

A new species of *Andocaeculus* (Acari, Caeculidae) from the Pampa biome, southern Brazil

Ana Paula Ott¹ & Ricardo Ott²

1. Departamento de Fitossanidade, Faculdade de Agronomia, Universidade Federal do Rio Grande do Sul. Av. Bento Gonçalves, 7712, 91540-000, Porto Alegre, RS, Brazil. (ana.ott@ufrgs.br)
2. Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul. Rua Dr. Salvador França, 1427, 90690-000, Porto Alegre, RS, Brazil. (rott@fzb.rs.gov.br)

ABSTRACT. A new caeculid species *Andocaeculus caioi* sp. nov. is described from Pampa biome in south Brazil. The species of this family are usually large and strong sclerotized mites with robust and spinulose legs I and II. Until now records of species for South America were known only from Chile and Argentina.

KEYWORDS. Mite, Neotropical, South America, taxonomy.

RESUMO. Uma nova espécie de *Andocaeculus* (Acari, Caeculidae) do bioma Pampa, sul do Brasil. Uma nova espécie de caeculídeo, *Andocaeculus caioi* sp. nov., é descrita para o bioma Pampa no sul do Brasil. As espécies desta família apresentam o corpo bastante esclerotizado e as pernas I e II com espinhos robustos. Até o momento, registros de espécies desta família na América do Sul eram conhecidos apenas para o Chile e Argentina.

PALAVRAS-CHAVE. Ácaro, neotropical, América do Sul, taxonomia.

The Pampa biome is an extensive natural grasslands region located between northeastern Argentina, Uruguay and south of Brazil (SUERTEGARAY & SILVA, 2009). This region includes some very fragile environments and is of common sense that the presence of grasslands and the hindering of forest expansion over the area are nowadays greatly influenced by the human activities. In the other hand this activities has great negative influence on the conservation of the natural areas and the biodiversity of the region (ROESCH *et al.*, 2009). The region focused in this paper (Área de Proteção Ambiental - APA - do Ibirapuitã; approximate coordinates 29°57'22" - 30°51'55"S, 55°21'02" - 55°55'13"W) is a federal protection area which includes private owned land around the almost whole extension of the Ibirapuitã River (ICMBIO, 2014).

Caeculidae are usually large and strong sclerotized mites which prey on Collembola (OTTO, 1993). The family is usually linked with arid habitats around the world (TAYLOR *et al.*, 2013). The Caeculidae includes nowadays 97 extant species distributed in seven genera (TAYLOR *et al.*, 2013). At least five species are known from South America: *Andocaeculus brundini* (Franz, 1962), *Neocaeculus bruchi* (Berlese, 1916) and *Microcaeculus weyrauchi* Franz, 1964 from Argentina; *M. castrii* Franz, 1964 and *M. nudus* Franz, 1964 from Chile.

The family was first revised by FRANZ (1952) and later by COINEAU (1974) which included an extensive analysis of morphological and also ecological aspects of some species. The last author proposes also the genus *Andocaeculus* to include "all South American species described by Franz": "*Ce genre est destine à recevoir les espèces que H. Franz a fait connaitre d'Amérique du Sud*" (COINEAU, 1974:279). Based on this comment we suspect that all species described by FRANZ (1962, 1964)

should be transferred to *Andocaeculus*. However, this seems to be not accepted once *Andocaeculus* remains as a monotypic genus including until now only the designed genus type species *A. brundini* (see TAYLOR *et al.*, 2013:448; checklist of Caeculidae provided by Yves Coineau). The three remaining *Microcaeculus* species described by FRANZ (1964) for South America were apparently not examined by COINEAU (1974) and therefore never formally revised or transferred to *Andocaeculus*.

All species of the three Caeculidae genera with South American distribution (*Andocaeculus* Coineau, 1974; *Microcaeculus* Franz, 1952 and *Neocaeculus* Coineau, 1967) can be recognized by the tarsal claws of different size on leg I. *Andocaeculus*, differently from the remaining two genera, can be recognized by the presence of one bothridium on the dorsal side of tarsi I and II as in *Caeculus* Doufour, 1832 (see COINEAU 1974:279). *Neocaeculus* and *Microcaeculus* should be recognized by differences in the aspidosomal sclerite length, not dorsally overhanging the gnathosoma in the first and overhanging in the second (COINEAU, 1967; COINEAU & ENNS, 1969; TAYLOR *et al.*, 2013). Regarding biogeographic distribution it's worth to mention that types species and most species of the genera *Microcaeculus* and *Neocaeculus* do not have Neotropical distribution being mostly and respectively from Palearctic and Australian regions.

In this paper we describe a new species of *Andocaeculus* from South America, the first caeculid registered to Brazil.

MATERIAL AND METHODS

Descriptions follows mainly TAYLOR *et al.* (2013), modified for the description of legs spines position and

numbers. Six positions for spines and spine rows were considered: d, dorsal; a, anterior; p, posterior; v, ventral; va, ventro-anterior; vp, ventro-posterior. Only leg articles with spines are indicated. Additional abbreviations used: tr, trochanter; bf, basifemur; fe, femur; ti, tibia; ta, tarsus.

Specimen for transmitted light examination was cleared with Nesbitt's fluid along two weeks and posteriorly washed out with acetic acid over one day and transferred to 80% ethanol; examination on compound microscope was made with the help of a slide containing clove oil. Spines location and counts were accomplished using compound and stereomicroscope for confirmation. Incident light images were taken through a stereomicroscope with attached camera and processed with Helicon Focus 5.3 multi-range program (Kozub *et al.*, 2012). Transmitted light images of cleared female were taken with a compound microscope using a digital camera and also processed with Helicon Focus. Drawings were made using printed images as models and compound microscope and stereomicroscope as three-dimensional shape confirmation tools. Electron scanning microscope (SEM) images were taken using a Jeol-JSM-5200 with attached SLR digital camera. All measurements in text are in millimeters; SEM scale bars are in micrometers.

Examined material is deposited at acarological collection of Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul (MCN, curator R. Ott).

Andocaeculus caioi sp. nov.

(Figs 1-42)

Type material. Holotype ♀ from Fazenda Rincão dos Moraes, Área de Proteção Ambiental do Rio Ibirapuitã, Sant'Ana do Livramento, Rio Grande do Sul, Brazil (30°28'54"S - 55°33'50"W), 29.XI.2013, R. Ott leg. (MCN-ACA 1889). Paratypes: 2♀, same data as holotype (MCN-ACA 1890; MCN-ACA 1891).

Etymology. The noun in apposition is a patronym in honour to Mr. Caio Silveira owner of the Fazenda Rincão dos Moraes and full supporter of the research activities on the Federal Environment Protection Area of the Ibirapuitã River ("APA do Ibirapuitã").

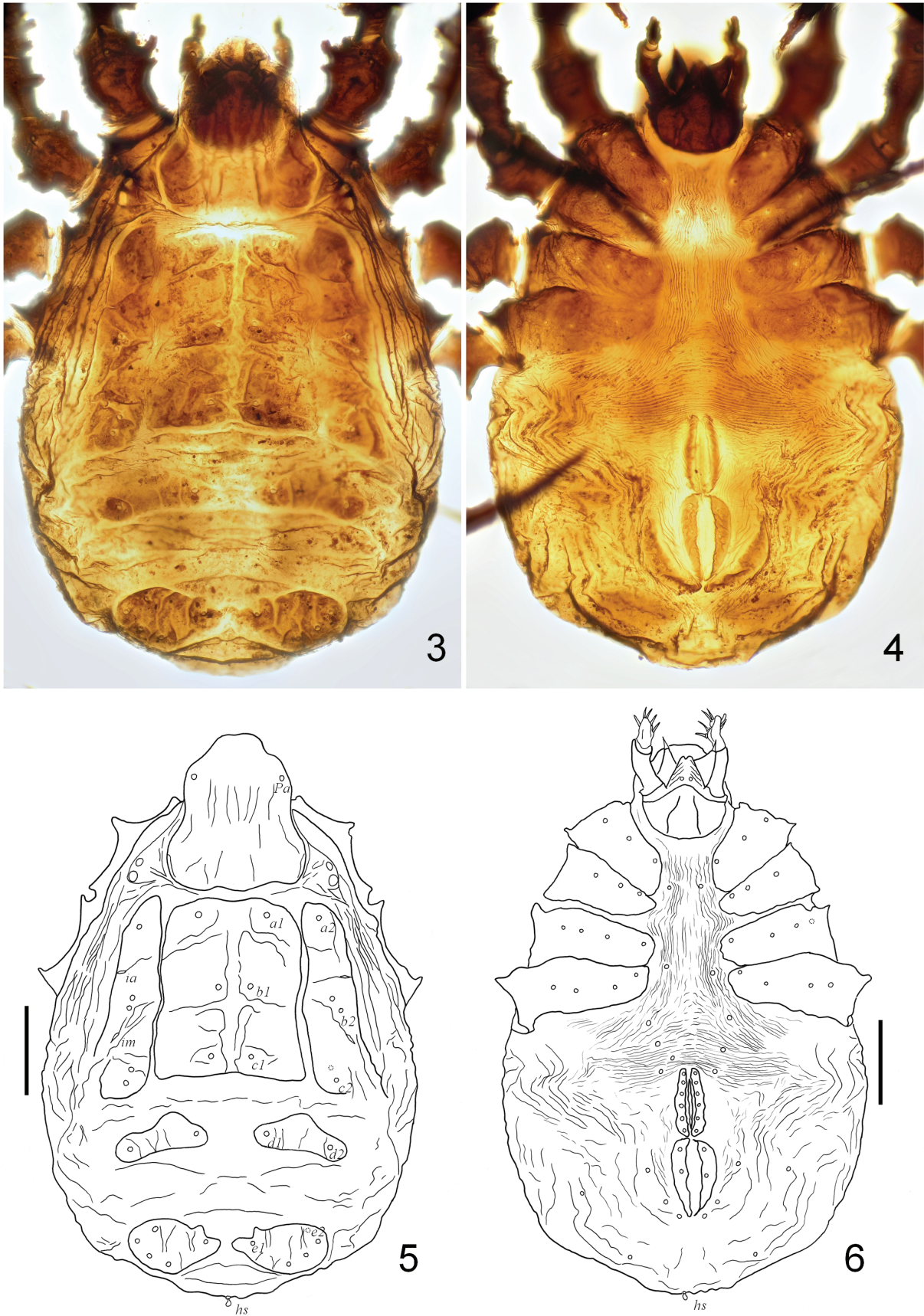
Diagnosis. *Andocaeculus caioi* sp. nov. can be recognized by the tarsal bothridia on the legs I and II. The species differs from *A. brundini* by the absence of aspidosomal setae *Pp* and dorsal setae *a1* and *b1*; can be also recognized by the paired setae *b2* and *c2* and by two setae at anterior face of trochanter II.

Description. Female (MCN ACA 1891, paratype). Idiossoma length 1.594; width 1.079.

Dorsum: orange brown tegument with dark brown to blackish sclerites (in ethanol; Fig. 1). Aspidosomal sclerite blackish, 0.451 long, 0.386 wide; setae *Pa* on anterior third of sclerite at the high of the anterior largest sclerite portion, setae *Pm* and *Pp* absent (Figs 3, 5). Two



Figs 1, 2. *Andocaeculus caioi* sp. nov.: 1, holotype ♀, dorsal view; 2, paratype ♀, ventral view.



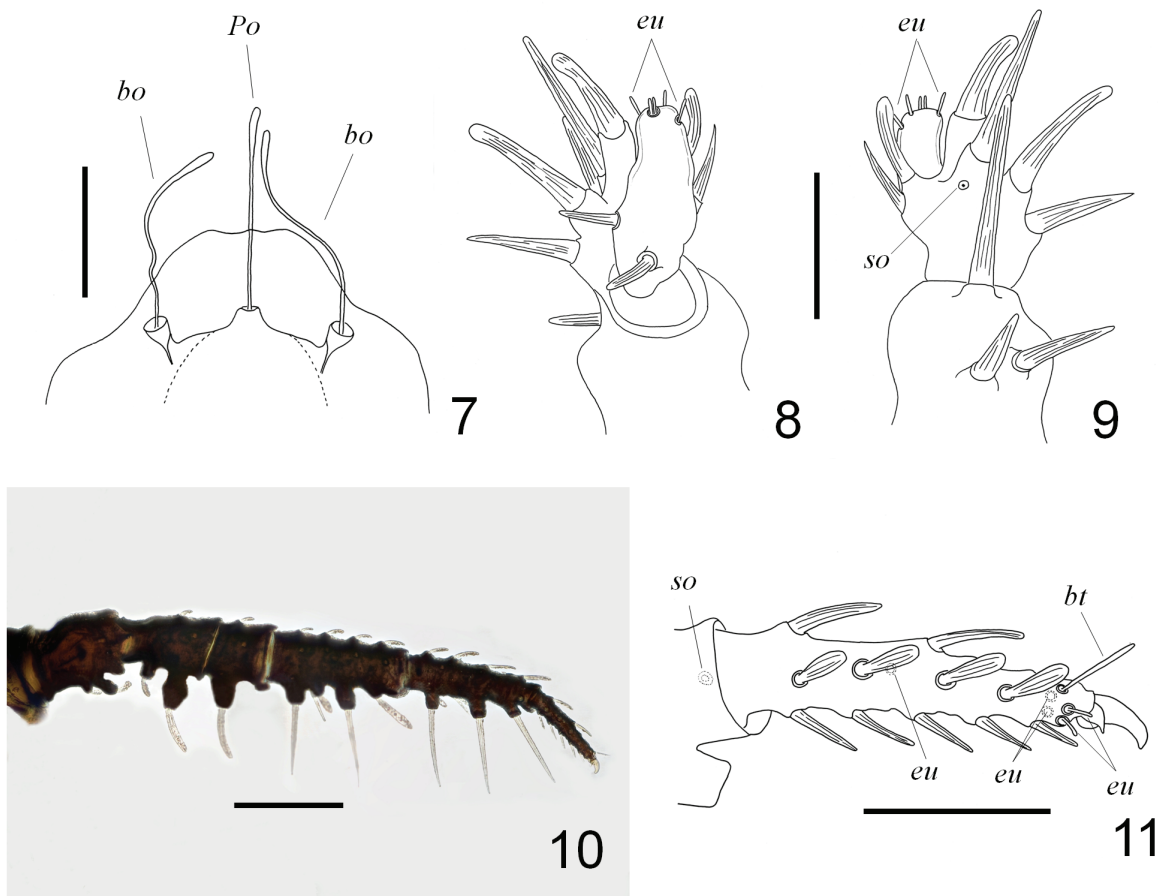
Figs 3-6. *Andocaeculus caioi* sp. nov., paratype ♀, cleared: 3, 5, dorsal view; 4, 6, ventral view. Scale bars: 5, 6, 0.25 mm.

pair of eyes on small triangular and blackish sclerite at level of posterior quarter of aspidosomal sclerite (Figs 1, 3, 5). Centrodorsal sclerite dark brown with blackish ridges, 0.467 long, 0.403 wide; paired setae *a1*, *b1*, *c1* present; setae *a1* more than twice apart from each other as for *b1* and *c1* (Figs 3, 5). Lateral sclerites dark brown with blackish ridges, 0.515 long, 0.129 wide; setae *a2*, *b2*, *c2* present, all positioned on middle line of sclerite; *b2* paired, *c2* paired; lyrifissure *ia* transversal, between *a2* and *b2*, on the ectal border of sclerite; lyrifissure *im* oblique between *b2* and *c2*, close to the border of the sclerite (Figs 3, 5). Medial sclerites dark brown with blackish ridges, close to reniform shape, apart from each other around its half width, 0.113 long, 0.274 wide; setae *d1*, *d2* present, *ds* absent. Posterior sclerites rounded with a mesal somewhat narrowed tip, close together, dark brown with blackish ridges, 0.174 long, 0.258 wide; setae *e1*, *e2* present, *es* absent; three additional setae present on postero-lateral position of each sclerite (Fig. 5). Pseudoanal sclerite less sclerotized, orange brown, only seta *hs* present.

Venter: orange brown tegument suffused with brown

areas; epimeres blackish, wrinkled aspect; dark brown genital and anal valves (Fig. 2). Epimeres I not touching the gnathosoma, with a clear seam between them; with three medial positioned and equally spaced small needle-like setae; epimeres I and II apparently fused, with a deep groove between each other; epimeres II also with three medial positioned and close to equally spaced small needle-like setae; epimeres II and III separated by a narrow seam; epimeres III and IV fused, with shallow groove between them, each with four medial positioned small needle-like setae. Genital valves with six pairs of small and thin needle-like setae, genital opening 0.209 long; aggenital sclerite inconspicuous. Anal valve with two pairs of small clavate setae; pseudoanal sclerites with three setae; 0.225 long (Figs 4, 6). Remaining ventral agenital seta distribution as in Figs 4, 6.

Gnathosoma: naso setae *Po* and bothridium *bo* almost of same size and shape, slightly enlarged distally (Fig. 7); subcapitulum dark, almost black, wrinkled aspect, setae absent. Hypostome with two pairs of needle-like setae near base and two distal pairs of very small setae.

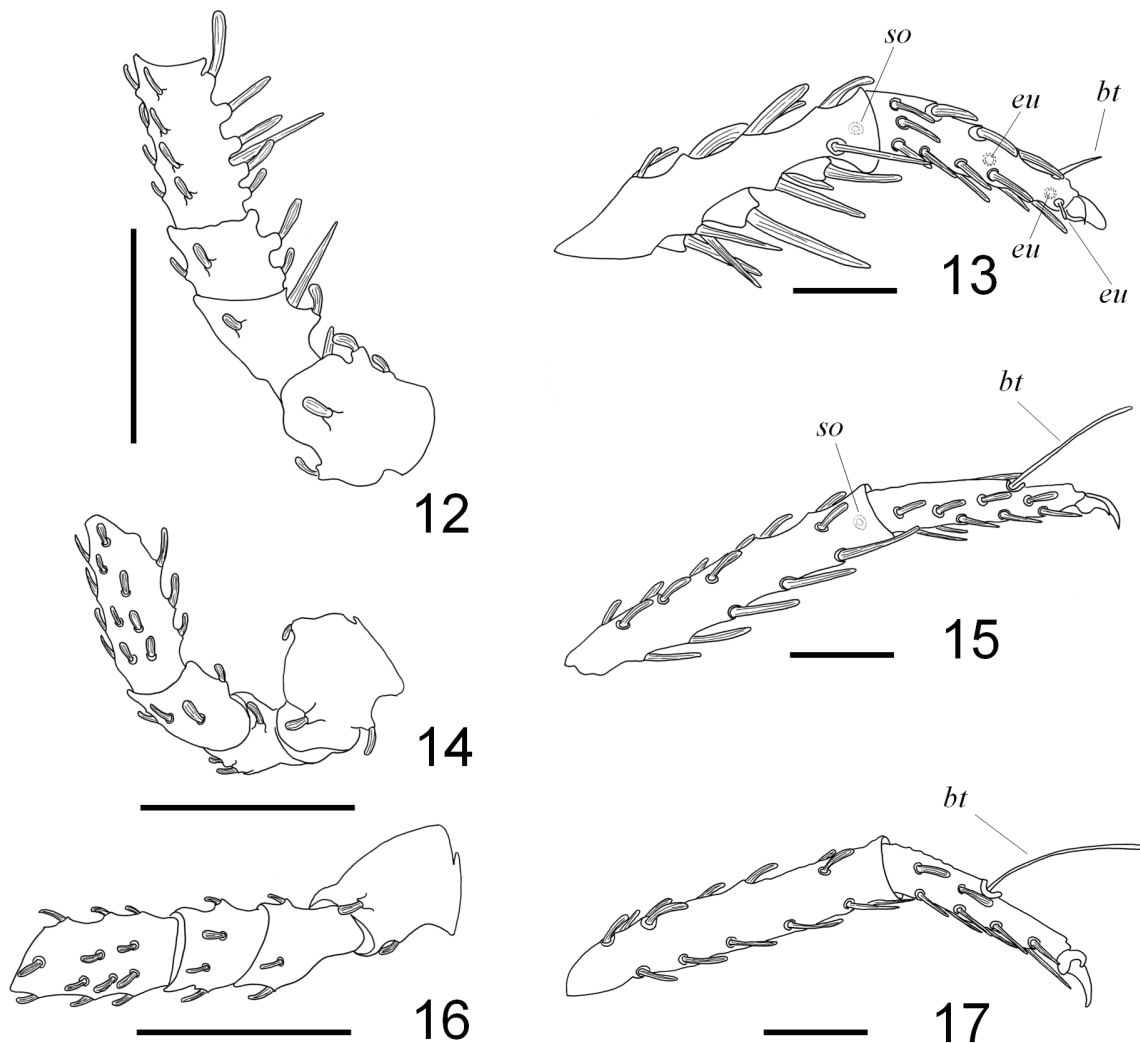


Figs 7-11. *Andocaeceulus caioi* sp. nov., paratype ♀: 7, anterior portion of aspidosoma, dorsal view. Palp: 8, ventral view; 9, dorsal view. 10, Leg I, prolateral view; 11, distal metatarsus and tarsus I, prolateral view (*Po*, naso setae; *bo*, bothridium; *bt*, tarsal bothridium; *so*, solenidion; *eu*, eupathidium). Scale bars: 7, 0.1 mm; 8, 9, 0.05 mm; 10, 0.25 mm; 11, 0.1 mm.

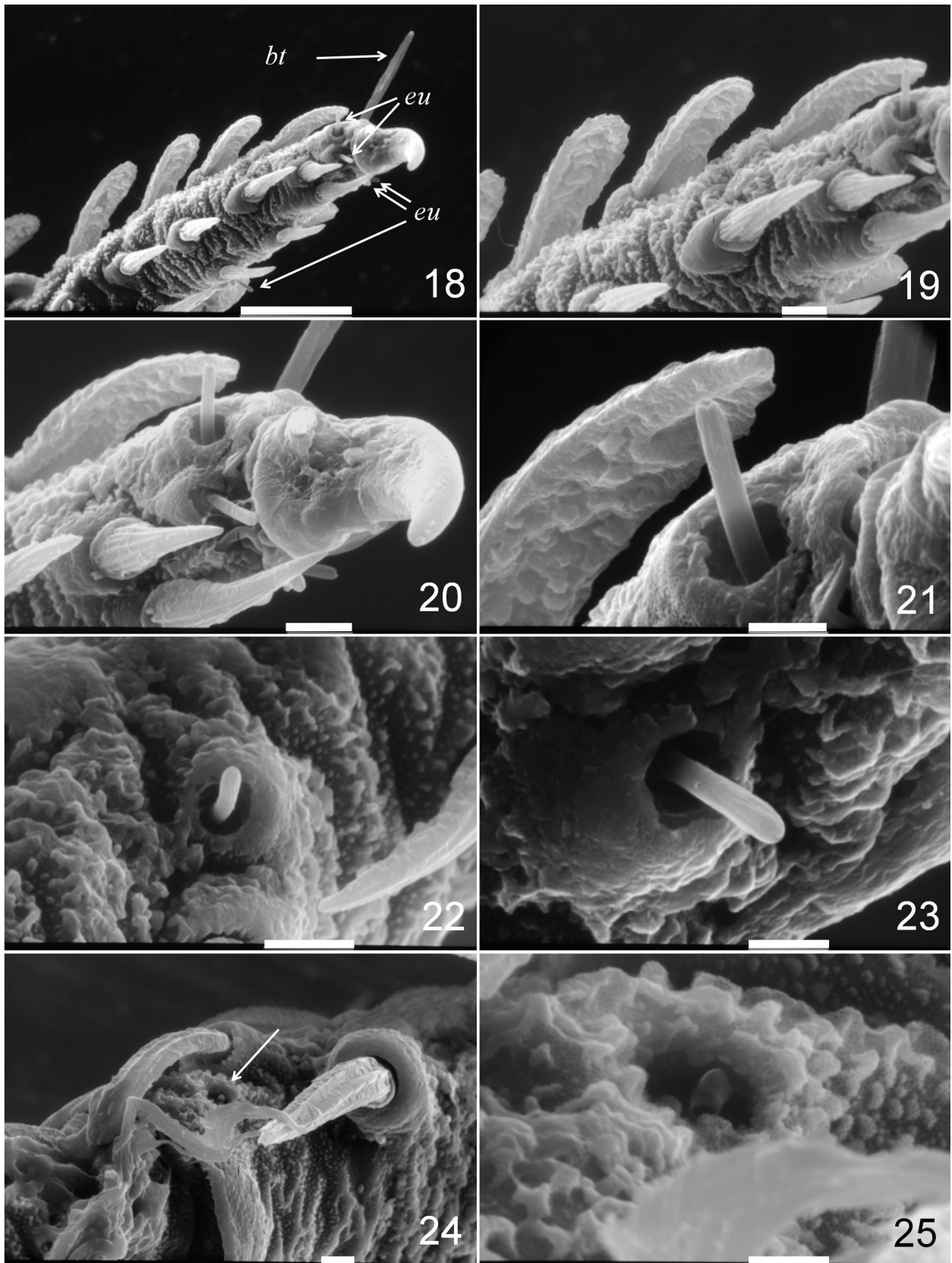
Chelicera with one dorso-distal needle-like seta; movable finger terminal, fixed finger regressed and tooth like. Palp (Figs 8, 9) four segmented, with fused femur-genu bearing three dorsal robust needle-like setae, distal one longer as proximal ones; tibia with six robust setae, three dorsal ones and one anterior, all about same length, two smaller retrolateral ones, one dorsal solenidion (Fig. 9); tarsus with two ventral setae, both prolaterally directed, five eupathidia: four distal ones being the two median very close together, the fifth one slightly in retrolateral position (Figs 8, 9).

Legs: blackish with white to light yellowish setae. Leg setae clavate or needle-like shaped, arranged mainly in five rows, ventral rows bearing mostly needle-like seta; all clavate setae mostly on anterior, dorsal or posterior rows. Legs I and II bearing very long needle-like setae (mainly on anterior and ventral sides of femur, genu and tibia) originating on large tubercles (Figs 10, 12, 13). Leg I with five eupathidia, all restricted to tarsus, being four distal ones at base of claws (two on each side) and one at

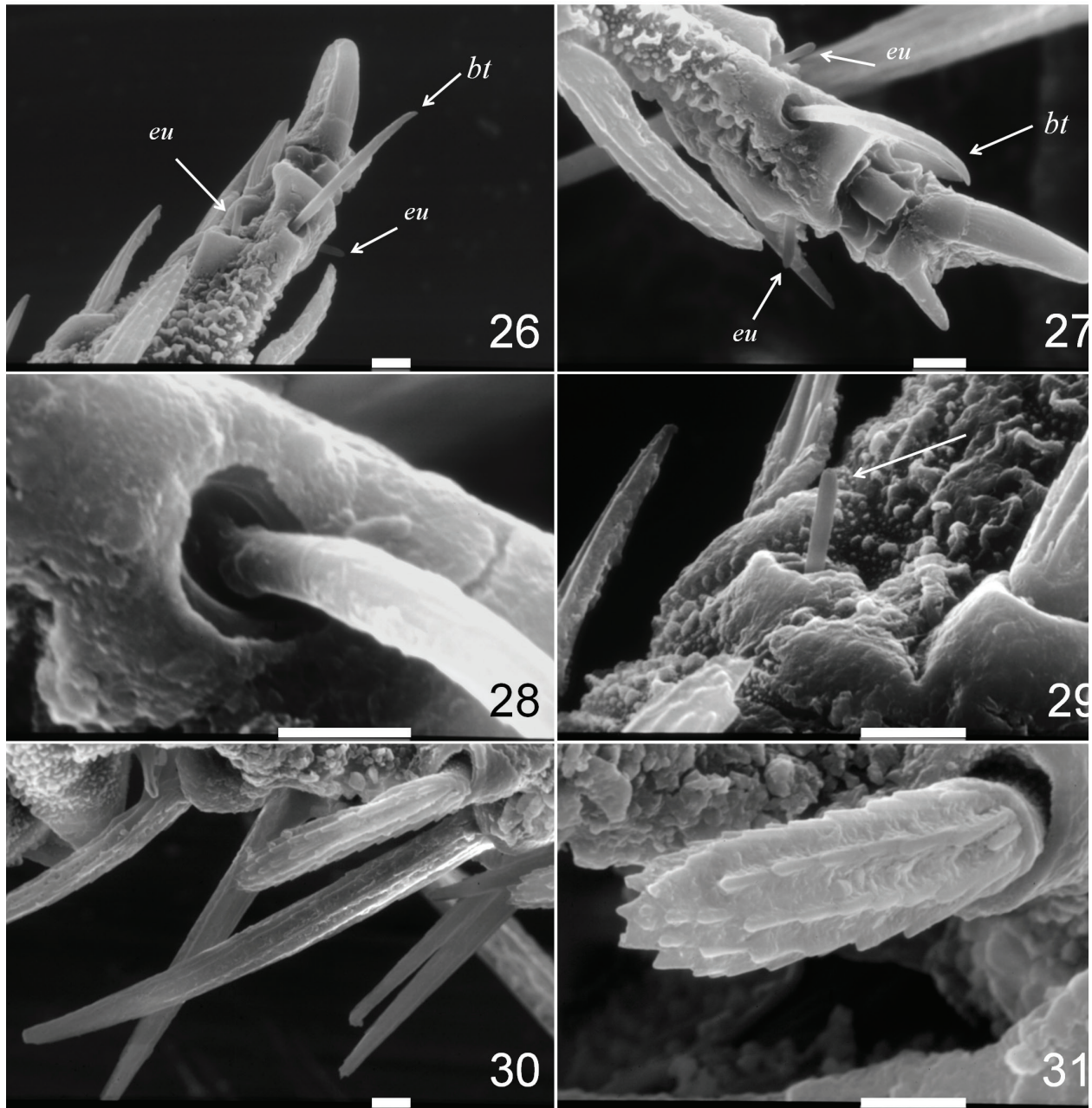
middle length in retrolateral position (Figs 11, 18-21); one distal solenidion on retrolateral side of tibia (Figs 11, 24, 25), one dorsal short bothridium distally on tarsus (Figs 11, 18); clavate setae distribution: tr, a1-1, d0-1; bf, a1-0-0, d0-0-1, p0-1-0, vp1-1-0; fe, a1-0, d0-1, p1-0, vp1-0; ge, a1-1-0-1, d1-1-1-1, p1-1-1-1; ti, a1-1-1-1, d1-1-1-0, p1-1-1-1; ta, a1-1-1-1, p1-1-0-0; needle-like setae distribution: bf, va1; fe, va1; ge, va1-1-0, v1-0-0, vp1-1-0; ti, va1-1-1, vp1-1-1; ta, va1-1-1-1-1, vp1-1-1-1-1. Leg II with three eupathidia, all restricted to tarsus, being two distal ones (the prolateral one at base of claws and the retrolateral one somewhat appart from claws, Figs 13, 26, 27) and one at middle length in retrolateral position (Figs 13, 29); one distal solenidion on tibia in retrolateral position (Fig. 13); one dorsal short bothridium on distal position of tarsus (Figs 13, 26-28); clavate setae distribution: tr, a1-1, d0-1, p0-1; bf, a1-0, d0-1, p1-0; fe, a1-1, d0-1, p1-0; ge, a1-1-0-1, d1-1-1-1, p1-1-1-1; ti, a1-1-1-1, d1-1-1-0, p1-1-1-1; ta, a1-1-1-1, p1-1-0-0; needle-like setae distribution: bf,



Figs 12-17 *Andocaeculus caioi* sp. nov., paratype ♀: 12, 14, 16, trochanter, basifemur, femur and genu, dorso-prolateral view; 13, 15, 17, metatarsus and tarsus, prolateral view; 12, 13, leg II; 14, 15, leg III; 16, 17, leg IV (bt, tarsal bothridium; so, solenidion; eu, eupathidium). Scale bars: 12, 14, 16, 0.25 mm; 13, 15, 17, 0.1 mm.



Figs 18-25. *Andocaeculus caioi* sp. nov., paratype ♀, scanning electron microscope images, Leg I: 18, tarsus, ventro-prolateral view; 19, same, detail; 20, tarsal claws, same view; 21, distal eupathidium, same view; 22, tarsal medial eupathidium, ventral view; 23, same, dorsal view; 24, distal metatarsus, ventral-retrolateral view (arrow: solenidion); 25, Same, solenidion detail (*bt*, tarsal bothridium; *eu*, eupathidium). Scale bars: 18, 50 µm; 19, 20, 22, 24, 10 µm; 21, 23, 25, 5 µm.



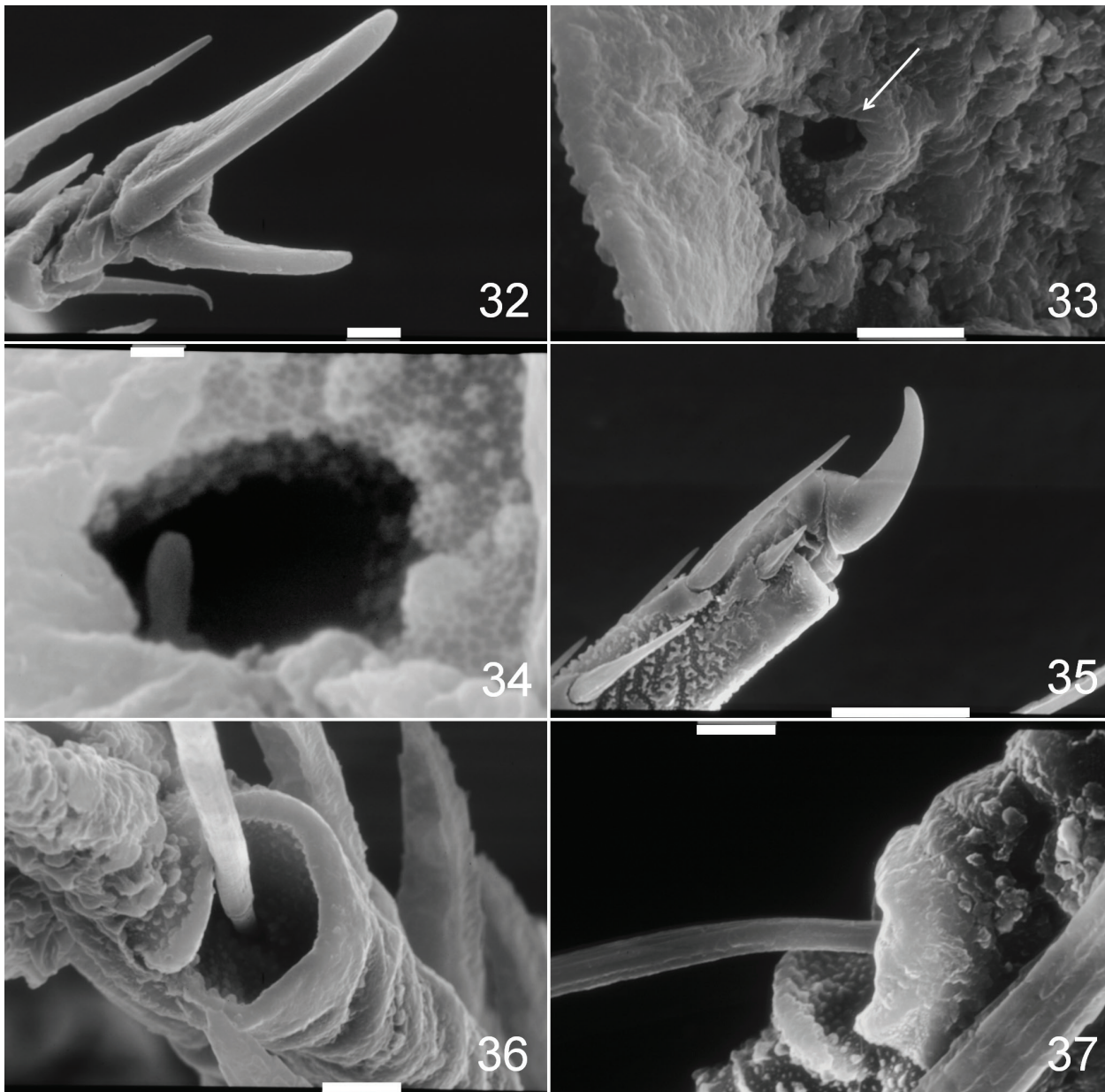
Figs 26-31. *Andocaeculus caioi* sp. nov., paratype ♀, scanning electron microscope images, Leg II: 26, tarsus, dorso-retrolateral view; 27, same, dorso-prolateral view; 28, tarsal bothridium, basal detail, same view; 29, tarsal medial eupathidium, dorso-retrolateral view; 30, metatarsal ventral spines, retrolateral view; 31, metatarsal clavate spine, retrolateral view (*bt*, tarsal bothridium; *eu*, eupathidium). Scale bars: 26, 27, 29-31, 10 µm; 28, 5 µm.

vp1-1; ge, va0-1-1, vp1-0-0; ti, va1-1-1, v1-0-1; vp1-1-1; ta, va1-1-1-1-1, vp1-1-1-1-1. Leg III with one distal solenidion on tibia in retrolateral position (Figs 15, 33, 34); one dorsal long bothridium at three quarters of the length of tarsus (Fig. 15); clavate setae distribution: tr, a1-0, d0-1, p0-1; bf, d0-1, p0-1, va0-1, vp1-1; fe, a1, d1, p1, va1, vp1; ge, a1-1-1-1, d1-1-1-0, p1-1-1-1, va1-1-1-0, vp1-0-0-1; ti, a1-1-1-0-1, d0-0-0-1-0, p1-1-1-1-1; ta, a1-1-1-1, p1-1-1-0; needle-like setae distribution: ti, va1-1-1-1-1, vp1-1-1-1-1; ta, va1-1-1-1-1, vp1-1-1-1-1. Leg

IV with one dorsal long bothridium at middle length of tarsus (Figs 17, 36, 37); clavate setae distribution: tr, d1, p1; bf, d0-1, p0-1, va0-1, vp1-1; fe, a1, d1, p1, va1, vp1; ge, a1-1-0-1, d1-1-1-0, p1-1-0-1, va1-0-1-1, vp1-0-1-0; ti, a1-1-0-0-1, d0-0-0-1-0, p1-1-1-0-1; ta, a1-1-1, p1-1-0; needle-like setae distribution: ti, va1-1-1-1-1, vp1-1-1-1-1; ta, va1-1-1-1-1, vp1-1-1-1-1.

Male. Unknown

Variation. Length 1.127-1.594 (n=10), width 0.724-1.095 (n=10).



Figs 32-37. *Andocaeculus caioi* sp. nov., paratype ♀, scanning electron microscope images, 32-34, leg III and 35-37, leg IV: 32, tarsal claws, dorsal view; 33, distal metatarsus, retrolateral view (arrow: solenidion); 34, same, solenidion detail; 35, tarsal claws, dorsal retrolateral view; 36, bothridium, antero-dorsal view; 37, same, retrolateral view. Scales: 32, 33, 36, 37, 10 µm; 34, 1 µm; 35, 50 µm.

Other examined material. 7♀ (MCN ACA 1892-1898) all 31.I.2014, R. Ott, M. Pairet & G. O. Silva leg; all same location as type material.

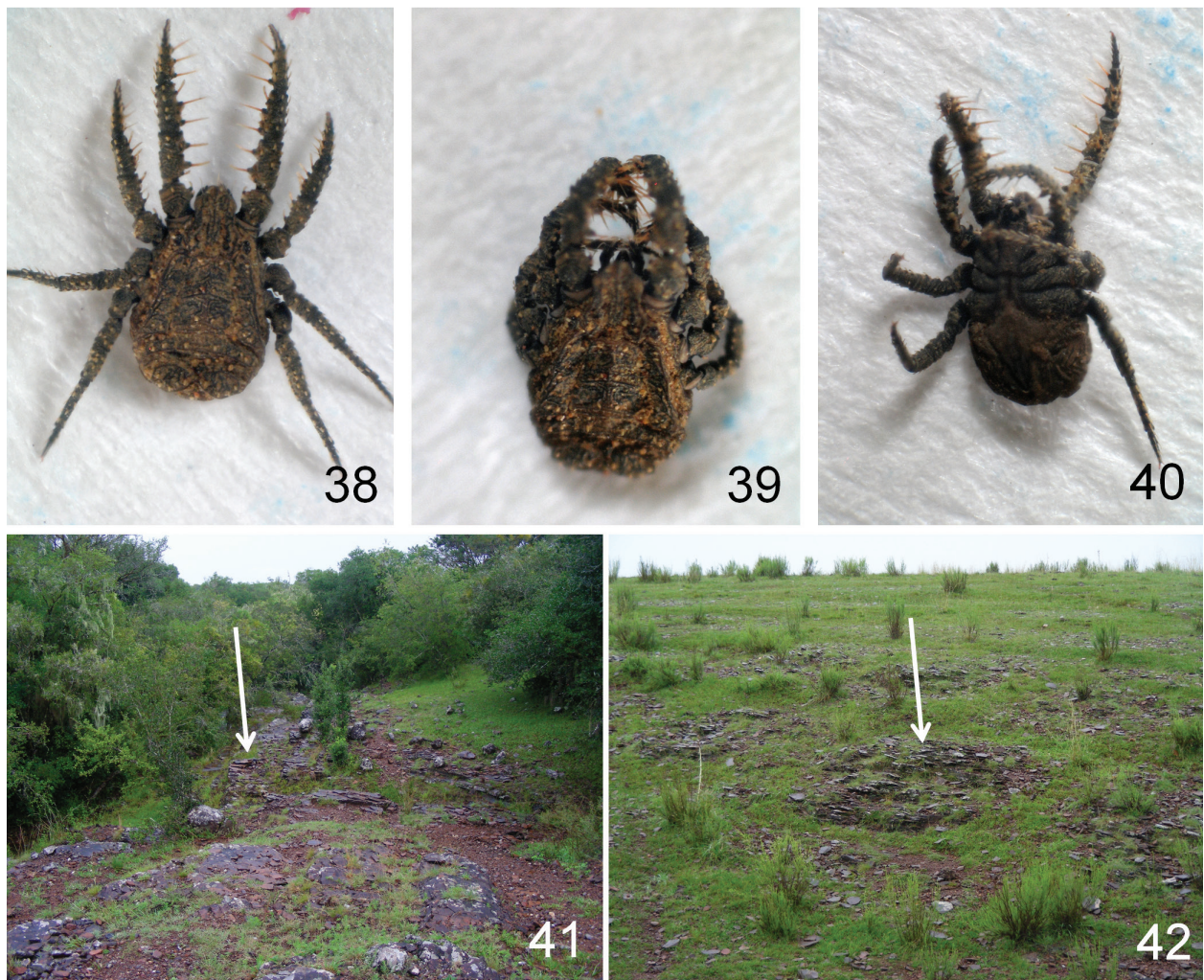
Distribution. Known only for the type locality.

Behaviour. Similar as reported by COINEAU (1974: pl. 3, 17) it was observed on live specimens that mites can present thanatosis behaviour in different positions (spread legs, withdrawn legs or irregular legs position) for many minutes, not moving even if pushed around (Figs 38-40).

Natural History. Specimens were collected under exfoliating basalt stones near a small creek (Fig. 41). Further examined material was collected in many other sites in the same area but not necessary close to water

bodies (Figs 42). As also noted by OTTO (1993) we suspect that the species is a specialized Collembola predator as many Entomobryidae were observed under the same rocks where the mites were found; unfortunately we were not able to catch any of them.

Acknowledgements. To RS Biodiversidade Project for financial support. To Antonio D. Brescovit (Instituto Butantan) for providing copies of the extensive Yves Coineau 1974 thesis. To ICMBio crew at Apa do Ibirapuitã, Eridiane Lopes da Silva and Raul Cândido da Trindade Paixão Coelho for help and support. For the Silveira family (Fazenda Rincão dos Moraes) for all the kind reception and logistic support. For Mariano Cordeiro Pairet Jr. and Guilherme Oyarzabal da Silva for the invaluable help on field.



Figs 38-42. 38-40, *Andocaeculus caioi* sp. nov., tanathosis positions images: 38, 39, dorsal view; 40, ventral view. 41, 42, Typical *A. caioi* sp. nov. habitat in exfoliating basalt outcrops (arrows), Pampa Biome, Área de Proteção Ambiental do Rio Ibirapuitã, Sant'Ana do Livramento, Brazil.

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