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Additions to the oppiooid oribatid mite fauna of Peru (Acari, Oribatida, Oppioidea)

Sergey G. ERMILOV1* and Stefan FRIEDRICH2

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1 Tyumen State University, Tyumen, Russia. ermilovacari@yandex.ru (*Corresponding author)
2 Zoologische Staatssammlung München, München, Germany. stefan.friedrich@zsm.mwn.de

ABSTRACT — Two new species of oribatid mites (Acari, Oribatida) of the superfamily Oppioidea are described on the basis of adult specimens from upper soil and leaf litter in the primary evergreen lowland rainforest of Amazonian Peru. Lasiobelba (Antennopippia) parachistyakovi Ermilov n. sp. (Oppiidae) is similar to L. (Antennopippia) chistyakovi Ermilov and Kaliz, 2012, but differs by the thick bothridial setae with short cilia and longer notogastral setae. Hammerella (Woasella) luanuocoensis Ermilov n. sp. (Granuloppiidae) is similar to H. (Woasella) parasufflata Ermilov, Sandmann, Marian and Mauraun, 2013, but differs by the thin costulae, shorter notogastral setae, and the absence of one tubercle anterior to each lamellar seta. The taxonomic status of the genus Varioppia Mahunka, 1985 is discussed, resulting in the following taxonomic proposals: Hammerella (Woasella) J. and P. Balogh, 2002 (=Varioppia Mahunka, 1985 n. syn.), Hammerella (Woasella) radiata (Mahunka, 1985) n. comb. An identification key for known species of Hammerella (Woasella) is given. Two oppioid species, Hammerella (Woasella) sufflata (Franklin and Woas, 1992) and Teratoppia (Teratoppiella) brevispectinata Balogh and Mahunka, 1978, are recorded for the first time in Peru.

KEYWORDS — mites; Lasiobelba; Hammerella; Varioppia; morphology; systematics; new synonym; new combination; new records; South America

INTRODUCTION

This work is part of our continuing study of the Peruvian oribatid mites (Acari, Oribatida) collected during the German Expedition to Amazonian Peru in 2013 (see Ermilov and Friedrich 2016) and includes data on the superfamily Oppioidea.

During taxonomic identification, we found nine species; from these, two species are new to science, one belonging to the subgenus Lasiobelba (Antennopippia) Mahunka, 1983 (Oppiidae), and the other to the subgenus Hammerella (Woasella) J. and P. Balogh, 2002 (Granuloppiidae). The main goal of the paper is to describe these new species and to present a list of the registered oppioid taxa.

In addition, we discuss the taxonomic status of the genus Varioppia Mahunka, 1985 and give an identification key for known species of Hammerella (Woasella).

MATERIALS AND METHODS

Material — All mites were collected from: South America, Amazonian Peru, 09°37'S, 74°56'W, Huánuco Department, Puerto Inca Province, Yuyapichis District, Área de Conservación Pri-
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between females and males in the body sizes. No differences between females and 23 males); notogaster width 282 (holotype: female), 431 – 464 (51 paratypes: 28 females and 23 males); notogaster width 282 (holotype), 265 – 298 (51 paratypes). No differences between females and males in the body sizes.

Methods — Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. 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 [h, p1, p2, p3] (both 32 – 36) longer than a in lateral part of mentum. Two pairs of adoral setae (or1, or2, 16 – 20) thin, smooth. Palps (53) with setation 0–2–1–3–8(+) present, semioval. Discidia absent. Anogenital setae slightly barbed. Apodemes 4 present, semioval. Discidia absent. Anogenital setae indistinctly barbed.

Description — Measurements — Body length: 431 (holotype: female), 431 – 464 (51 paratypes: 28 females and 23 males); notogaster width 282 (holotype), 265 – 298 (51 paratypes). No differences between females and males in the body sizes.

Integument (Figs 1A, 2A) — Body color light brownish. Body surface punctate, lateral side and podosomal region with tuberculate cerotegument (diameter tubercle up to 4).

Prodorsum (Figs 1A, 2A) — Rostrum slightly protruding, rounded. Rostral (ro, 47 – 51), lamellar (le, 36 – 41), interlamellar (in, 49 – 55) and exobothridial (ex, 16 – 20) setae setiform, barbed; le and ex thinnest, le inserted on large tubercles (length 8 – 10), equal distanced from ro and in. Bothridial setae (bs, 176 – 188) setiform, thick, densely ciliate. Longitudinal row of muscle sigilla present anteriad to bothridia. Interbothridial region with three pairs of muscle sigilla. Interbothridial and postbothridial tubercles absent. Lateral ridges (rl) developed between bothridia and acetabula IV, distally expanded to form a scale, which is located posterior to each bothridium.

Notogaster (Figs 1A, 2A) — Anterior border convex medially. Nine pairs of notogastral setae setiform, barbed, inserted in two parallel rows (except posterior setae), setae c and their alveoli absent. Setae la, lm and lp (73 – 82) longer and thicker than h2, h3 (36 – 45), h1 and p1 (20 – 24), setae p2 and p3 shortest (16 – 18) and thinnest. Lyrifissures ia, im and ip well developed, ih and ips not visible. Opisthontal gland openings (gla) located laterally and close to im.

Gnathosoma (Figs 1B, 2A, 3A-C) — Morphology of subcapitulum, palp and chelicera typical for Lasio belba (e.g. Ermilov et al. 2014). Subcapitulum longer than wide (110 – 114 × 73 – 82). Anteromedial parts of rutelli with very small tooth. Three pairs of subcapitular setae setiform, barbed; h and m (both 32 – 36) longer than a (20 – 24), h inserted in lateral part of mentum. Two pairs of adoral setae (or1, or2, 16 – 20) thin, smooth. Palps (53) with setation 0–2–1–3–8(+) present, semioval. Discidia absent. Anogenital setae indistinctly barbed.

Descriptions

Lasio belba (Antennoppia) parachistyakovi
Ermilov n. sp.
(Figures 1–3)


Description — Measurements — Body length: 431 (holotype: female), 431 – 464 (51 paratypes: 28 females and 23 males); notogaster width 282 (holotype), 265 – 298 (51 paratypes). No differences between females and males in the body sizes.
FIGURE 1: Lasiobelba (Antennoppia) parachistyakovi Ermilov n. sp.: A – dorsal view (legs except basal parts not illustrated); B – ventral view (palps except basal parts and legs except trochanters not illustrated). Scale bar 100 µm.
Figure 2: *Lasiobelba (Antennoppia) parachistyakovi* Ermilov n. sp.: A – lateral view, right side (palp except trochanter and legs except basal part of leg III not illustrated); B – tibia and basal part of tarsus of leg I, right, antiaxial view; C – femur and genu of leg IV, left, antiaxial view; D – tibia and tarsus of leg IV, left, antiaxial view. Scale bar (A) 100 µm, scale bar (B–D) 50 µm.
Figure 3: *Lasiobelba (Antennoppia) parachistyakovi* Ermilov n. sp.: A – subcapitulum, ventral view, and palptrochanter; B – palp (trochanter not illustrated), left, paraxial view; C – chelicera, left, paraxial view. Scale bar (A, C; B) 16 μm.
TABLE 1: Leg setation and solenidia of adult *Lasiobelba (Antennoppia) parachistyakovi* Ermilov n. sp. and *Hammerella (Wasella) huanucoensis* Ermilov n. sp.

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<td>l', (v), ϕ</td>
<td>fl'', (tc), (p), (u), (a), s, (pv)</td>
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Note: Roman letters refer to normal setae, Greek letters to solenidia (except ϵ = famulus). Single prime (’) marks setae on the anterior and double prime (”) setae on the posterior side of a given leg segment.

Epimeral and lateral podosomal regions (Figs 1B, 2A) — Sejugal apodemes slightly longer than apodemes 2, both of medium size, apodemes 4 complete, semi-oval, strong. Epimeral setal formula: 3–1–3–3; all setae setiform, slightly barbed, 1a, 1c, 2a, 3a and 4b (20 – 24) shorter than 2b, 4a and 4c (35 – 45), 3c longest (53 – 61), inserted on tubercles. Seta 1c distanced from pedotecta I. Discidia absent.

Anogenital region (Figs 1B, 2A) — Five pairs of genital (g₁, 20 – 24; g₂–g₅, 16 – 20), one pair of aggenital (ag, 16 – 20), three pairs of adanal (ad₁–ad₃, 18 – 22) and two pairs of anal (an₁, an₂, 16 – 20) setae setiform, indistinctly barbed. Adanal lyrifissures (iad) distinct, located parallel and very close to anal aperture.

Legs (Figs 1A, B, 2A–D) — Morphology of leg segments, setae and solenidia typical for *Lasiobelba* (e.g. Ermilov and Kalúz 2012). Claw of each leg indistinctly serrate on dorsal side. Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [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 1. Seta p setiform on tarsus I, and very short, conical on tarsi II–IV. Famuli (c) of tarsi I short, thin, swollen and truncated distally, inserted posteriorly to solenidion ω₂.

Type deposition — The holotype is deposited in the collection of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; five paratypes are deposited in the collection of the Bavarian State Collection of Zoology, Munich, Germany; five paratypes are deposited in the collection of the Senckenberg Institution Frankfurt, Germany; 41 paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology — The specific name *parachistyakovi* refers to the similarity between the new species and *Lasiobelba (Antennoppia) chistyakovi* Ermilov and Kalúz, 2012.

Remarks — The genus *Lasiobelba* comprises two subgenera and 32 species, and is distributed in the tropics (Subías 2004, updated 2016). The main morphological traits for these genus and subgenera and an identification key for all species of *Lasiobelba* were presented by Ermilov et al. (2014).

The new species is morphologically most similar to *Lasiobelba (Antennoppia) chistyakovi* Ermilov and Kalúz, 2012 from Ecuador (see Ermilov and Kalúz 2012) in having long bothridial setae, differences of notogastral setae in length, localization of dorsal notogastral setae in two longitudinal rows and insertion of lamellar setae on large tubercles, and the absence of discidia. However, the new species differs from the latter by the morphology of bothridial setae (thick, with short cilia vs. thin, with long cilia) and longer notogastral setae (vs. comparatively shorter).

Also, *Lasiobelba (Antennoppia) parachistyakovi* Ermilov n. sp. is morphologically similar to *Trapezop-
**Hammerella (Woasella) huanucoensis**

Ermilov n. sp. (Figures 4–6)


**Description** — Measurements – Body length: 332 (holotype: female), 298 – 332 (16 paratypes: seven females and nine males); notogaster width 182 (holotype), 166 – 182 (16 paratypes). No differences between females and males in the body sizes.

Integument (Figs 4A, 5A) — Body color light brownish. Body surface punctate, lateral side and podosomal region with sparse tuberculate cerotegument (diameter tubercle up to 4).

Prodorsum (Figs 4A, 5A) — Rostrum with small median indentation (ind; well visible in frontal view). Costulae short, thin, parallel. Transcostula absent. Rostral (28), lamellar (18 – 20), interlamellar (32) and exobothridial (16 – 20) setae setiform, barbed; le and ex thinnest, le located nearer to interlamellar setae, than to rostral setae. Transverse thin ridge (r) located posteriorly to insertions of rostral setae. Bothridial setae (53 – 57) with long stalks and shorter, elongate, rounded distally heads, having five to six of long (45 – 53) cilia and three to five of short barbs unilaterally. Longitudinal row of muscle sigilla present anteriarid to bothridia and lateral to costulae. Interbothridial region with two pairs of muscle sigilla. Interbothridial tubercles absent. Postbothridial tubercles present.

Notogaster (Figs 4A, 5A) — Anterior border straight. Humeral tubercles indistinct, directed to postbothridial tubercles. Ten pairs of notogastral setae present, setae c minute (2), other setae setiform, smooth, inserted in four parallel rows (except posterior setae). Setae p2 and p3 (20–24) shorter than p1 (24–28), other setae longest (32–41) and thickest. All lyrifissures clearly visible. Opisthontal gland openings located posterior to im and distanced from it.

Gnathosoma (Figs 4B, 5A, 6A–C) — Morphology of subcapitulum, palp and chelicera typical for *Hammerella* (e.g. Franklin and Woas 1992; Ermilov et al. 2012). Subcapitulum longer than wide (73 – 77 × 53 – 57). Antero-medial parts of rutelli with thin tooth. Three pairs of subcapitular setae setiform; m longest (28) barbed, h (24) sparsely ciliate on dorsal side, a shortest (16), barbed. Two pairs of adoral setae (6) thin, smooth. Palps (41 – 45) with setation 0–2–1–3–8(+ω); solenidion of palp-tarsi as long as one third of tarsi, thick, expanded distally, pressed to the surface, attached in medio-distal parts to seta ul”. Chelicerae (69 – 73) with two setiform, barbed setae; cha (20) longer than cbh (12) barbed. Trägårdh’s organ tapered, slightly granulate.

Epimeral and lateral podosomal regions (Figs 4B, 5A) — Sejugal apodemes and apodemes 2 short, similar in length, apodemes 4 absent, substituted by muscle sigilla. Epimeral setal formula: 3–1–3–3; all setae setiform, slightly barbed, 1a, 2a and 3a (16–20) shorter than 1b, 3b, 3c, 4a, 4b and 4c (32 – 41), 1c longest (45 – 53), inserted on pedotecta I, 3c inserted on tubercles. Discidia absent.

Anogenital region (Figs 4B, 5A) — Six pairs of genital setae minute (g1–g6, 8). One pair of aggenital (32), three pairs of adanal (32) and two pairs of anal (16 – 20) setae setiform, smooth. Adanal lyrifissures distinct, inverse apoanal, distanced from the anal aperture.

Legs (Figs 4A, B, 5A–C) — Morphology of leg segments, setae and solenidia typical for *Hammerella*...
Figure 4: *Hammerella (Wosella) huanucoensis* Ermilov n. sp.: A – dorsal view (legs except basal parts of legs II and III not illustrated); B – ventral view (palps and legs except basal parts of legs IV not illustrated). Scale bar 100 µm.
FIGURE 5: *Hammerella* (*Woasella*) *huanucoensis* Ermilov *n.* sp.: A – lateral view, right side (gnathosoma and legs except basal part of legs I, III and IV not illustrated); B – tibia (solenidion not illustrated) and basal part of tarsus of leg I, right, antiaxial view; C – tibia (solenidion except basal part not illustrated) and tarsus of leg IV, right, paraxial view. Scale bar (A) 100 µm, scale bar (B, C) 20 µm.
FIGURE 6: *Hammerella (Woasella) huanucoensis* Ermilov *sp.*. A – subcapitulum, ventral view, and palptrochanter; B – palp (trochanter not illustrated), left, ventral view; C – chelicera, left, paraxial view. Scale bar (A, C; B) 16 µm.
(e.g. Franklin and Woas 1992; Ermilov et al. 2012). Claw of each leg indistinctly serrate on dorsal side. Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [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 1. Setae p setiform on tarsi I, and very short, conical on tarsi II–IV. Famuli (ε) of tarsi I short, thin, swollen and truncated distally, inserted posteriorly to solenidion ω₁.

**Type deposition** — The holotype is deposited in the collection of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; two paratypes are deposited in the collection of the Bavarian State Collection of Zoology, Munich, Germany; two paratypes are deposited in the collection of the Museo de Historia Natural, Tyumen, Russia; two paratypes are deposited in the collection of the Museo de Historia Natural, Peru; two paratypes are deposited in the collection of the Museo de Historia Natural, Lima, Peru; two paratypes are deposited in the collection of the Museo de Historia Natural, Tyumen, Russia.

**Etymology** — The specific name *huanucoensis* refers to the Peruvian Department, Huánuco, where the new species was collected.

**Remarks** — The genus *Hammerella* comprises five subgenera and 13 species, and is distributed in the tropics (Subías 2004, updated 2016). The main morphological traits for these genus and subgenera and an identification key for all species (known to 2012) of *Hammerella* were presented by Ermilov et al. (2012).

The new species is morphologically most similar to *Hammerella (Wasella*) parasufflata Ermilov, Sandmann, Marian and Maraun, 2013 from Ecuador (see Ermilov et al. 2013), which have thick costulae, and there are no doubt, that these two species belong to one genus/subgenus. The thickness of the costulae is an intrasubgeneric character in this case. In addition, the other main generic characters of *Varioppia* correspond to *Hammerella (Wasella*) (see Ermilov et al. 2012, 2013), therefore based on the above explanations, we do not support the systematic placement of *Varioppia* in Oppiidae. We also do not accept the taxonomic status of this genus, and propose the following changes: a) *Hammerella (Wasella*) J. and P. Balogh, 2002 (=*Varioppia* Mahunka, 1985 n. syn.), b) *Hammerella (Wasella)* radiata (Mahunka, 1985) n. comb.

**Key to known species of the subgenus *Hammerella (Wasella)***

1. Costulae connected by two transcostulae; rostrum truncate; body size: 470 × 280.………………..………………..…………………………H. (W.) sufflata (Franklin and Woas, 1992) (see Franklin and Woas 1992). Distribution: Brazil and Peru.
   — Transcostulae absent; rostrum with median indentation or rounded …………………..………………..2

2. Large tubercles not developed before lamellar setae; dorsal notogastral setae comparatively shorter, lm not reaching the insertions of lp; discidia absent; body size: 298–332 × 166–182………………..…………………………Hammerella (Wasella) huanucoensis Ermilov n. sp. Distribution: Peru.
   — Large tubercles developed before lamellar setae;
dorsal notogastral setae comparatively longer, lm reaching the insertions of lp; discidia present ...


OTHER RECORDS OF OPPIOIDEA FROM PERU

Besides two new species described above, we found 7 additional species, belonging to 5 genera and 3 families:

Granuloppiidae — Hammerella (Woasella) sufflata (Franklin and Woas, 1992), 20 specimens. Distribution: Brazil. First record for Peru.

Teratoppiidae — Teratoppiia (Teratoppiia) reducta Balogh and Mahunka, 1969, 6 specimens. Distribution: Neotropical region. Species was recorded earlier in Peru (e.g. Wunderle 1992; Franklin et al. 2006). — Teratoppiia (Teratoppiella) brevipictinata Balogh and Mahunka, 1978, 2 specimens. Distribution: Neotropical region. First record for Peru.

Oppiidae — Aeroppia sp1, 12 specimens. The study of type materials of some species in the genus Aeroppia is necessary for final identification. — Aeroppia sp2, 3 specimens. The study of type materials of some species in the genus Aeroppia is necessary for final identification. — Brachioppiia cuscinensis Hammer, 1961, 9 specimens. Distribution: Neotropical region, India and Japan. Species was recorded earlier in Peru (e.g. Hammer 1961; Ermilov and Gwiazdowicz 2015). — Gittella variabilis Ermilov, Sandmann, Marian and Maraun, 2013, 7 specimens. Distribution: Neotropical region. Species was recorded earlier in Peru (Ermilov and Gwiazdowicz 2015).

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This project was supported by Prof. Dr. Roland Melzer (Zoologische Staatssammlung München, München, Germany) and the “Freunde der Zoologischen Staatssammlung”. An overarching project, study of South American mites, was supported by the Russian Science Foundation (project 14-14-01134).

REFERENCES


Material collected: see “Material and methods” section. All specimens are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.