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The oribatid mite genus *Acaroceras* (Acari, Oribatida, Microzetidae)

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**ABSTRACT** — A new microzetid mite species, *Acaroceras* (A.) *brasiliensis* n. sp., is described from Brazil. It differs from the other representatives of the genus by the talon-like lamellar setae with ciliate branches (versus simple) and the presence of lamellar apophyses (versus absent). An identification key to the known subgenera and species of *Acaroceras* is provided. Three species of *Microzetes* are transferred to the genus *Berleszetes*: *B. longistriatus* (Sarkar, 1992) n. comb., *B. monoramai* (Sarkar, 1992) n. comb. and *B. rudrasagarensis* (Sarkar, 1992) n. comb.

**KEYWORDS** — oribatid mites; new species; Microzetidae; *Acaroceras*; key; new combination; Brazil

**INTRODUCTION**


The main diagnostic characters of the genus *Acaroceras* are (summarized from Grandjean 1936; Balogh 1962a, b; Mahunka 1991, 1993; Balogh and Balogh 1992, including our additions): bothridial setae setiform, ciliate, directed forward; lamellar setae setiform, exception – talon-like with ciliate branches, inserted under distal parts of lamellae; interlamellar setae setiform, long, inserted on the basal parts of lamellae, directed forward; lamellae wide, without lateral tooth, separated medio-distally and fused medially in basal part, with teeth or rounded distally, not cover anterior and central parts of prodorsum; interlamellar apophysis present, simple, furcated or fungoid; lamellar apophyses usually absent, rarely present; notogaster without reticulate ornamentation and striae; usually 10 pairs of epimeral setae, exception – epimeral neotrichy present (correspond to subgenus *A.* (*Trichacaroceras*)); one or two (correspond to subgenus *A.* (*Malgoceras*)) pairs of aggenital setae; adanal lyrifissures located near to anal plates or antero-laterally (correspond to subgenus *A.* (*Malgoceras*)) to them.

During taxonomic identification of oribatid mites from Brazil, we discovered one new species of the genus *Acaroceras*. The main goal of our paper is to describe and illustrate it. In addition, we provide

**MATERIALS AND METHODS**

Three specimens (holotype: male; two paratypes: all males) of *Acaroceras (Acaroceras) brasiliensis n. sp.*: Brazil, 22°57' S, 43°09' W, Rio de Janeiro, Morro do Leme, Forte Duque de Caxias, 91 m a.s.l., Atlantic forest, soil litter (unknown date and collector).

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. The notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus. General terminology used in this paper follows that of F. Grandjean (summarized by Norton and Behan-Pelletier 2009). Drawings were prepared with the aid of a drawing tube using the Carl Zeiss compound microscope "Axioskop-2 Plus".

**DESCRIPTION OF A NEW SPECIES**

*Acaroceras (Acaroceras) brasiliensis* n. sp.  
(Figures 1-3)


Notogastral setae minute, smooth. Epimeral setae setiform, barbed, little varied in length. Anterior pair of genital setae and aggenital setae well developed, barbed; other genital setae and anal and adanal setae minute, smooth.

Description — Measurements. Body length: 192 (holotype: male), 192 – 196 (two paratypes: both males); body width: 147 (holotype), 147 – 151 (two paratypes).

Integument — Body color light brownish to brown. General body surface smooth. Prodorsum between lamellae covered densely by filamentous cerotegument, notogaster covered by indistinct microgranular cerotegument. Lateral part of prodorsum and pedotecta I, and ventral plate nearly to posterior part of circumpedal carinae with short striae. Epimeral region with four long, strong longitudinal striae.

Prodorsum — Rostrum rounded. Two pairs of lobed structures present near to rostrum, all horn-like, directed upward in medio-basal part, and slightly backwards in distal part. Anterior pair (sl1) longer and thinner than posterior pair (sl2). Lamellae wide, fused medially in basal part by interlamellar apophysis (ap). Lamellae distally wide, outer and inner distal parts rounded, without teeth and indentations. Interlamellar apophysis bifurcate, with short, rectangular basal part and two long, thin branches, not reaching the level of insertions of lamellar setae. In addition, three pairs of transverse lamellar apophyses present: anterior (apa) and medial (apm) pairs simple, posterior pair (app) bifurcate. Rostral setae (ro, 41 – 45) setiform, slightly barbed, inserted on large tubercles. Lamellar setae (le, 16 – 20) talon-like, with eight long (41 – 49), simple, thin branches. Interlamellar setae (in, 110 – 123) setiform, thickened, smooth, far beyond the rostrum. Bothridial setae (ss, 98 – 106) setiform thickened, densely ciliate. Exobothridial setae and their alveoli not visible. Tutoria (tu) with long knife-like cusp.

Notogaster — Anterior margin distinct, straight. Pteromorphs pointed distally (lt), with tooth (tp) on anterior margin. Nine pairs of short, setiform, smooth notogastral setae present, c (8) longer than others (4). All lyrifissures (ia, im, ip, ih and ips)
Figure 1: *Acaroceras* (*Acaroceras*) *brasiliensis* n. sp.: A – dorsal view; B – frontal view. Scale bar 50 μm.
Figure 2: Acaroceras (Acaroceras) brasiliensis n. sp.: A – ventral view (legs not illustrated); B – posterior view. Scale bar 50 µm.
Figure 3: Acaroceras (Acaroceras) brasiliensis n. sp.: A – lateral view (legs not illustrated); B – subcapitulum, ventral view; C – trochanter, femur and genu of leg I, left, paraxial view; D – femur, genu and tibia of leg II, left, antiaxial view; E – trochanter, femur and genu of leg III, right, antiaxial view; F – leg IV, right, antiaxial view. Scale bar 20 μm.
distinct. Opisthonotal gland openings (gla) located posteriorly to im.

Gnathosoma — Generally, morphology is typical for Microzetidae (for example, Grandjean 1936; Engelbrecht 1972; Ermilov and Anichkin 2011; Ermilov et al. 2013). Subcapitulum slightly longer than wide (49 – 53 × 45 – 49). Subcapitular setae (h, m, a) setiform, barbed, similar in length (12). Two pairs of adoral setae (or) minute (4), thin, smooth. Palps (45) with setation 0-2-1-3-9(ω). Chelicerae (57) with two setiform, barbed setae: cha (24) longer than chb (16). Cheliceral tubercle (8) straight, blunt-ended.

Epimeral and lateral podosomal regions — Epimeral setal formula: 3-1-3-3. All setae (16 – 24) simple, barbed. Setae 3c inserted on pedotecta II; setae 4c inserted on discidia. Epimeral border IV well developed. Pedotecta I (Pd I) large, scale-like (in lateral view), covering acetabula I. Pedotecta II (Pd II) rounded distally (in ventral view), partly covering acetabula II. Discidia (dis) large, triangular, rounded. Circumpedal carina (cp) distinct.

Anogenital region — Six pairs of genital setae simple, g1 (14 – 16) slightly barbed, thicker and longer than other smooth setae g2-g6 (4). One pair of aggenital setae (ag, 12 – 14) setiform, slightly barbed. Two pairs of anal (an1, an2, 4) and three pairs of adanal (ad1-ad3, 4) setae minute, thin, smooth. Lyrifissures iod located in paraanal position.

Legs — Generally, morphology is typical for Microzetidae (for example, Grandjean 1936; Engelbrecht 1972; Ermilov and Anichkin 2011; Ermilov et al. 2013). Claw of each leg smooth. Formulas of leg setation and solenidia: I (1-5-3-4-19) [1-2-2], II (1-5-3-4-15) [1-1-2], III (2-3-1-3-15) [1-1-0], IV (1-2-2-3-12) [0-1-0]; homology indicated in Table 1. Antero-ventral part of femora IV serrate (ser). Setae p setiform on tarsi I, thorn-like on tarsi II-IV. Famulus short, setiform, straight. Solenidia ω1 on tarsi I and ϕ on tibia I setiform, long, other solenidia short, slightly thickened, blunt-ended.

Type deposition — The holotype is deposited in the collection of the Senckenberg Institution Frankfurt, Germany; two paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology — The name of the new species Acaroceras can be distinguished by the key which is presented below.

**Key to known species Acaroceras**


— One pair of aggenital setae; adanal lyrifissures located laterally to anal plates 2


<p>| Table 1: Leg setation and solenidia of Acaroceras (Acaroceras) |
|---|---|---|---|</p>
<table>
<thead>
<tr>
<th>Leg</th>
<th>Trochanter</th>
<th>Femur</th>
<th>Tarsus</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>v’</td>
<td>d, (l), bv”, v’”</td>
<td>(l), v’, σ</td>
</tr>
<tr>
<td>II</td>
<td>v’</td>
<td>d, (l), bv”, v’”</td>
<td>(l), v’, σ</td>
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<td>III</td>
<td>l’, v’</td>
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<tr>
<td>IV</td>
<td>v’</td>
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<td>d, l’</td>
</tr>
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Roman letters refer to normal setae (ε to famulus), Greek letters to solenidia. Single prime (’ ) marks setae on anterior and double prime (” ) setae on posterior side of the given leg segment. Parentheses refer to a pseudosymmetrical of setae.
3. Interlamellar apophysis fungoid ................. 4
   — Interlamellar apophysis furcated distally or simple .................................. 6

4. Anterior parts of lamellae with outer very long process; notogastral setae la, h2 and h3 slightly dilated distally, densely barbed; body size: 279 × 230. ..................................... A (Acaroceras) index Balogh and Mahunka, 1977(b). Distribution: Brazil.
   — Anterior parts of lamellae without outer very long process; notogastral setae la, h2 and h3 slightly simple, smooth .................................................. 5

   — Outer tooth of lamellae slightly elongated, clearly longer than small, triangular inner tooth; interlamellar setae reaching the anterior parts of lamellae; body size: 212 – 220 × 172 – 182. ......................... A (Acaroceras) hamifer Balogh and Mahunka, 1977(a). Distribution: Neotropical region.

   — Interlamellar apophysis not trifurcated distally ............................................ 7

7. Interlamellar apophysis bifurcated distally .... 8
   — Interlamellar apophysis simple .......... 15

8. Basal stalk of interlamellar apophysis clearly shorter than apical branches ........................................ 9
   — Basal stalk of interlamellar apophysis not shorter than apical branches .................. 10

   Distribution: Brazil.

10. Interlamellar setae not reaching anterior parts of lamellae ........................................... 11
    — Interlamellar setae reaching anterior parts of lamellae .................................... 12


    — Antero-medial part notogaster without cavity .................................................. 13

    — Distal margin of pteromorphs with several teeth; pores absent in ano-adanal region .......... 14

    — Distal margin of pteromorphs with four teeth; epimeral and anogenital regions not striate; body size: 282 × 210 ... A (Acaroceras) interiunctus

15. Interlamellar apophysis short, 1/4-1/5 times as long of lamellae ........................................... 16
— Interlamellar apophysis long, 1/2 times as long of lamellae ......................................................... 19

16. Interlamellar setae reaching the anterior parts of lamellae; antero-medial part of lamellae rounded; body size: 235 – 320 × 145 – 200. .................................................. At (Acaroceras) galapogoensis Schatz and Palacios-Vargas, 1999. Distribution: Galápagos Islands. — Interlamellar setae not reaching the anterior parts of lamellae; antero-medial part of lamellae pointed ........................................... 17

— Inner margin of lamellae smooth; epimeral and anogenital regions striate ........................................... 18

— Rostrum without lateral horn-like processes; notogastral setae lm and lp well developed, about 1/2 times as long of h₂; body length: 220 – 260. ......................... A. (Acaroceras) odontatus Grandjean, 1936. Distribution: Venezuela.

— Interlamellar setae not reaching the anterior parts of lamellae ......................................................... 20


REMARKS ON SYSTEMATIC PLACEMENT OF SOME MICROZETIDAE

The analysis of literature on the Microzetidae has revealed an incorrect systematic placement of three species of the genus Microzetes Berlese, 1913, which were described by Sarkar (1992) from India: M. longistriatus Sarkar, 1992, M. monoramai Sarkar, 1992 and M. rudrasagarensis Sarkar, 1992. All morphological traits of these species correspond to those of the genus Berleszetes Mahunka, 1980. Hence, they should be combined in the latter genus: B. longistriatus (Sarkar, 1992) n. comb., B. monoramai (Sarkar, 1992) n. comb. and B. rudrasagarensis (Sarkar, 1992) n. comb.

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