

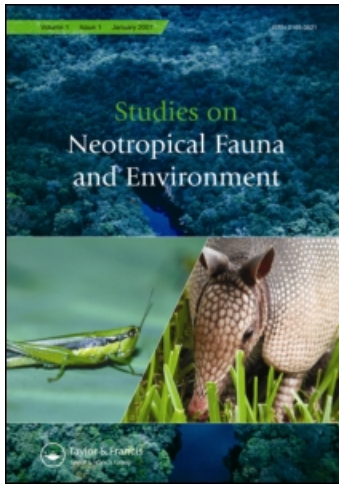
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## Studies on Neotropical Fauna and Environment

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t713817190>

### Two new troglomorph Pachylinae (Opiliones, Laniatores, Gonyleptidae) from caves in Bahia, Brazil

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First Published: December 2008

**To cite this Article** Kury, Adriano B.(2008)'Two new troglomorph Pachylinae (Opiliones, Laniatores, Gonyleptidae) from caves in Bahia, Brazil',*Studies on Neotropical Fauna and Environment*,43:3,247 — 253

**To link to this Article:** DOI: 10.1080/01650520701731794

**URL:** <http://dx.doi.org/10.1080/01650520701731794>

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## ORIGINAL ARTICLE

### Two new troglomorph Pachylinae (Opiliones, Laniatores, Gonyleptidae) from caves in Bahia, Brazil

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(Received 6 July 2007; accepted 8 October 2007)

Two new species of troglomorph Pachylinae are described from caves in a xeric biome of eastern Brazil. Both are assigned to extant genera, known from epigeal environment – *Discocyrtus* Holmberg, 1878 and *Eusarcus* Perty, 1833. These are the first records of Opiliones from the caves “Gruna do Brejo & Verruga” and “Caverna Pedra Furada,” Sistema Lapa Doce in the Brazilian state of Bahia. Both species show moderate troglomorph features such as partial depigmentation and elongation of appendages.

**Keywords:** Brazil; Caatinga; cave fauna; harvestmen; troglomorphy

#### Introduction

Troglomorph opilions of the family Gonyleptidae Sundevall, 1833 are typically deemed rare in the literature, although in recent years, the discovery of a number of new species is enhancing our knowledge on this matter (Pérez and Kury 2002). Obligatory cave organisms tend to look all alike (e.g., with elongate appendages, reduced eyes and pigmentation) due to convergent characters related to cave life (Culver 1982) and, in the case of the Opiliones, the elongation of pedipalps and legs, and the increase of tarsomere number often caused new supraspecific taxa to be erected according to the system created by Roewer in the first half of the twentieth century (e.g., Roewer 1923) and which became the most influential paradigm for harvestmen taxonomy. For example, Šilhavý (1974) created a new subfamily, Pachylospelinae, for a single troglomorph species of Gonyleptidae. More recently, Pinto-da-Rocha (1996) and Pérez and Kury (2002) described two other troglomorph species of Pachylinae Sørensen, 1884 (the largest subfamily), which were both placed in new monotypic genera. As the boundaries of most genera in the Pachylinae are uncertain, the relationship of those monotypic genera to their epigeal counterparts remains obscure, preventing finer analyses of the evolution of these Opiliones in the cave environment.

Now, as a result of a survey in caves of the Brazilian state of Bahia by a joint expedition of the Museu Nacional, Rio de Janeiro and the University of São Paulo, two new species of Pachylinae were recognized. Unlike previously known troglomorph

pachylines, these two could be allocated in well-known genera, although at first sight they bear little resemblance with their epigeal counterparts.

The following abbreviations for depositories are used: MNRJ, Museu Nacional, Rio de Janeiro; MZSP, Museu de Zoologia, São Paulo. All measurements are in millimeters.

#### Results

*Discocyrtus pedrosoi* sp. n. (Figures 1–8)

#### Type material

Brazil: ♂ holotype (MNRJ 17768), Bahia, Andaraí, Distrito de Igatú, Gruna do Brejo & Verruga, 7 April 2005, D.R. Pedroso and M.E. Bichuette leg.; 6♂, 4♀, six juvenile paratypes (MNRJ 17769), same data as holotype; 1♂, 1♀ paratypes (MZSP), same data as holotype.

#### Etymology

The species is named after Denis Rafael Pedroso from the MNRJ for discovering the type series of this species, among other interesting arachnids.

#### Distribution

Known only from the type locality, Gruna do Brejo & Verruga (12°53'37.9"S, 41°19'26.1"W; in decimal degrees –12.893861°, –41.323917°; 683 m) which is a sandstone cave. WWF Ecoregion NT1304 Caatinga (biome type 13 – Deserts and Xeric Shrublands).

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**Diagnosis**

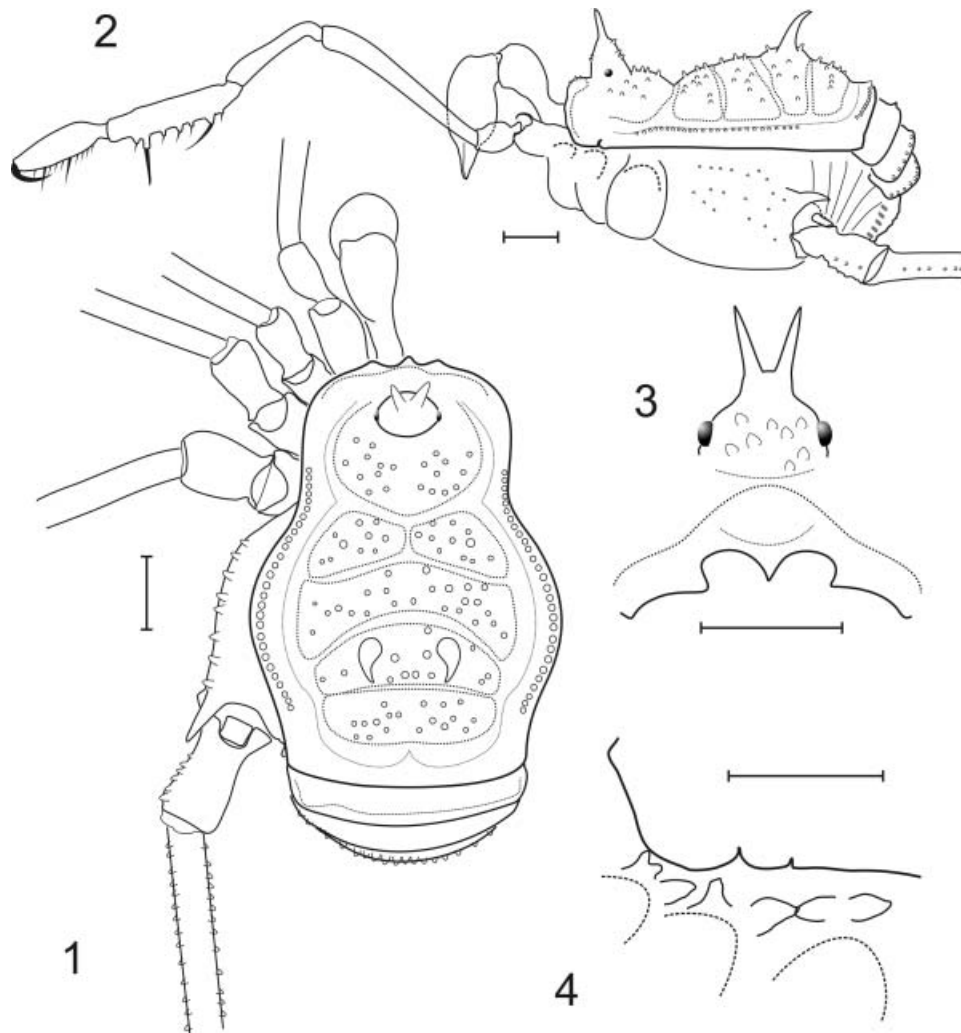
The new species can be readily separated from all other *Discocyrtus* by the higher tarsal count, elongated appendages, and dull mahogany color, contrasting to the often elaborate black, green, red, yellow, brown pattern present in many species, and in the unusual ratio length/width of the body, making it elongated, while other species are typically broad-bodied.

**Description***Male holotype*

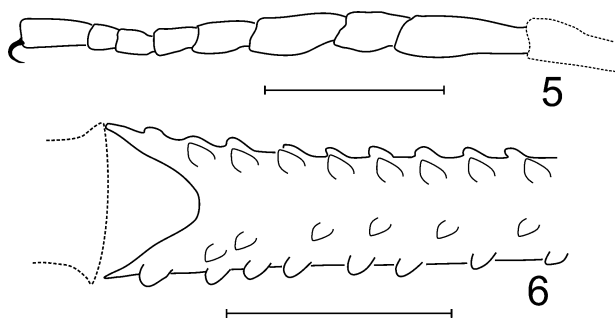
*Measurements.* Carapace width 2.9; carapace length 2.2, abdominal scutum width 4.4, length 3.8.

*Dorsum (Figures 1–4).* Dorsal scutum longer than wide, lateral borders of carapace sub-straight,

abdominal scutum growing wider regularly reaching maximum width at area II, then narrowing again to parallel sides (Figure 1). Cheliceral sockets shallow, without frontal apophyses (Figure 3). Eye mound narrow, high, not directly on the anterior border of carapace, armed with a pair of divergent high spines fused basally (Figure 3). Mesotergum divided into four clearly defined areas. Area I divided into left and right halves by median groove. All areas unarmed, except area III with a pair of paramedian acuminate spines curved backwards (Figure 2). Ozopore with two openings, posterior one smaller. Adjacent coxal apophyses of leg I: anterior bifid, posterior simple pointed backwards, leg II: anterior simple, posterior simple pointed backwards, leg III: anterior and posterior simple pointed, respectively, front and backwards (Figure 4). Free tergites unarmed.



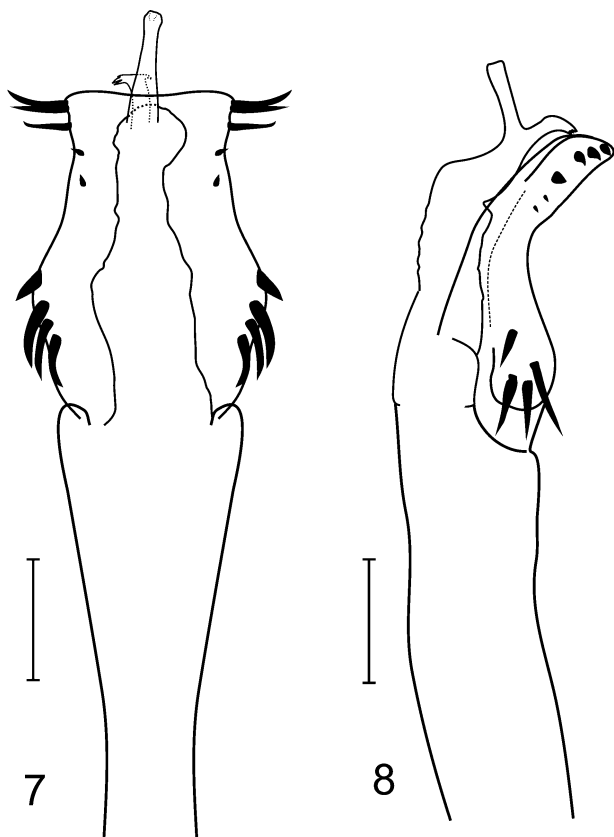
Figures 1–4. *Discocyrtus pedrosoi* sp. n., male holotype (MNRJ 17768). (1) Habitus, dorsal view. (2) Same, lateral view. (3) Eye mound, frontal view. (4) Ozopore region, lateral view. Scale bars: 1 mm.



Figures 5, 6. *Discocorytus pedrosoi* sp. n., male holotype (MNRJ 17768). (5) Tarsus I, lateral view. (6) Left femur IV, distal part, ventral view. Scale bars: 1 mm.

**Venter.** Coxae I–III parallel; IV much larger than the others, directed obliquely. Stigmatic area Y-shaped, clearly sunken relative to distal part of coxa IV. Intercoxal bridges well marked. Stigmata visible. Free sternites and anal operculum unarmed.

**Chelicera (Figures 1, 2).** Basichelicerite elongate, bulla still well marked, hand not swollen.



Figures 7, 8. *Discocorytus pedrosoi* sp. n., male paratype (MNRJ 17769), distal part of penis. (7) Dorsal view. (8) Lateral view. Scale bars: 0.1 mm.

**Pedipalpus (Figure 2).** Segments very slender and elongated, especially patella and tibia (measurements in Table 1). Spines of tibia and tarsus very long. Tibia ventrally with six (IiIlii) or seven (IiiiIii) mesal and seven (iIiiiIi) ectal spines. Tarsus with seven (iIiiiIii) mesal and 10 (iiiiIiiiIi) ectal spines.

**Legs (Figures 5, 6).** All segments slender (measurements in Table 2) and without major processes, except coxa IV with distal dorso-prolateral spiniform apophysis (Figures 1, 2). All femora sub-straight. Femur to tibia I–IV each with multiple rows of acuminate granules (Figure 6). Coxa IV clearly surpassing scutum in the dorsal view. Basitarsus I slightly swollen (Figure 5). Tarsal counts: 8(3)-8(3)/41(3)-41(3)/7-7/7-7.

**Genitalia (Figures 7, 8).** Ventral plate of penis irregular hexagonal, without middle constriction, with corners rounded and basal part wider. Apical border straight. Basal lobes of ventral plate poorly defined, not projecting from main level. Lateral border of ventral plate with two groups of setae, basal group with four short straight setae and distal group with three short setae. Two intermediate very short and small setae are present closest to the distal group. Glans sac very elongated, arising from prominence which ends much below the level of insertion of the basalmost seta. Stylus straight, with apex not inflated. Ventral process of stylus inserted at basal position (forming angle of about 90° with stylus), sub-straight, only bent ventrally at apex, forming a small flabellum.

**Female paratype**

Measurements: carapace width 2.8; carapace length 2.2, abdominal scutum width 4.4, length 3.7. Similar to male in armature and proportions. Articles of basitarsus I not swollen. Without sexual difference in tarsal counts. Some articles in intermediate state of fusion. Variation in tarsal counts of male and female paratypes: 7-10(3)/30-47(3)/7-8/7-8.

***Eusarcus elinae* sp. n. (Figures 9–17)**

**Type material**

Brazil: ♂ holotype, 1♀ paratype (MNRJ 17776), Brazil, Bahia, Iraquara: Caverna Pedra Furada, Sistema Lapa Doce; 31 March 2005, D.R. Pedroso and M.E. Bichuette, leg.

**Etymology**

Species named after Maria Elina Bichuette from the University of São Paulo, who studied these caves and collected the type series of this species.

Table 1. Pedipalp measurements of *Discocyrtus pedrosoi* sp. n., male holotype and female paratype.

	Cx	Tr	Fe	Pa	Ti	Mt	Ta	Claw	Total
Male	1.00	0.90	3.50	2.00	2.70	–	1.80	0.90	12.80
Female	1.00	1.00	3.58	1.83	2.33	–	1.42	1.25	12.42

Cx, coxa; Tr, trochanter; Fe, femur; Pa, patella; Ti, tibia; Mt, metatarsus; Ta, tarsus.

### Distribution

Known only from the type locality, Caverna Pedra Furada (12°20'59"S, 41°36'14"W; in decimal degrees –12.349722°, –41.603889°), a limestone cave. WWF Ecoregion NT1304 Caatinga (biome type 13 – Deserts and Xeric Shrublands).

### Diagnosis

Closest to *E. aduncus*, *E. berlae*, and *E. sooretamae* by the “*Metagraphinotus*” facies: slender, elongated body with coxa IV (even of males) hidden under scutum and the combination of prolateral apophyses of coxa IV (short, truncated, oblique) and trochanter IV (sub-basal, spiniform, curved anteriorly). Easily distinguished from these three by the lack of a strong spiniform process in area III. Distinguished from all other *Eusarcus* by the femur IV very long, sub-straight and almost entirely unarmed.

### Description

#### Male holotype

**Measurements.** Carapace width 2.9; carapace length 2.2, abdominal scutum width 4.4, length 3.3.

**Dorsum (Figures 9–12).** Dorsal scutum longer than wide, lateral borders of carapace sub-straight, abdominal scutum growing wider regularly reaching maximum width at boundary of areas II–III, then narrowing again regularly (Figure 9). Cheliceral sockets shallow, but flanked by a pair of well-developed apophyses, stouter than median apophysis (Figure 11). Eye mound narrow, high, far off the anterior border of carapace, armed with a pair of minute tubercles not in transverse line (Figure 9–11).

Mesotergum divided into four clearly defined areas. Area I divided into left and right halves by median groove. All areas unarmed, except area III with median mound causing it to partially invade area IV (Figures 9, 10). Ozopore with two openings, posterior one smaller. Adjacent coxal apophyses of leg I: anterior simple pointed forward, posterior simple pointed backwards, leg II: three anterior erect, posterior simple pointed backwards, leg III: anterior and posterior simple pointed, respectively, front and backwards (Figure 12). Free tergites unarmed.

**Venter.** Coxae I–III ordinary, transverse, densely granulose, with well-marked tubercular bridges, coxa IV extremely long almost parallel to main body axis, stigmatic area Y-shaped elongate, with posterior border deeply concave sheltering the free sternites, stigmata clearly visible.

**Chelicera (Figures 9, 10).** Without remarkable features, basichelicerite short, bulla attenuate, hand not swollen.

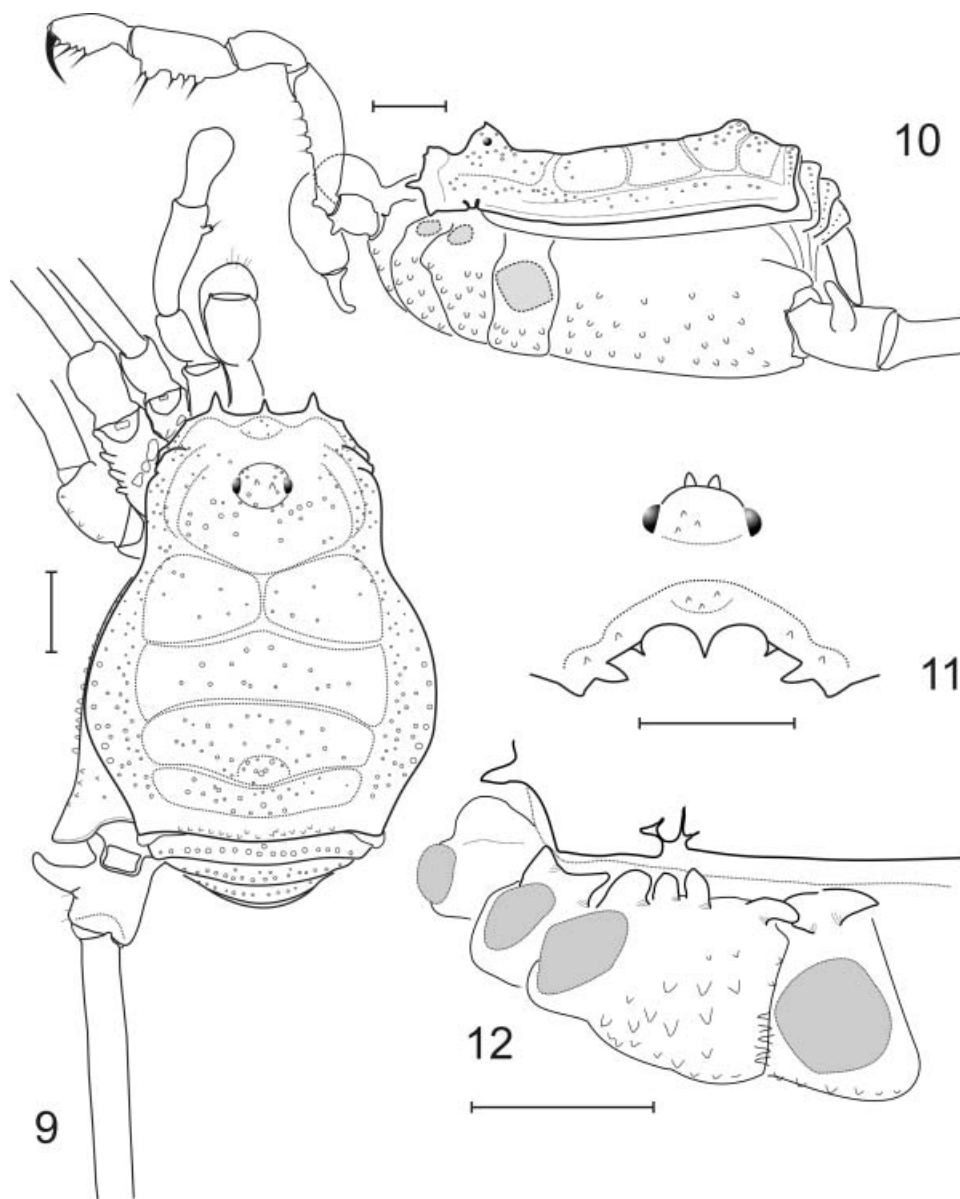
**Pedipalpus (Figure 10).** Measurements in Table 3; trochanter with ventral setiferous tubercle; femur slender, slightly convex dorsally, with a well-developed subapical mesal (inner) spine, a ventro-basal larger setiferous tubercle plus a ventral row of three smaller setiferous tubercles, patella unarmed, tibia ectal with five (IiiIi) and mesal with four (IiIi) spines, tarsus ectal with four (IiIi) and mesal with three (Iii) spines.

**Legs (Figures 13–15).** Measurements in Table 4; basitarsus I not swollen (Figure 13). Coxa IV hidden

Table 2. Leg measurements of *Discocyrtus pedrosoi* sp. n., male holotype and female paratype (in parentheses).

	Tr	Fe	Pa	Ti	Mt	Ta	Total
Leg I	1.00 (0.92)	5.71 (4.92)	1.57 (1.67)	4.29 (4.08)	7.71 (7.08)	3.43 (3.00)	23.71 (21.67)
Leg II	1.14 (0.83)	11.57 (8.83)	2.00 (1.67)	10.00 (7.67)	12.86 (9.67)	12.00 (8.83)	49.57 (37.50)
Leg III	1.43 (1.17)	7.57 (6.00)	2.14 (1.83)	5.14 (3.83)	12.14 (6.83)	4.29 (2.50)	32.71 (22.17)
Leg IV	1.57 (1.17)	10.14 (8.17)	3.00 (2.33)	7.43 (6.00)	10.57 (8.33)	4.71 (3.67)	37.43 (29.67)

See Table 1 for abbreviations.

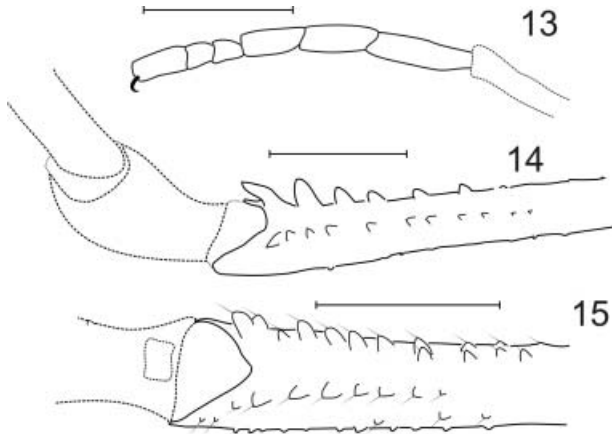


Figures 9–12. *Eusarcus elinae* sp. n., male holotype (MNRJ 17776). (9) Habitus, dorsal view. (10) Same, lateral view. (11) Eye mound, frontal view. (12) Ozopore region, lateral view. Scale bars: 1 mm.

under scutum, only apical portion visible in dorsal view; with large, rounded-lanceolate apophysis. Trochanter IV with basal prolateral stout hooked apophysis (Figure 9). Leg segments straight and unarmed, except for femora III–IV, each with a ventro-distal double row of acuminate tubercles increasing distally (Figures 14, 15).

**Genitalia** (Figures 16, 17). Ventral plate of penis subrectangular, with corners strongly attenuated, especially basal ones and slight middle constriction. Apical border slightly concave. Basal lobes of ventral

plate poorly defined, not projecting from main level. Lateral border of ventral plate with two groups of setae, basal group with four short straight setae and distal group with three short setae. An intermediate very short and small seta is present midway between the groups. Glans sac elongated, arising from prominence which ends at the level of insertion of the basalmost seta. Stylus curved, with apex a little inflated. Ventral process of stylus inserted at basal position (forming angle of about  $90^\circ$  with stylus), fingerlike, strongly curved dorsally, widened at apex and with many apical soft lobes but not forming a flabellum.



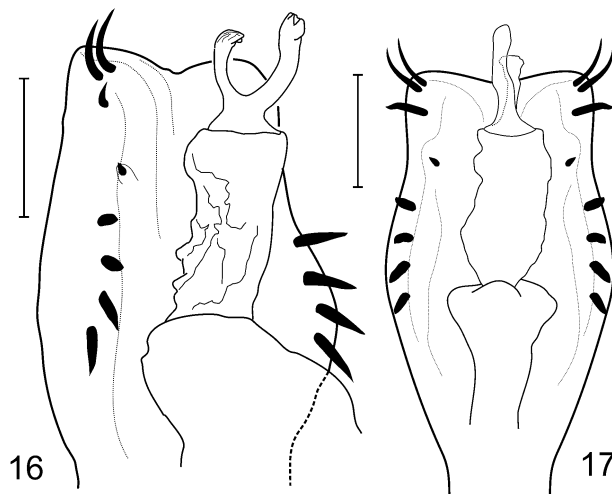
Figures 13–15. *Eusarcus elinae* sp. n., male holotype (MNRJ 17776). (13) Tarsus I, lateral view. (14) Right femur III, distal part, ventral view. (15) Right femur IV, distal part, ventral view. Scale bars: 1 mm.

#### Female paratype

Measurements: carapace width 2.3; carapace length 1.7, abdominal scutum width 3.3, length 3.0. Slightly smaller than the male. Legs II–IV clearly shorter. Armature of legs III–IV much reduced. Tarsal counts: 6(3)–6(3)/11(4)–11(4)?–6/6–6.

#### Discussion

The taxonomic status of *Discocyrtus* Holmberg, 1878 and *Eusarcus* Perty, 1833 is very different. *Discocyrtus* is a large genus with some 75 species without any revision and doubtless many undescribed ones. One has trouble trying to identify samples,



Figures 16, 17. *Eusarcus elinae* sp. n., male holotype (MNRJ 17776), distal part of penis. (16) Dorso-lateral view. (17) Dorsal view. Scale bars: 0.1 mm.

especially because there are many sympatric species in the Brazilian Atlantic Forest. *Eusarcus* has been revised recently in an unpublished thesis (Hara 2005), in which all 34 species were described, synonymies were proposed, and a character matrix was prepared, leading to a phylogenetic analysis. The author also presented a key to the species of *Eusarcus*.

Troglomorphism of the two new cavernicolous species is expressed: (1) in the pigmentation, which, although not absent, in both *E. elinae* sp. n. and *D. pedrosoi* sp. n. is lighter than in related epigeic species, more so in the latter; (2) in the elongation of the dorsal scutum; (3) in the elongation of the pedipalpus, much more extreme in *D. pedrosoi* sp. n.; (4) in the elongate and relatively unarmed legs, but *E. elinae* sp. n. still keeps the rows of spines in femur III of male typical of a group of genera in Pachylinae; and (5) in the high tarsal counts (especially in *D. pedrosoi* sp. n.). Ocular apparatus seems to be normal in both species compared to the epigeic *Discocyrtus* and *Eusarcus*.

The generic assignment of *Discocyrtus pedrosoi* sp. n. was made on the basis of: (1) the high erect spiniform processes of the eye mound, geminated at base; (2) shape and angle of the apical prolateral process of coxa IV of male; and (3) male genitalia.

According to the current paradigm for Pachylinae (e.g., de Mello-Leitão 1932; Soares and Soares 1954), *Eusarcus elinae* sp. n. fits well the morphotype of *Metagraphinotus* Mello-Leitão, 1927, which can be clearly seen in the apophyses of coxa and trochanter IV. However, there is an unpublished proposal (Hara 2005) for synonymizing *Metagraphinotus* with *Eusarcus* Perty, 1833. Hara's synonymy is convincing enough, and his illustrations of male genitalia of many species of *Eusarcus* fit perfectly well in the structure described here. The generic assignment of *Eusarcus elinae* sp. n. was made based on: (1) structure of prolateral distal apophysis of trochanter IV of male, which forms a typical “*Metagraphinotus*” pincer with the coxal apophysis; (2) ventral armature of femur III of male; (3) structure of male genitalia with stylus and its ventral process curved (stylus less so) so that they converge at their bases and tips; and (4) well-developed frontal processes of carapace flanking cheliceral sockets.

Another interesting note is that both *Discocyrtus* and *Eusarcus* were hitherto thought to be restricted to the Atlantic forest, reaching Argentina, except for an Amazonian species of doubtful identity which might not belong to *Discocyrtus* (see Kury 2003) while the two new species occur in the open, xeric formations of Central Brazil. The cave environments involved probably represent refuges witnessing a former period of greater humidity when moist forest habitats

Table 3. Pedipalp measurements of *Eusarcus elinae* sp. n., male holotype and female paratype.

	Cx	Tr	Fe	Pa	Ti	Mt	Ta	Claw	Total
Male	0.52	0.66	1.62	0.90	0.86	–	0.93	0.66	6.14
Female	0.32	0.58	1.21	0.84	0.89	–	0.79	0.79	5.42

See Table 1 for abbreviations.

Table 4. Leg measurements of *Eusarcus elinae* sp. n., male holotype and female paratype (in parentheses).

	Tr	Fe	Pa	Ti	Mt	Ta	Total
Leg I	0.50 (0.63)	3.94 (2.58)	1.06 (1.11)	2.88 (1.89)	4.70 (2.74)	2.58 (1.74)	15.65 (10.68)
Leg II	0.58 (0.67)	9.70 (5.08)	2.12 (1.33)	8.03 (4.08)	10.15 (4.83)	4.85 (3.42)	35.43 (19.42)
Leg III	0.71 (0.58)	6.21 (3.63)	1.52 (1.00)	3.64 (2.21)	6.06 (3.53)	2.73 (1.84)	20.86 (12.79)
Leg IV	1.00 (0.75)	10.76 (5.42)	1.97 (1.42)	7.73 (3.83)	11.21 (5.42)	3.79 (1.83)	36.45 (18.67)

See Table 1 for abbreviations.

were more widespread in Brazil (Haffer 1969; van der Hammen 1974; Whitmore and Prance 1987). Later retraction of these forests in more arid periods may have caused these relicts to become isolated in caves.

### Acknowledgments

This study was supported by grant no. 520406/98-2 from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). The Fundação Universitária José Bonifácio (FUJB) contributed to the equipment of the Laboratory of Arachnology of MNRJ. Maria Elina Bichuette (USP) created the opportunity for a joint excursion in Bahia caves. Alessandro Giupponi and Amazonas Chagas were my eyes in the dismal moments of weariness. Ricardo Pinto-da-Rocha (USP) provided comments and suggestions to the draft.

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