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http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2016): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the «Investissements d’avenir» programme (Labex Agro: ANR-10-LABX-0001-01)

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THREE NEW SPECIES OF ORIBATID MITES (ACARI, ORIBATIDA) FROM ECUADOR

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(Received 07 October 2012; accepted 03 November 2012; published online 29 March 2013)

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ABSTRACT — Three new oribatid mite species – *Ampullobates ecuadoriensis* n. sp., *Plenotocepheus neotropicus* n. sp. and *Monoschelobates hemileiformis* n. sp. – are described from Ecuador. The three genera are also new for Ecuador. *Ampullobates ecuadoriensis* n. sp. is morphologically similar to *Ampullobates nigriclavatus* Grandjean, but differs from the latter by the morphology of the lamellar, exuvial and some epimeral setae, sensilli, the size of the interlamellar and exobothridial setae and the position of the genital setae. *Plenotocepheus neotropicus* n. sp. is morphologically similar to *Plenotocepheus mollicoma* Hammer, but differs by the length of interlamellar setae, morphology of sensilli, localization of lyrifissures ad and anal setae ad and structure of leg setae u. Finally, *Monoschelobates hemileiformis* n. sp. is morphologically similar to *Monoschelobates parvus* Balogh and Mahunka, but shows differences in body size, length of the interlamellar, notogastral and anogenital setae and the presence of aggenital setae.

KEYWORDS — oribatid mites; new species; *Ampullobates*; *Plenotocepheus*; *Monoschelobates*; Ecuador

INTRODUCTION

This paper is a part of our ongoing studies on the Ecuadorian oribatid mite fauna (Ermilov and Kalúz 2012a-e). It reports the description of three new species, one belonging to the genus *Ampullobates* Grandjean, 1962 (Hermanniellidae), one to the genus *Plenotocepheus* Hammer, 1966 (Tetracondylidae) and another to the genus *Monoschelobates* Balogh and Mahunka, 1969 (Scheloribatidae).

*Ampullobates* is a monotypic genus proposed by Grandjean (1962) with *Ampullobates nigriclavatus* Grandjean as type species. This genus is herein recorded for the first time from Ecuador. The main generic characters of *Ampullobates* are presented by Grandjean (1962b), and summarized by Balogh and Balogh (1988, 1992).

*Plenotocepheus* is a genus proposed by Hammer (1966) with *Plenotocepheus mollicoma* Hammer, 1966 as type species. It currently comprises ten species, distributed in the subtropics; this genus is herein recorded for the first time from Ecuador. The main generic characters of *Plenotocepheus* are presented by Hammer (1966), and summarized by Balogh and Balogh (1992) and Grobler (1995a). Known species of this genus were included in several keys (Grobler 1995a, b; Balogh and Balogh 2002).

*Monoschelobates* is a genus proposed by Balogh and Mahunka (1969) with *Monoschelobates parvus* Balogh and Mahunka, 1969 as type species. It
currently comprises two species, recorded from Brazil; this genus is herein recorded for the first time from Ecuador. The main generic characters of *Monoschelobates* are presented by Balogh and Mahunka (1969), and summarized by Balogh and Balogh (1992).

The purpose of this paper is to describe and illustrate three new species, *Ampullobates ecuadoriensis* n. sp., *Plenotocepheus neotropicus* n. sp. and *Monoschelobates hemileiformis* n. sp.

**MATERIAL AND METHODS**

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. All body measurements are presented in micrometers. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate, to avoid discrepancies caused by different degrees of notogastral distortion. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral view. Terminology used in this paper follows that of Grandjean (1962a, b), Grobler (1995a, b), Norton and Behan-Pelletier (2009).

**DESCRIPTIONS OF NEW SPECIES**

*Ampullobates ecuadoriensis* n. sp.

(Figures 1-2)

Diagnosis — Body size 664 – 713 x 431 – 481. Surface of prodorsum microtuberculate. Surface of notogaster and anogenital region foveolate. Interlamellar setae setiform, thickened, densely barbed. Notogastral setae slightly barbed: *h*1, *h*2 and *p*1 dilated distally, and *p*2 and *p*3 simple. Epimeral setae *1a*, *2a* and *3a* bifurcate. One pair of genital setae inserted separately from others.

Measurements — Body length 697 (holotype), 664 – 713 (mean 693; four paratypes); notogaster width 448 (holotype), 431 – 481 (mean 452; four paratypes).

Integument — (Figures 1A, 2I). Body color yellowish to brown. Surface of prodorsum and ventral side microtuberculate (diameter of tubercles up to 2). Surface of notogaster, anogenital region, genital and anal plates foveolate (diameter of foveolae up to 12).


Notogaster — (Figures 1A, C; 2B-D). Anterior margin convex. Notogaster covered by the thin exuvium, having three pairs of centrodorsal setae (*d*1, *E*1, 65 – 73; *e*1, *E*1, 49 – 53; *f*1, *E*1, 36 – 41) and six pairs of setal alveoli. Exuvial setae simple, thick, straight, densely barbed. Notogastral setae *c*1, *c*2, *c*3, *d*1, *d*2, *e*1, *f*2, *f*1 and *f*2 reduced. Only six pairs of notogastral setae well developed: *p*1, *h*1 and *h*2 (32 – 41) dilated distally, slightly serrate; *p*2 and *p*3 (28 – 32) thickened, setiform, straight, slightly barbed; *c*3 (16) setiform, thin, smooth. Lyrifissures and opisthontal gland openings (*gla*) located typically for the family.

Gnathosoma — (Figures 2E-G). Typical for Hermanniellidae (Grandjean 1962b; Ermilov and Kalúz 2012a). Subcapitulum longer than wide: 164 – 172 x 123. Subcapitular setae setiform, straight, smooth; *m* (53 – 57) longer than *h* (41 – 45) and *a* (32 – 36). Adoral setae *or*1 (20 – 24) fusiform, smooth; adoral setae *or*2 (24 – 28) thickened, densely barbed. Palps (length 94) with setation 0-2-1-3-6(+1ω). Solenidion not attached with eupathidium (*acm*). Chelicerae (length 164) with two setiform, barbed setae: *cha* (82) longer, than *chb* (36). Trägårdh’s organ not evident.

Epimeral region — (Figures 1B; 2H). Epimeral setal formula: 3-1-2-3. Setae slightly barbed: *1a*, *2a*, 3a (all 32 – 36) bifurcate; others (all 41 – 45) setiform, straight. Discidia (*dis*) blunt-ended distally.

Anogenital region — (Figures 1B; 2I). Seven pairs of genital setae (anterior pair 32 – 36; others 16 – 20) setiform, smooth inserted in two parallel rows; seventh pair longest (41 – 45), inserted separately from others. One pair of aggenital (*ag*) and
Figure 1: Ampullobates ecuadoriensis n. sp.: A – dorsal view; B – ventral view, legs, subcapitular setae and palps not shown; C – lateral view of prodorsum, legs and gnathosoma not shown; D – sensillus. Scale bar (A, B) 200 µm, scale bar (C) 100 µm, scale bar (D) 20 µm.
Figure 2: *Ampullobates ecuadoriensis* n. sp.: A – interlamellar seta; B – exuvial seta d1 E; C – notogastral seta h1; D – notogastral seta p2; E – subcapitulum, left half; F – palptarsus; G – anterior part of chelicera; H – epimal seta 3a; I – genital plate, left; J – leg tarsus I, left, antiaxial view. Scale bar (A+D, G, I) 20 µm, scale bar (E, J) 50 µm, scale bar (F, H) 10 µm.
two pairs of anal setae similar in length \((a_{n1}, a_{n2}, 36 - 41)\), setiform, smooth. Three pairs of anal setae \((a_{n1}, 45 - 49, a_{n2}, 36 - 41)\) setiform, slightly barbed. Lyrifissures \(iad\) in inverse apoanal position, located laterally to anal setae \(a_{d3}\).

Legs — (Figure 2J). Typical for Hermanniellidae (Grandjean 1962a; Ermilov and Kalúz 2012a). Claw of each tarsus smooth. Homology of setae and solenidia is indicated in Table 1. Famulus (\(e\)) and solenidia setiform.

Material examined — Holotype (male) and four paratypes (two males, two females): Southern Ecuador, 3°58' S, 79°50' W, Estación Scientifica San Francisco, 2000 m. a.s.l., upper organic soil layer in mostly undisturbed rain forest, 01.04.2008, collected by F. Marian and D. Sandmann.

Type deposition — The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; two paratypes are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; two paratypes are in the personal collection of the first author.

Etymology — The specific name “ecuadoriensis” refers to the country of origin, Ecuador.

Remarks — *Ampullobates ecuadoriensis* n. sp. can be distinguished from the type species *Ampullobates nigriclavatus* Grandjean, 1962 (see Grandjean 1962b) by the setiform, bent lamellar setae (versus thickened, straight in *A. nigriclavatus*), longer interlamellar and exobothridial setae (versus minute in *A. nigriclavatus*), poorly developed, lanceolate sensillar head (versus well developed, rounded distally in *A. nigriclavatus*), thick, not dilated centrodorsal setae (versus clearly dilated in *A. nigriclavatus*), bifurcate epimeral setae \(1a, 2a, 3a\) (versus setiform in *A. nigriclavatus*), and the position of one pair genital seta separated from the other six pairs (versus all genital setae inserted in two rows in *A. nigriclavatus*).

<table>
<thead>
<tr>
<th>Leg</th>
<th>Trochanter</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus</th>
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<td>(d, (l), bv'', v'')</td>
<td>(l, (v), \phi_1, \phi_2)</td>
<td>(l, (v), \phi_1, \phi_2)</td>
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<td>(l, (v), \phi_1)</td>
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<tr>
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<td>(d, l', ev')</td>
<td>(l', v', \phi_1)</td>
<td>(l', v', \phi_1)</td>
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<td>IV</td>
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<td>(d, l', ev')</td>
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</table>

Roman letters refer to normal setae (\(e\) to famulus); Greek letters to solenidia; \(\phi_1\) and \(\phi_2\) — solenidion and seta coupled. Single prime (\(\prime\)) marks setae on anterior and double prime (\(\prime\)) setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.


**Table 1:** Leg setation and solenidia of *Ampullobates ecuadoriensis* n. sp.
Figure 3: Plenotocepheus notropicus n. sp.: A – dorsal view; B – ventral view, legs, subcapitular setae and palps not shown; C – lateral view of prodorsum, legs and gnathosoma not shown; D – sensillus. Scale bar (A, B) 200 µm, scale bar (C) 100 µm, scale bar (D) 20 µm.
FIGURE 4: Plenotocephius neotropicus n. sp.: A – Prodorsal and notogastral condyles; B – subcapitulum, left half; C – palptarsus; D – anterior part of chelicera; E – epimetal seta 4b; F – genital plate, right; G – aggenital seta; H – anal seta an2; I – leg tarsus I, right, antiaxial view. Scale bar (A) 50 µm, scale bar (B, D, F, I) 20 µm, scale bar (C, E, G, H) 10 µm.
(69 – 77), lamellar (73 – 77) and interlamellar (139 – 147) setae setiform, slightly barbed. Sensilli (106 – 118) lanceolate, smooth. Exobothridial setae (8) thin, smooth. All prodorsal condyles well developed, similar in sizes, rounded distally, located separately. Pedotecta I and II (Pt II) developed typically for genus.

Notogaster — (Figures 3A, C; 4A). Median condyles absent. Lateral condyles present, small, rounded distally. Notogaster with 14 pairs of notogastral setae, which are medium sized (127 – 164), setiform, slightly barbed. Lyrifissures and opisthonal gland openings developed in the typical arrangement of the family.

Gnathosoma — (Figures 4B-D). Typical for Tetracondylidae (Grobler 1995a; Ermilov et al. 2010). Claw of each tarsus with several small bars in dorsal side. Homology of setae and solenidia indicated in Table 2. Tarsi I and II with one to two conical teeth on dorsal side. Leg setae u thorn-like on all tarsi. Famulus short, with small swelling distally. Solenidia simple.

Material examined — Holotype (male) and seven paratypes (four males, three females): Southern Ecuador, 3°58’ – 4°70’ S, 78°58’ – 79°50’ W, Bombuscaro, Podocarpus National Park and Estacion Cientifica San Francisco, 2000 – 3000 m. a.s.l., upper organic soil layer in mostly undisturbed rain forest, 01.04.2008, collected by F. Marian.

Type deposition — The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; three paratypes are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; four paratypes are in the personal collection of the first author.

Etymology — The specific name "neotropicus" refers to the region of origin, the Neotropical region.

Remarks — Plenotocepheus neotropicus n. sp. is most similar to Plenotocepheus mollicoma Hammer, 1966 (see Hammer 1966) from New Zealand in the absence of medial notogastral condyles and shape of body setae. However, it is clearly distinguishable.

## Table 2: Leg setation and solenidia of Plenotocepheus neotropicus n. sp.

<table>
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<th>Leg</th>
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<th>Tibia</th>
<th>Tarsus</th>
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<tr>
<td>I</td>
<td>υ'</td>
<td>d, l₀, bv''</td>
<td>l₀, υ', σ</td>
<td>(l₀), (v), ϕ₁, ϕ₂</td>
<td>(l₀), (v), ϕ₁, ϕ₂</td>
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<tr>
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<td>υ'</td>
<td>d, l₀, bv''</td>
<td>l₀, υ', σ</td>
<td>l₀', (v), ϕ</td>
<td>(l₀'), (v), ϕ</td>
</tr>
<tr>
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<td>l₀', υ'</td>
<td>d, l₁, ev'</td>
<td>l₁', σ</td>
<td>(v), ϕ</td>
<td>(v), ϕ</td>
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<tr>
<td>IV</td>
<td>υ'</td>
<td>d, ev'</td>
<td>d, l₁</td>
<td>(v), ϕ</td>
<td>(v), ϕ</td>
</tr>
</tbody>
</table>

Roman letters refer to normal setae (e to famulus); Greek letters to solenidia; d ø and d _ø_ — solenidion and seta coupled. Single prime (’) marks setae on anterior and double prime (’’) setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.
able from the latter by the long interlamellar setae, which are longer than the rostral and lamellar setae (interlamellar setae considerably shorter than rostral and lamellar setae in *P. mollicoma*), sensillar heads weakly pointed distally, longer than its stalk (sensillar heads with long, thin tip, longer than its stalk in *P. mollicoma*), lyrifissures *iad* in direct apoanal position (inverse apoanal in *P. mollicoma*), distance between adanal setae *ad*3-*ad*3 longer than that between *ad*2-*ad*2 (shorter in *P. mollicoma*), and thorn-like leg setae *u* on tarsi I (setiform in *P. mollicoma*).

**Monoschelobates hemileiformis** n. sp.  
(Figures 5-6)


Measurements — Body length 498 (holotype), 448 – 498 (mean 471; five paratypes); notogaster width 282 (holotype), 265 – 282 (mean 272; five paratypes).


Prodorsum — (Figures 5A, C, D). Rostrum rounded in dorsal view. Lamellae located dorsolaterally, little longer than half of prodorsum (see in lateral view), without cusps. Translamella absent, but rudimentary parts present nearby to lamellae. Prolamellar and sublamellar lines present. Sublamellar porose areas (*Al*) round, small (6 – 8). Rostral (53 – 65), lamellar (90 – 102) and interlamellar (164 – 172) setae setiform, barbed. Lamellar setae inserted on the distal part of lamellae. Sensillii (77 – 82) clavate, its head slightly barbed. Exobothridial setae (2 – 4) minute, thin, smooth. Pedotecta I and II typical for genus.

Notogaster — (Figures 5A, C). Antero-medial part straight or weakly convex. Ten pairs of short (24 – 36), smooth notogastral setae present. Four pairs of sacculi (*Sa*, *S1*, *S2*, *S3*) small. Lyrifissures and opisthontonal gland openings in typical arrangement of the family.


Anogenital region — (Figures 5B; 6E, F). Four pairs of genital (*g1*, 20 – 24; *g2-g4* 14 – 16), one pair of aggenital (12), two pairs of anal (12 – 16) and three pairs of adanal (20) setae setiform, smooth. Lyrifissures *iad* located in paranal position.

Legs — (Figure 6G). Typical for Scheloribatidae (Ermilov et al. 2011; Ermilov and Kalúz 2012e). Claw of each tarsus smooth. Homology of setae and solenidia indicated in Table 3. Famulus short, with small swelling distally. Solenidia simple.

Material examined — Holotype (male) and five paratypes (three males, two females): Southern Ecuador, 4°60’ S, 78°58’ – 79°10’ W, Cajanuma, Podocarpus National Park, 3000 m. a.s.l., upper organic soil layer in mostly undisturbed rain forest, 01.04.2008, collected by D. Sandmann.

Type deposition — The holotype is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; two paratypes are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; three paratypes are in the personal collection of the first author.

Etymology — The specific name “*hemileiformis*” refers to the similarity of the new species to representatives of the subgenus *Scheloribates* (*Hemileius*) Berlese, 1916.

Remarks — *Monoschelobates hemileiformis* n. sp. can be distinguished from the type species, *M. parvus* Balogh and Mahunka, 1969 (see Balogh and
Figure 5: Monoschelobates hemileiformis n. sp.: A – dorsal view; B – ventral view, legs, subcapitular setae and palps not shown; C – lateral view of prodorsum, legs and gnathosoma not shown; D – sensillus. Scale bar (A+C) 100 µm, scale bar (D) 20 µm.
Figure 6: Monochelobates hemileiformis n. sp.: A – subcapitulum, left half; B – palp tarsus; C – anterior part of chelicera; D – tutorium and epimeral seta 4c; E – genital plate, right; F – anal plate, right; G – leg tarsus I, right, paraxial view. Scale bars (A, C, F, G) 20 µm, scale bar (B, D, E) 10 µm.
Roman letters refer to normal setae (e to famulus); Greek letters to solenidia; \( \frac{d}{d} \) and \( \frac{d}{d} \) — solenidion and seta coupled. Single prime (′) marks setae on anterior and double prime (ʺ) setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

TABLE 3: Leg setation and solenidia of Monoschelobates hemileiformis n. sp.

<table>
<thead>
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<tbody>
<tr>
<td>I</td>
<td>( v' )</td>
<td>( d, (l), bv'', v'' )</td>
<td>( l), v', \sigma )</td>
<td>( l), (v), \varphi_1, \varphi_2 )</td>
<td>( f(l), (tc), (it), (p), (u), (a), s, (pv), v' )</td>
</tr>
<tr>
<td>II</td>
<td>( v' )</td>
<td>( d, l', l'', bv'', v'' )</td>
<td>( l), \sigma )</td>
<td>( l), (v), \varphi )</td>
<td>( f(l), (tc), (it), (p), (u), (a), s, (pv), \omega_1, \omega_2 )</td>
</tr>
<tr>
<td>III</td>
<td>( l', v' )</td>
<td>( d, l', ev' )</td>
<td>( l', \sigma )</td>
<td>( l', (v), \varphi )</td>
<td>( f(l), (tc), (it), (p), (u), (a), s, (pv) )</td>
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<tr>
<td>IV</td>
<td>( v' )</td>
<td>( d, ev' )</td>
<td>( d, l' )</td>
<td>( l', \sigma )</td>
<td>( f(l), (tc), (it), (p), (u), (a), s, (pv) )</td>
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Due to the combination of generic characters (in particular, rudimentary pteromorphs, four pairs of sacculi, ten pairs of short notogastral setae, four pairs of genitalic setae), the species of the genus Monoschelobates are similar to species of the subgenus Scheloribates (Hemileius). Only a single main difference is monodactylous leg tarsi in Monoschelobates versus tridactylous in Scheloribates (Hemileius). Also, the type species of Monoschelobates, M. parvus, is without aggenital setae. Presence of absence of aggenital setae, and variation in numbers of leg claws are not apomorphic characters, therefore it can be used as subgeneric characters. Hence, possibly, Monoschelobates parvus and M. hemileiformis n. sp. should be included in the subgenus Scheloribates (Hemileius). However, the classification of genera in the family Scheloribatidae is difficult, and the further research on the taxonomic status of Monoschelobates is needed.

ACKNOWLEDGEMENTS

We cordially thank Dr. Umukusum Ya. Shtanchaeva (Caspian Institute of Biological Resources, Makhachkala, Russia) and Prof. Dr. Luis S. Subías (University Complutense de Madrid, Madrid, Spain) for consultations. We cordially thank reviewers for the valuable comments. Oribatid mites were investigated as part of the Research Unit “Biodiversity and sustainable management of a megadiverse mountain ecosystem in South Ecuador”, subproject “Soil fauna: Diversity and functioning” headed by Mark Maraun and Stefan Scheu; financial support by the German Research Foundation is gratefully acknowledged (RU 816).

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doi:10.1051/acarologia/20122046


doi:10.1080/01647954.2012.687499


doi:10.5733/afin.052.0207


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