth. Separated furrows for tarsi IV absent.

**Gnathosoma (Figure 6f):** Corniculi horn-like, internal malae divided into several marginally pilose branches. Hypostomal setae are as follows: h1 (ca. 80 µm) smooth and situated near the anterior margin of gnathosoma; h2 (ca. 60 µm), h3 (ca. 69 µm), and h4 (ca. 77 µm) long and marginally serrate. Epistome subtriangular and marginally pilose (Figure 6g). Chelicerae (Figure 6h) without internal sclerotized node, movable digit shorter than fixed digit. Movable digit with 1 tooth, fixed digit bearing 2 teeth. Trochanter of palps bearing a short and smooth and a long and marginally serrate seta; other setae on palps smooth.

Male, nymphs, and larvae are unknown.

**Etymology:** We dedicate the new species to Dr Durmuş Ali Bal, the excellent Turkish Uropodina researcher.

**Notes:** The new species belongs to the *Trachyuropoda graeca*-group on the basis of the presence of the strongly sclerotized rectangular or L- and c-shaped dorsal grooves (Hirschmann, 1976). This group contains 7 species, but only 4 already known species (*T. mesofovea* Hirschmann,

**Table 1.** Distinguishing characteristics between the species of the Neotropical *Trachyuropoda arcuata*-group.

	<i>T. arcuata</i>	<i>T. difoveolata</i>	<i>T. similiarculata</i>	<i>T. newtoni</i>	<i>T. darwini</i>
Strongly sclerotized dorsal lines anterior to cavities	Absent	Present	Absent	Absent	Absent
Surface of genital shield of female	Only the male is known	Smooth	Only the male is known	Smooth	With a few oval pits
Surface of sternal shield of male	With oval pits	Only the female is known	With oval pits	Only the female is known	Smooth
Lateral part of cavities	Reaching to margin of dorsal shield	Reaching to margin of dorsal shield	Reaching to margin of dorsal shield	Not reaching to margin of dorsal shield	Not reaching to margin of dorsal shield
Distance between 2 U-shaped dorsal cavities	ca. 50 $\mu\text{m}$	ca. 40 $\mu\text{m}$	ca. 50 $\mu\text{m}$	ca. 100 $\mu\text{m}$	ca. 50 $\mu\text{m}$
Region	Brazil	Brazil	Brazil	Panama	Galápagos

1976; *T. mesofoveasimilis* Hirschmann, 1976; *T. represa* Hirschmann, 1976; and *T. rufipes* Hirschmann, 1976) have L- or c-shaped dorsal grooves on the posterior area of the dorsum. The distinguishing characteristics of the species having L- or c-shaped dorsal grooves are shown in Table 2.

### 3.1.1.3. *Trachyuropoda extremica* sp. nov.

Material examined: Holotype: Female. Colombia, near Rio Claro, from lichens and moss, 5 May 1984, leg. J. Balogh (HNHM). Paratypes: 2 males, locality and date same as in holotype (1 paratype in ISB, 1 in HNHM).

Description: Female. Length of idiosoma 990  $\mu\text{m}$ , width 710  $\mu\text{m}$  ( $n = 1$ ). Shape oval, anterior margin with 1 central neck-like and 2 lateral wing-like outlines, posterior margin rounded.

Dorsal idiosoma (Figure 7a): Marginal and dorsal shields completely separated. Central area of dorsal shield elevated from other parts of dorsum, elevated area divided into a larger anterior and a smaller posterior part, these 2 parts separated by a deep, transversal furrow bordered by strongly sclerotized margins, which bear short and needle-like setae. Central part of elevated anterior area bearing an oval and strongly sclerotized groove, posterior elevated area bearing a U-like, strongly sclerotized groove with spine-like setae on its caudal region. Other setae on dorsal shield long (ca. 91–99  $\mu\text{m}$ ), smooth, and spine-like. Elevated areas covered by oval pits, other parts of dorsum without pattern. Marginal shield without ornamentation, marginal setae (ca. 59–80  $\mu\text{m}$ ) basally serrate (Figures 7b and 7c).

Ventral idiosoma (Figure 7d): Surface of sternal shield smooth; several T-shaped sternal setae can be observed. Ventral shield without ornamentation, each

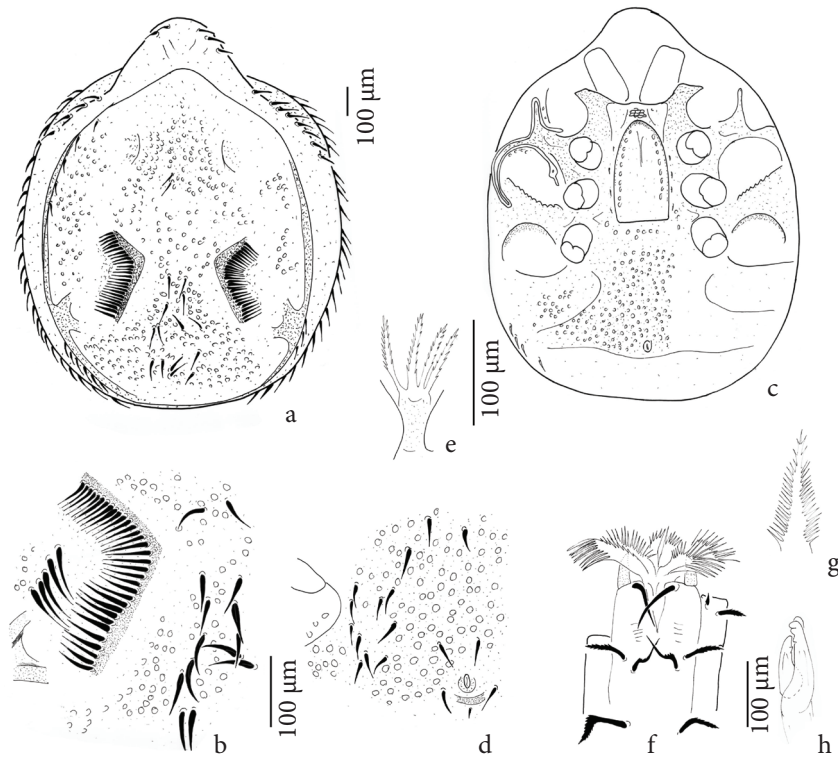
ventral setae smooth and spine-like. First pair of ventral setae short (ca. 18  $\mu\text{m}$ ), other setae on ventral area long (ca. 69–79  $\mu\text{m}$ ), except the shorter (ca. 40  $\mu\text{m}$ ) postanal seta. A shallow transversal furrow situated anterior to anal opening (Figure 7e). Stigmata situated between coxae II and III, peritremes long, anterior part hook-like, posterior part L-shaped. Genital shield linguliform, its surface smooth in central area, but covered by oval pits near its anterior and lateral margins. Apical process absent. Base of tritosternum narrow, tritosternal laciniae divided into 4 smooth branches (Figure 7f). Pedofossae deep and their surface smooth; separated furrows for tarsi IV absent.

Gnathosoma (Figure 7f): Corniculi horn-like, internal malae divided into several marginally pilose branches. Hypostomal setae are as follows: h1 (ca. 45  $\mu\text{m}$ ) smooth and situated near the anterior margin of gnathosoma; h2 (ca. 63  $\mu\text{m}$ ), h3 (ca. 79  $\mu\text{m}$ ), and h4 (ca. 82  $\mu\text{m}$ ) long and marginally serrate. Epistome subtriangular and marginally pilose (Figure 7g). Chelicerae without internal sclerotized node, movable digit shorter than fixed digit. Movable digit with 1 tooth, fixed digit bearing 2 teeth. Trochanter of palps bearing a short and smooth and a long and marginally serrate seta; other setae on palps smooth.

Male. Length of idiosoma 920–930  $\mu\text{m}$ , width 660–680  $\mu\text{m}$  ( $n = 2$ ). Shape of idiosoma similar to that of female.

Dorsal side: Well-sclerotized ridges and bulges as in female.

Ventral side: Sternal region of hologastric shield strongly sclerotized near anterior margin of genital opening. All sternal setae short (ca. 30–40  $\mu\text{m}$ ), smooth, and spine-like. Sternal shield covered by oval pits near its anterior margin and posterior to genital opening, other



**Figure 6.** *Trachyuropoda bali* sp. nov. female: a) dorsal view; b) L-shaped, strongly sclerotized dorsal groove with dorsal setae and ornamentation; c) ventral view; d) anal region, ventral setae, and ornamentation; e) tritosternum; f) ventral view of gnathosoma; g) epistome; h) chelicera.

areas smooth (Figure 7h). Ventrianal area of hologastric shield similar to that of female.

Nymphs and larvae are unknown.

**Etymology:** The name of the new species refers to the extremely long, spine-like setae of the dorsal shield.

**Notes:** On the basis of the deep transversal furrows on the dorsal shield, the new species belongs to the

*Trachyuropoda bostocki*-group (Hirschmann, 1976). This group consists of 8 species, but the long, smooth, and spine-like setae on the dorsal shield are unique characters in this species group.

### 3.1.2. Notes on the biology of these 3 described species

While most of the previously described *Trachyuropoda* species were found in anthills and this group seems to

**Table 2.** The most important differences between species having L- or c-shaped dorsal grooves in the *Trachyuropoda graeca*-group.

	<i>T. mesofovea</i>	<i>T. mesofoveasimilis</i>	<i>T. represa</i>	<i>T. rufipes</i>	<i>T. bali</i>
Shape of dorsal grooves	L-shaped	c-shaped	c-shaped	Hook-like	L-shaped
Anterior grooves	c-shaped	c-shaped	c-shaped	c-shaped	Absent
Surface of female genital shield	With small oval pits	Smooth	With small oval pits	With small oval pits	With larger oval pits
Second loop on prestigmatid part of peritreme	As long as the first	As long as the first	As long as the first	As long as the first	Longer than the first
Occurrences	Paraguay	Unknown	Brazil	Unknown	Colombia

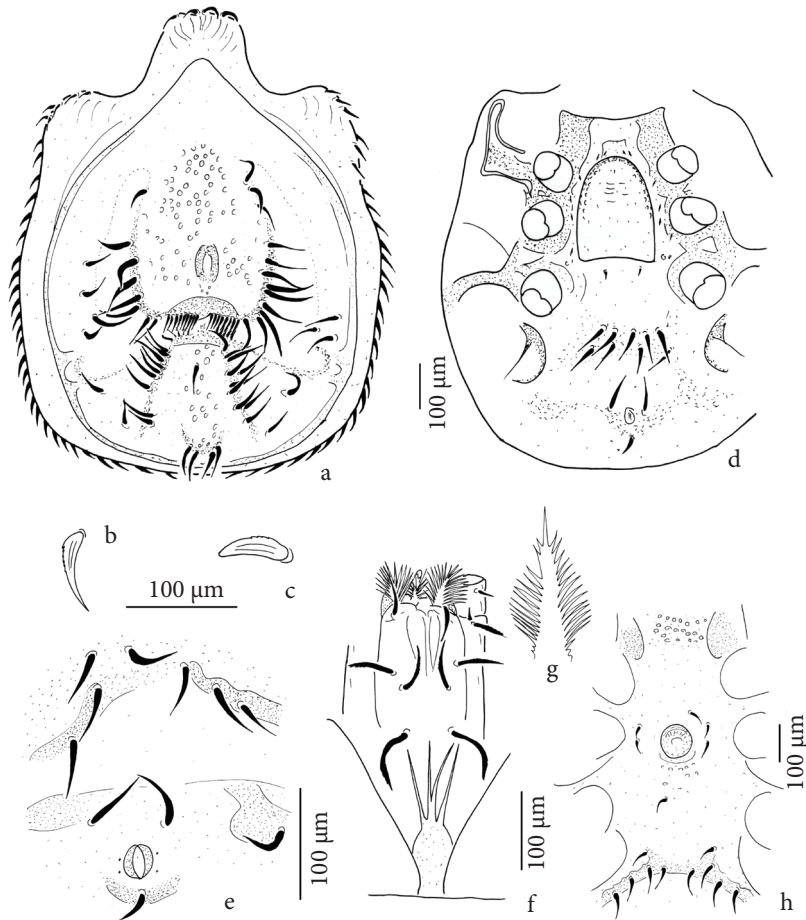


Figure 7. *Trachyuropoda extremica* sp. nov. female: a) dorsal view; b-c) marginal setae; d) ventral view; e) anal region and ventral setae; f) tritosternum and ventral view of gnathosoma; g) epistome; h) intercoxal area of male.

be myrmecophilous, our species were collected from soil, leaf litter, moss, and lichens, which are not typical habitats for trachyuropodid mites. We have 2 hypotheses for the occurrences in these habitats: not all the species of

this genus are myrmecophilous and they occur in other habitats as well, or the collected samples were small nests of ants but the collector did not observe it and noted the samples as soil, moss, or lichens.

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