Two new species of oribatid mites (Acari: Oribatida) from Ethiopia, including a key to species of Pilobatella

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Abstract

Two new oribatid mite species, Austrocarabodes (Uluguroides) kluttzi Ermilov, Winchester, Lowman & Wassie sp. nov. (Carabodidae) and Pilobatella lowmanae Ermilov, Winchester & Wassie sp. nov. (Haplozetidae), are described from the Afro-montane forests, in the northern highlands of Ethiopia. An identification key to all known species of Pilobatella is given. An annotated checklist of identified oribatid mite taxa sampled in this study is presented. Fourteen species, six genera and three families are recorded for the first time from Ethiopia.

Key words: oribatid mites, Austrocarabodes (Uluguroides), Pilobatella, new species, key, checklist, Ethiopia

Introduction

The oribatid mite fauna of Ethiopia is poorly known and until recently, only 39 species had been recorded (Berlese 1916; Aoki 1971; Mahunka 1982, 1983, 1984; Bernini 1988; Niedbała 2008). During the last three years oribatid mites have been more intensively studied (Ermilov et al. 2010a–c, 2011a–c) and, at present, 128 species have been documented (Ermilov et al. 2012). They are often the dominant microarthropod group in forest soil-litter habitats and it is expected that continued research on the Ethiopian oribatid mite fauna will significantly augment the recorded species diversity for the country.

In the course of taxonomic identification of oribatid mites (see Checklist of identified oribatid mites), collected in Afro-montane forests in the northern highlands of Ethiopia, we found representatives of two new species, one belonging to the genus Austrocarabodes Hammer, 1966 (subgenus Uluguroides Mahunka, 1983) (Carabodidae) and the other to Pilobatella Balogh and Mahunka, 1967 (Haplozetidae).

Austrocarabodes (Uluguroides) is a small subgenus that was proposed by Mahunka (1983) as a genus with Uluguroides trichosus Mahunka, 1983 as the type species. Currently, the subgenus comprises seven species and one subspecies, which are distributed in the Ethiopian region (Subías 2004, online version 2011). Earlier, two species were recorded from Ethiopia (see Ermilov et al.

Pilobatella is a small genus that was proposed by Balogh and Mahunka (1967) with Pilobatella punctulata Balogh and Mahunka, 1967 as the type species. Currently, the genus comprises nine species, which have a pantropical distribution (Subías 2004, online version 2011; Mahunka 2011). Representatives of Pilobatella have not been recorded from Ethiopia before. The main generic characters of the genus Pilobatella are presented by Balogh and Mahunka (1967) and summarized by Balogh and Balogh (1984, 1992); see also subsection Remarks. An identification key to some species of this genus is presented by Balogh and Balogh (2002).

The main purpose of this paper is to describe and illustrate two new species of oribatid mites from the genera Austrocarabodes and Pilobatella that were discovered from soil-litter in the northern highland Afro-montane forests of Ethiopia. In addition, an identification key to all known species of Pilobatella and a checklist of identified oribatid mites from these Afro-montane forests is presented.

Materials and methods

Oribatid mites associated with suspended soils/epiphytes and ground debris in Ethiopian Church Forests were collected in August, 2010. We sampled two fragments of forest—Debresena and Zahar. Debresna (11°51’ N, 37°59’ E) is a 11.5 hectare fragment containing 34 tree species at an elevation of 2690 metres. Zahar (11°48’ N, 37°34’ E) is lower (1950 m) in elevation and has less tree species (29). Although both fragments are small, they differ markedly in the degree of human impact within and outside of the forest fragment: Debresna represents a fragment that is significantly more intact with reduced human impacts when compared to Zahar.

We used single rope techniques to access the canopy and samples were collected with a soil corer, 3 cm diameter x 5 cm deep. Contents of each sample core were extracted in the field. Oribatid mites were extracted into 75% EtOH using Berlese funnels which were run for 48 hours. Since power was unavailable, samples were extracted using moth balls, a variation on the standard extraction technique but one that is proving to be valuable for areas where a power source is unavailable. Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. All body measurements are presented in micrometers (μm). 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 aspect.

Formulae for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulae for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus.

General terminology used in this paper follows that of Norton and Behan-Pelletier (2009).

List of collecting sites

Et-N-1. Afro-montane forest, northern highlands of Ethiopia, 11°51’ N, 37°59’ E, 2690 m above sea level, Debresena, (Church forest) soil, 19 August 2010, coll. N.N. Winchester.

Checklist of identified oribatid mites

Malaconothridae
Malaconothrus ensifer Mahunka
    Distribution: Et-N-1, Et-N-2

Camisiidae
Camisia tryphosa Colloff—The genus and species are recorded for the first time from Ethiopia
    Distribution: Et-N-1, Et-N-2
Heminothrus hooki (Piffl)—The species is recorded for the first time from Ethiopia
    Distribution: Et-N-2

Nothridae
Nothrus crassisetus Mahunka
    Distribution: Et-N-1, Et-N-2

Aleurodamaeidae
Aleurodamaeus africanus Mahunka
    Distribution: Et-N-2

Damaeidae
Metabelba glabriseta Mahunka
    Distribution: Et-N-1, Et-N-2

Astegistidae—The family is recorded for the first time from Ethiopia
Cultroribula bicuspidata Mahunka—The genus and species are recorded for the first time from Ethiopia
    Distribution: Et-N-2

Gustaviidae
Gustavia aethiopica Mahunka
    Distribution: Et-N-2

Damaeolidae
Fosseremus laciniatus (Berlese)—The species is recorded for the first time from Ethiopia
    Distribution: Et-N-1

Eremulidae—The family is recorded for the first time for Ethiopia
Eremulus csuzdi Mahunka & Mahunka-Papp—The genus and species are recorded for the first time from Ethiopia
    Distribution: Et-N-2

Oppiidae
Arcoppia arborea Ermilov, Sidorchuk & Rybalov
Distribution: Et-N-1

*Neoamerioppia polygonata* (Mahunka)
Distribution: Et-N-1, Et-N-2

**Teratoppiidae**

*Teratoppi a pectinata* Balogh
Distribution: Et-N-1

**Carabodidae**

*Australocarabodes (Uluguroides) klutzi* Ermilov, Winchester, Lowman & Wassie *sp. nov.*
Distribution: Et-N-1, Et-N-2

*Congocepheus taurus* Balogh —The species is recorded for the first time from Ethiopia
Distribution: Et-N-2

**Microtegeidae**

*Microtegeus rugosus* Mahunka
Distribution: Et-N-1, Et-N-2

**Phenopelopidae**

*Eupelops pocsi* Mahunka—The species is recorded for the first time from Ethiopia
Distribution: Et-N-1, Et-N-2

**Mycobatidae**—The family is recorded for the first time from Ethiopia

*Allozetes africanaus* Balogh—The genus and species are recorded for the first time from Ethiopia
Distribution: Et-N-2

**Mochlozetidae**

*Unguizetes atypicus* (Mahunka)
Distribution: Et-N-1, Et-N-2

**Caloppiidae**

*Zetorchella pedestris* Berlese—The species is recorded for the first time from Ethiopia
Distribution: Et-N-2

**Haplozetidae**

*Pilobatella lowmanae* Ermilov, Winchester & Wassie *sp. nov.*—The genus is recorded for the first time from Ethiopia
Distribution: Et-N-1

**Hemileiidae**

*Hemileius tropicus* Balogh—The genus and species are recorded for the first time for Ethiopia
Distribution: Et-N-1

**Scheloribatidae**

(?) *Perscheloribates luminosus* Hammer (a problem of identification of this species was discussed earlier—Ermilov, Rybalov & Franke, 2011).
Distribution: Et-N-1, Et-N-2

*Perscheloribates minitus* (Pletzen)
Scheloribates aethiopicus Mahunka
Distribution: Et-N-1, Et-N-2

Scheloribates fimbriatus Thor—The species is recorded for the first time from Ethiopia
Distribution: Et-N-1, Et-N-2

Scheloribates praecincisus (Berlese)—The species is recorded for the first time from Ethiopia
Distribution: Et-N-1, Et-N-2

Galumnidae

Galumna incisa Mahunka
Distribution: Et-N-2

Galumna lanceosensilla Ermilov, Sidorchuk, Rybalov
Distribution: Et-N-1

Galumna flabellifera Hammer—The species is recorded for the first time from Ethiopia
Distribution: Et-N-1, Et-N-2

Galumnella areolata Balogh—The species is recorded for the first time from Ethiopia
Distribution: Et-N-2

Pilizetes anufrievi Ermilov, Sidorchuk & Rybalov
Distribution: Et-N-2

Descriptions of new species

Austrocarabodes (Uluguroides) klutzi Ermilov, Winchester, Lowman and Wassie sp. nov.
(Figs 1–19)

Diagnosis
Body length 481–498 by 265–282; surface of notogaster foveolate, surface of anogenital region wrinkled; prodorsal and notogastral setae well developed, phylliform, serrated; sensilli long, setiform, pilose; five pairs smooth genital setae present; adanal setae phylliform, serrated.

Description
Measurements. Adult body length 481 (holotype), 481–498 (two paratypes); body width 265 (holotype), 265–282 (two paratypes).

Integument. Body color yellow-brown. Body surface microfoveolate, but visible only under high magnification (×1500). Surface of anogenital region with short wrinkles. Surface of notogaster foveolate (diameter of foveolae up to 16). Margins of foveolae thickened. Distance between foveolae more or less than their diameter.

Prodorsum (Figs 1, 3–7). Rostrum widely rounded in dorsal view. Two prodorsal transverse ridges present between lamellae: first ridge well developed on anterior part of prodorsum; second ridge interrupted medially, poorly visible in central part of prodorsum. Rostral seta (ro, 41–53) phylliform, with serrated outer margin, set on apophyses. Lamellar seta (le, 49–61) phylliform, with serrated margins, situated latero-ventrally on lamellae. Interlamellar seta (in, 69–73) phylliform, with serrated outer margin. Sensillus (53–61) setiform, thickened, hook-like, pilose unilaterally.

Notogaster (Figs 1, 3, 11, 12). Fourteen pairs of notogastral setae phylliform, with serrated margins or outer margin. Posterior setae p1–p3, h3 (49–57) shorter than others (61–73). Lyrifissures ia, im, and opisthonotal gland opening not observable.
FIGURES 1–3. *Austrocarabodes (Ulugaroides) kluttzi* Ermilov, Winchester, Lowman & Wassie sp. nov., adult: 1 — dorsal view; 2 — ventral view, legs not shown; 3 — lateral view of prodorsum, epimeral setae and borders, gnathosoma and legs not shown. Scale bar 100 μm.
FIGURES 4–10. *Austrocarabodes (Uluguroides) klutzi* Ermilov, Winchester, Lowman & Wassie sp. nov., adult: 4 — rostral seta; 5 — lamellar seta; 6 — interlamellar seta; 7 — sensillus; 8 — right half of subcapitulum; 9 — palp; 10 — anterior part of chelicera. Scale bars (4–6, 8, 10) 20 μm, (7, 9) 10 μm.
FIGURES 11–17. *Austrocarabodes (Ulugaroides) klatzi* Ermilov, Winchester, Lowman & Wassie sp. nov., adult: 11 — notogastral seta *da*; 12 — notogastral seta *p2*; 13 — epimeral seta *lb*; 14 — epimeral seta *4a*; 15 — epimeral seta *4c*; 16 — genital plate, right and aggenital seta; 17 — anal plate, right and adanal seta *ad2*. Scale bars (11–15) 10 μm, (16, 17) 20 μm.

*Lateral part of body* (Figs 2, 3). Tutorium long, thin, convex. Exobothridial seta not evident. Pedotectae I (Pt I), II (Pt II) and triangular discidium (*dl*) well developed. Lyrifissures *ih*, *ips*, and *ip* visible, short, thin.
Gnathosoma (Figs 8–10). Subcapitulum longer than wide: 98–102 by 82–90. Hypostomal setae setiform, with poorly visible sparse barbs; \( h \) (4–6) shorter than \( m \) and \( a \) (both 12–16). Adoral setae and their alveoli absent. Palp 45, with setation 0–2–1–3–8(+)l0. Solenidion long, little shorter than palpaltarsus, thickened, blunt-ended, not attached with eupathidium. Chelicera 118–127, both cheliceral setae setiform, weakly thickened, barbed; \( cha \) (36–41) longer than \( chb \) (20–24). Trägårdh’s organ (Tg) distinct.

Epimeral region (Figs 2, 13–15). Epimeral setal formula 3–1–3–3. Setae \( 1a, 1c, 2a, \) and \( 3a \) shortest (4–8), setiform, thin, smooth. Setae \( 4a \) and \( 4c \) longest (36–41), thickened, barbed; other setae little shorter (28–36) and thinner, also barbed.

Anogenital region (Figs 2, 16, 17). Five pairs genital (\( g_1-g_5 \), 36–49) and one pair aggenital (\( ag_1 \), 41–53) setae setiform, weakly thickened in proximal half, smooth. Two pairs anal setae (\( an_1, an_2 \)) short (8), setiform, smooth. Three pairs anal setae (\( ad_1-ad_3 \), 16–24) phylliform, with serrated margins. Lyrifissure \( iad \) clearly visible.

Legs (Figs 18, 19). Claw of each leg with tooth ventrally and several poorly visible tubercles dorsally. Formulae of leg setation and solenidia: I (1–4–3–4–16) [1–2–2], II (1–4–3–3–15) [1–1–2], III (2–3–1–2–15) [1–1–0], IV (1–2–2–2–11) [0–1–0]; homology of setae and solenidia indicated in Table 1. Setae setiform, usually barbed, but some setae thorn-like (\( u \)) or dilated in median part (on genua and femora). Famulus (\( e \)) short, straight, blunt-ended, inserted posterior to solenidion \( \omega_2 \). All solenidia setiform; \( \varphi_1 \) on tibiae I longest.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Trochanter</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>( v' )</td>
<td>( d, (l), bv'' )</td>
<td>( l, v', \sigma )</td>
<td>( l, (v), \varphi_1, \varphi_2 )</td>
<td>( (ft), (tc), (it), (p), (u), (a), s, (pv), e, \omega_1, \omega_2 )</td>
</tr>
<tr>
<td>II</td>
<td>( v' )</td>
<td>( d, (l), bv'' )</td>
<td>( l, v', \sigma )</td>
<td>( l', (v), \varphi )</td>
<td>( (ft), (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>( (v), \varphi )</td>
<td>( (ft), (tc), (it), (p), (u), (a), s, (pv) )</td>
</tr>
<tr>
<td>IV</td>
<td>( v' )</td>
<td>( d, ev' )</td>
<td>( d, l' )</td>
<td>( (v), \varphi )</td>
<td>( ft'', (tc), (p), (u), (a), s, pv'' )</td>
</tr>
</tbody>
</table>

Roman letters refer to normal setae (\( e \) 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 pair of setae.

Type material

The holotype (female) has the following collection data: Et-N-1. The two paratypes (females) have the following collection data: Et-N-2.

Type deposition

The holotype (alcohol) is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; one paratype (alcohol) is deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; one paratype is in the personal collection of the first author.

Etymology

This species is named after Bob Kluttz, who helped collect the type material and has contributed extensively to the sampling and funding associated with the arthropod biodiversity research project conducted in the Church Forests of Ethiopia. Mr. Kluttz is a consummate research assistant whose diligence and perseverance under all field conditions ensured that quality samples were collected.
FIGURES 18–19. *Austrocarabodes (Uluguroides) klutzi* Ermilov, Winchester, Lowman & Wassie *sp. nov.*, adult: 18 — leg I, without trochanter, left, paraxial view; 19 — leg IV, left, antiaxial view. Scale bar 20 μm.
Remarks
In having the combination of five pairs of genital setae, medium body size, wrinkled anogenital region, and phylliform, well-developed and serrate prodorsal and notogastral setae, *Austrocarabodes (Uluguroides) klutzi* sp. nov. is very similar to *Austrocarabodes (Uluguroides) pentatrichus* Balogh, 1962 from Tanzania. However, it clearly differs from the latter by the long setiform sensilli, having a curved distal half (versus short, weakly dilated apically in *A. (U.) pentatrichus pentatrichus*), foveolate notogaster (versus not foveolate in *A. (U.) pentatrichus pentatrichus*), shorter aggenital setae and epimeral setae 1b (longer in *A. (U.) pentatrichus pentatrichus*). See Ermilov et al. (2010a) for a key to the other species.

*Pilobatella lowmanae* Ermilov, Winchester and Wassie sp. nov. (Figs 20–34)

**Diagnosis**
Adult body length 531–564 by 298–332; surface of body microfoveolate, pteromorphs striate; prodorsal setae long, setiform, barbed; interlamellar setae longer than rostral and lamellar setae; sensillus setiform, bilaterally ciliate; notogastral setae short; genital plate with six pairs of genital setae; one pair of aggenital setae present; leg tarsi with one claw.

**Description**

**Measurements.** Body length 564 (holotype), 531 (paratype); body width 332 (holotype), 298 (paratype).

**Integument.** Body color brown. Body surface microfoveolate, only visible under high magnification in dissected specimen. Dorsolateral parts of notogaster with specific ornamentation. Pteromorphs weakly striate. Anogenital region with poorly visible light ornamentation.

**Prodorsum** (Figs 20, 22–26). Rostrum rounded. Lamella located dorsolaterally, longer than half of prodorsum. Rostral (53), lamellar (65–69), and interlamellar (86–90) setae setiform, barbed. Rostral setae inserted laterally. Lamellar setae inserted near the lamella tip. Sensillus (110–118) setiform, bilaterally ciliate.

**Notogaster** (Figs 20, 22). Ten pairs of notogastral setae short (20), thin, smooth or with poorly visible sparse setulae. Four pairs of small sacculi present: S1 and S2 oblong, S1 and S3 oval. Lyrifissures ia, im, ip, and opisthgonotal gland opening (gla) developed typically for the genus.

**Lateral part of body** (Fig. 22). Tutorium long, almost straight. Sublamellar line present. Sublamellar porose area oval (Al, 20). Exobothridial seta (24–28) setiform, slightly barbed. Pedotectae I, II, discidium, and circumpedal carina developed typically for the genus. Lyrifissures ih and ips short, thin.

**Gnathosoma** (Figs 27–29). Subcapitulum longer than wide: 118 x 86–94. Hypostomal setae (all 20–24) setiform, with short cilia in distal half, except smooth m. Two pairs of dorsal setae (or1, or2, 16–20) straight, bilaterally ciliate. Palp 86, with setation 0–2–1–3–9(+1ω). All setae on femur, genu, tibia, and ventral setae on tarsus with short cilia. Solenidion long, thickened, blunt-ended, attached with eupathidium. Chelicera (143), both cheliceral setae setiform, with short cilia; cha (45) longer than chb (24). Trägårdh’s organ distinct.


**Anogenital region** (Figs 21, 31, 32). Six pairs of genital (16–20), one pair of aggenital (12), two pairs of anal (20), and three pairs of adanal (ad1, ad2 24, ad3 20) setae setiform, with short cilia. Lyrifissure iad in paranal position.
Legs (Figs 33, 34). Monodactylous. Claw of each leg with tubercle in ventro-basal part. Formulae of leg setation and solenidia: I (1–5–3–4–20) [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 of setae and solenidia indicated in Table 2. All setae setiform, many are barbed or with short cilia. Famulus short, straight, blunt-ended.
Solenidia $\omega_1$ on tarsi I, $\omega_1$ and $\omega_2$ on tarsi II, $\sigma$ on genu III thickened, blunt-ended; the other solenidia setiform.

**FIGURES 23–32.** Pilobatella lowmanae Ermilov, Winchester & Wassie sp. nov., adult: 23 — rostral seta; 24 — lamellar seta; 25 — interlamellar seta; 26 — sensillus; 27 — left half of subcapitulum; 28 — palp; 29 — anterior part of chelicera; 30 — epimeral seta 3b; 31 — genital plate, right; 32 — anal plate, left. Scale bars (23–29, 31) 20 $\mu$m, (30) 10 $\mu$m, (32) 50 $\mu$m.

*Type material*

The holotype (female) and paratype have the following collection data: Et-N-1
TABLE 2. Leg setation and solenidia of adult Pilobatella lowmanae sp. nov.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Trochanter</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>v'</td>
<td>d, (l), v'', bv''</td>
<td>(l), v, σ</td>
<td>(l), (v), φ₁, φ₂</td>
<td>(f₁), (tc), (i), (p), (u), (a), s, (pv), v', (pl), l', e, φ₁, φ₂</td>
</tr>
<tr>
<td>II</td>
<td>v'</td>
<td>d, l', l'' v'', bv''</td>
<td>(l), v, σ</td>
<td>(l), (v), φ</td>
<td>(f₁), (tc), (i), (p), (u), (a), s, (pv), φ₁, φ₂</td>
</tr>
<tr>
<td>III</td>
<td>l', v'</td>
<td>d, l', ev'</td>
<td>l', σ</td>
<td>l', (v), φ</td>
<td>(f₁), (tc), (i), (p), (u), (a), s, (pv)</td>
</tr>
<tr>
<td>IV</td>
<td>v'</td>
<td>d, ev'</td>
<td>d, l'</td>
<td>l', (v), φ</td>
<td>ft'', (tc), (p), (u), (a), s, (pv)</td>
</tr>
</tbody>
</table>

See Table 1 for explanations.

Type deposition

The holotype (alcohol) is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; paratype (alcohol) is in the personal collection of the first author.

Etymology

This species is named after Dr. Meg Lowman, who is instrumental in promoting the ongoing research mission to study the arthropod biodiversity associated with Ethiopian Church Forests and who has worked tirelessly on promoting these global “hotspots” as critical conservation areas. Her passion for science and international leadership have led to establishing partnerships with the Christian Orthodox clergy, implementing sustainability initiatives and involving local communities to adopt best practices to solve the environmental challenges faced by these forests.

Remarks

Balogh and Mahunka (1967) proposed the generic characters to the genus Pilobatella, two of which are: three pairs of aggenital setae and legs with one claw. However, Corpuz-Raros (1979) and Scull (1985) describe Pilobatella pseudovermiseta Corpuz-Raros, 1979 and Pilobatella maurensis Scull, 1985, respectively, with only one pair of aggenital setae. Also Mahunka (2003) described Pilobatella baloghi Mahunka, 2003 with tridactylous legs. Hence, these additions should be indicated in any future diagnosis of the genus.

Distinctive characters of the new species with the other species of the genus Pilobatella can be found in the identification key below.

Key to species of Pilobatella

1. One pair of aggenital setae present .............................................. 2
   - Three pairs of aggenital setae present ..................................... 4
2. Sensilli bacilliform, with weakly dilated head; rostral, lamellar interlamellar, and notogastral setae subequal in length. Distribution: Cuba .......................................................... P. maurensis Scull, 1985
   - Sensilli setiform; rostral, lamellar, and interlamellar setae several times longer than notogastral setae .... 3
3. Sensilli ciliate unilaterally; lamellar setae longer than interlamellar setae; smaller species (418 × 242). Distribution: Philippines .................................................. P. pseudovermiseta Corpuz-Raros, 1979
   - Sensilli ciliate bilaterally; lamellar setae shorter than interlamellar setae; larger species (531–564 × 298–332). Distribution: Ethiopia .................................................... P. lowmanae sp. nov.
4. Leg tarsi with three claws; larger species (520–556 × 277–297). Distribution: Kenya ...........................
<table>
<thead>
<tr>
<th>P. baloghi Mahunka, 2003</th>
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<tr>
<td>Leg tarsi with one claw; smaller species (body length less than 500, notogaster width less than 250)</td>
</tr>
</tbody>
</table>

5. Sensilli setiform; sacculi Sa slit-shaped. Distribution: Oriental region

- Sensilli bacilliform or with dilated head; sacculi Sa not slit-shaped | 6 |

6. Sensili bacilliform, without developed head | 7 |

- Sensilli with well developed head; smaller species | 8 |

7. Lamellar setae inserted between lamellae; larger species (432–472 × 236–240). Distribution: India

- Lamellar setae inserted on tip of the lamellae; smaller species (330 × 198). Distribution: Madagascar | 9 |

8. Sejugal apodeme and apodeme 3 form transversal apodemes in front of genital aperture. Distribution: Kenya

- No transversal apodeme in front of genital aperture | 9 |

9. A semicircular formation is presented between sejugal apodeme and apodeme 3; five pairs of genital setae. Distribution: Kenya

- No semicircular formation between sejugal apodeme and apodeme 3; six pairs of genital setae. Distribution: Congo | 9 |

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