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TWO NEW SPECIES OF *ANDEREMAEUS* (ACARI, ORIBATIDA, ANDEREMAEIDAE) FROM PERU

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The oribatid mite genus *Anderemaeus* (Oribatida, Anderemaeidae) is recorded from Peru for the first time. Two new species of this genus, *A. friedrichi* sp. n. and *A. paracapitatus* sp. n., are described based on material collected from soil and litter in Andean mountain forests.

Keywords: oribatid mites, taxonomy, morphology, Neotropical Region

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The oribatid mite genus *Anderemaeus* (Acari, Oribatida, Anderemaeidae) was proposed by Hammer (1958), with *Anderemaeus monticola* Hammer 1958 as type species. At present, the genus comprises 12 species, which are distributed in the Neotropical region (11 species) and Australia (one species). The taxonomic revision and the identification key to the known species of *Anderemaeus* have been presented by Norton and Ermilov (2019).

During the taxonomic identification of oribatid mites from Peru, we found two new species of *Anderemaeus*. The main goal of this paper is to describe and illustrate them.

As of yet, representatives of *Anderemaeus* have not been registered in Peru; hence, ours is the first record of *Anderemaeus* in this country.

METHODS

Observation and documentation. For measurement and illustration, specimens were mounted in lactic acid on temporary cavity slides. All measurements are in micrometers. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster; other structures were oriented to avoid parallax errors. Notogastral width refers to the maximum in dorsal aspect. Setal lengths were measured perpendicular to their long axis, accounting for curvature. Formulas for leg solenidia are given in square brackets according to the sequence

genu-tibia-tarsus. Drawings were made with a camera lucida using a Leica DM 2500 light microscope.

Terminology and conventions. General morphological terminology used in this paper mostly follows that of F. Grandjean: see Travé and Vachon (1975) for references, Norton (1977) for leg setal nomenclature, and Norton and Behan-Pelletier (2009) for overview.

Abbreviations. *Prodorsum*: Setae: *ro*, *le*, *in*, *bs*, *ex* – rostral, lamellar, interlamellar, bothridial, and exobothridial seta, respectively. Other structures: *ea* – prodorsal enantiophysis; *exv* – alveolar vestige of second exobothridial seta; *lam* – lamella; *lr* – latero-rostral ridge; *plr* – prelamellar ridge; *plam* – prolamella; *tu* – tutorium; *rb* – rostral bulge; *ibr* – interbothridial ridge; *ibt* – interbothridial tubercle. *Notogaster*: Setae: *c*, *la*, *lm*, *lp*, *h*-row (*h*₁, *h*₂, *h*₃), *p*-row (*p*₁, *p*₂, *p*₃). Other structures: *hp* – humeral process; *cr* – crista; *ia*, *im*, *ip* – anterior, middle, posterior lyrifissure, respectively; *ih*, *ips* – same, associated with setal rows, *h* and *p*, respectively; *gla* – opening of opisthonotal gland. *Gnathosoma*: Setae: *a*, *m* – anterior, middle seta of gena; *h* – hypostomal seta of mentum; *or* – adoral seta; *v*, *l*, *d*, *cm*, *acm*, *ul*, *su*, *vt*, *lt*, *sup*, *inf* – palp setae; ω – palp tarsal solenidium; *cha*, *chb* – cheliceral setae; Structures: *Tg* – Trägårdh's organ. *Epimeral and lateral podosomal regions*: Setae: *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c* – setae of epimeres I–IV. Structures: *ep* – epimeral pit; *cir* – circumpedial carina; *dis* – discidium; *e3* – enantiophysis across epimeral border 3; *e4* – aggenital enantiophysis, across epimeral border 4; *PdI*,

PdII – pedotectum I, II respectively. *Anogenital region*: Setae: *g* – genital seta; *ag* – aggenital seta; *an* – anal seta; *ad* – adanal seta. Structures: *ian*, *iad* – anal and adanal lyrifissure, respectively. *Legs*: Setae: σ , ϕ , ω – solenidia of genu, tibia and tarsus, respectively; ε – famulus of tarsus I; *d*, *l*, *v* – dorsal, lateral, ventral seta, respectively; *ev*, *bv* – basal trochanteral setae; *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* – tarsal setae. Structures: *trt* – trochanteral tooth; *p.a* – porose area.

TAXONOMY

Anderemaeus friedrichi Ermilov,
Subías et Shtanchaeva sp. n.
(Figs 1, 2)

Material. Holotype (δ) and one paratype (1 ϕ): South America, Central Peru, Andes, 09°42'58" S, 75°05'33" W, Huánuco Department, Huánuco Province, Chinchao District, NW Tunel de Carpish, 2770 m a.s.l., upper soil and leaf litter in primary mountain forest, Winkler extraction, 14.IV.2016 (S. Friedrich, F. Wachtel, and D. Hauth).

One paratype (1 δ): South America, Central Peru, Andes, 09°43'55" S, 76°11'12" W, Huánuco Department, Huánuco Province, Churubamba District, Área de Conservación Privada Unchog, 3580 m a.s.l., upper soil and leaf litter in primary mountain forest, Winkler extraction, 11.IV.2016 (S. Friedrich, F. Wachtel, and D. Hauth).

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 Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis. Body length: 540–547. Cerotegument mostly columnar, amorphous and granular. Rostrum rounded. Lamella with cusp. Prolamella and prelamellar ridge present. Prodorsal enantiophysis developed. Rostral and lamellar setae medium-sized, setiform, flexible; interlamellar seta long, thickened, erect; bothridial seta longest on prodorsum, thickened, without developed head; exobothridial seta short, simple. Interbothridial region with one pair of simple tubercles. Nine pairs of notogastral setae present; *c* medium-sized, setiform, flexible, others (*p*₁ medium-sized; others long) thickened, erect. Epimeral setae *3c*, *4c* medium-sized, setiform, flexible, others short, setiform, erect. Enantiophysis *e3* and aggenital enantiophysis well developed. Anogenital setae short, setiform, erect.

Description. Measurements. Body length: 540 (holotype), 540, 547 (paratypes); body width: 315 (holotype), 323, 330 (paratypes).

Integument. Body color brown. Cuticle slightly microtuberculate sculpturing; lamella, tutorium, pedotecta I, II, podosomal region, and lateral part of pro-

dorsum and epimeres I, II partially foveate. Cerotegument with larger excrescences columnar; smaller excrescences amorphous to irregularly granular; dense cerotegumental tubercles located between bothridium and acetabula II, III.

Prodorsum. Rostrum broadly rounded, with medial bulge in rostral limb between rostral setae. Lamella about two-thirds length of prodorsum, with distinct tubular cusp; pair slightly convergent. Lamella continuing short distance past cusp as low, narrow prolamella; pair convergent but separated anteriorly. Transverse prelamellar ridge present. Tutorium thin, blade-like, with abrupt posterior end, opposing separate tubercle to form prodorsal enantiophysis. Rostral and lamellar setae (52–56) setiform, flexible, slightly barbed; interlamellar seta (101–109) thickened, erect, barbed; bothridial seta (124–135) thickened, barbed; exobothridial seta (19) setiform, thin, flexible, smooth. Interbothridial region with one pair of simple tubercles. Postbothridial tubercle represented by unclear thickening.

Notogaster. Humeral process rectangular, but posterior part slightly developed. Crista well visible in lateral aspect. Nine pairs of notogastral setae (*h*₁ absent); seta *c* (37–45) setiform, flexible, barbed, others (*p*₁: 37–45; others: 75–90) thickened, erect, barbed. Opisthonotal gland opening and all lyrifissures distinct.

Gnathosoma. Subcapitulum size: 112–116 × 82–86; subcapitular setae (*a*, *m*: 22; *h*: 26) setiform, slightly erect, roughened; adoral seta (11) setiform, flexible, smooth. Palp length: 64–75; setation: 0–2–1–3–9(+ ω); postpalpal seta (6) spiniform, smooth. Chelicera length: 112–116; cheliceral setae (*cha*: 32–34; *chb*: 20–22) setiform, flexible, barbed.

Epimeral and lateral podosomal regions. Epimeral setal formula: 3–1–3–3; setae *3c*, *4c* (49–60) setiform, flexible, barbed, others (*1a*, *1c*, *2a*, *3a*: 19–26; *3b*: 30–41; *1b*, *4a*, *4b*: 26–34) setiform, erect, roughened. Enantiophysis *e3* present, spanning groove of epimeral border 3. Seta *3b* inserted on simple tubercle; *3c* inserted on separate sharp tubercle located nearly to pedotectum II. Aggenital enantiophysis well developed across epimeral border 4, its posterior tubercle about two times as large as anterior; latter, bearing seta *4a*, connected across epimere IV to posterior tubercle of *e3* by low ridge. Circumpedal carina and discidium well developed.

Anogenital region. Genital (15–19), aggenital (22–26), anal (15–19), and adanal (22–26) setae setiform, erect, roughened. Anal and adanal lyrifissures well visible.

Legs. Tridactylous; median claw thicker than lateral claws, all roughened on dorsal side. Porose area on leg femora I–IV and on trochanters III, IV distinct. Trochanters III and IV dorsodistally with strong and slight tooth, respectively. Formulas of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–4–3–4–16) [1–1–2], III (2–3–2–3–15) [1–1–0], IV (1–2–

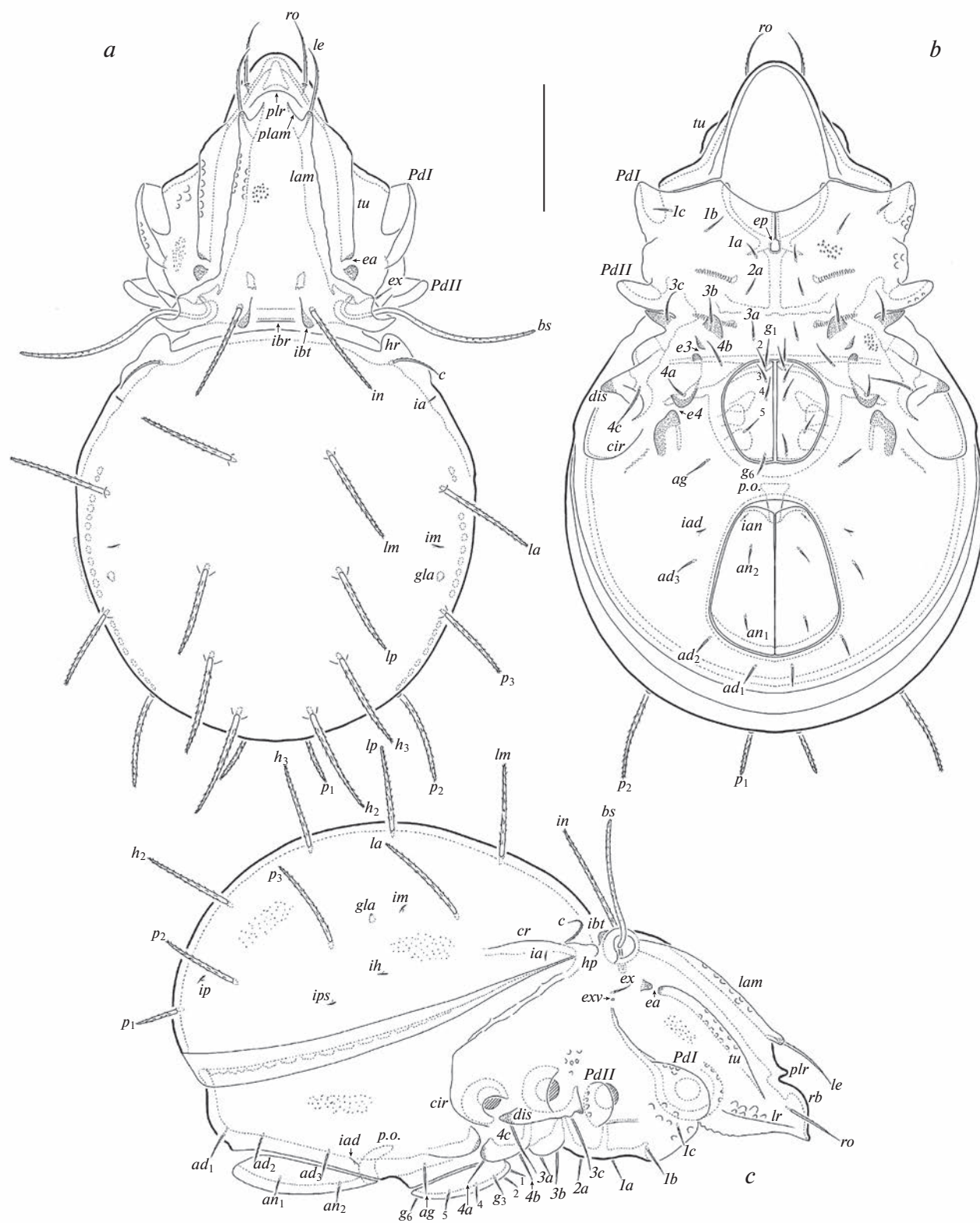


Fig. 1. *Anderemaeus friedrichi* sp. n., adult: *a* – dorsal view (not shown: legs); *b* – ventral view (not shown: gnathosoma, legs); *c* – right lateral view (not shown: gnathosoma, legs). Scale bar 100 μ m.

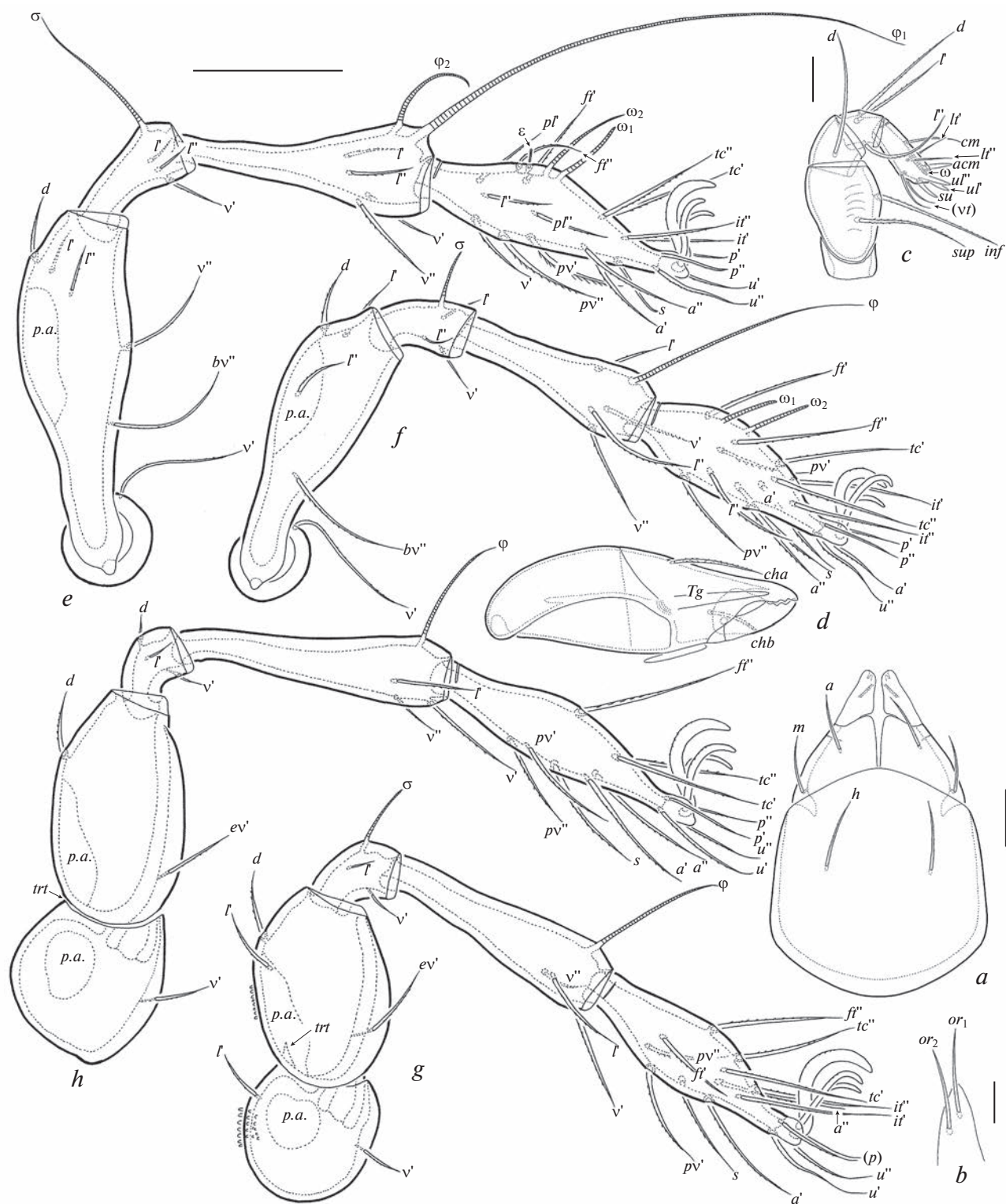


Fig. 2. *Anderemaeus friedrichi* sp. n., adult: *a* – subcapitulum, ventral view; *b* – left lip with adoral setae, left, ventral view; *c* – palp, right, antiaxial view; *d* – chelicera, left, paraxial view; *e* – leg I, right, antiaxial view; *f* – leg II, right, antiaxial view; *g* – leg III, left, antiaxial view; *h* – leg IV, left, antiaxial view. Scale bar, μm : *a*, *d* – 20; *b* – 5; *c* – 10; *e*–*h* – 50.

Table 1. Leg setation and solenidia of adult *Anderemaeus friedrichi* sp. n. and *A. paracapitatus* sp. n.

Leg	<i>Tr</i>	<i>Fe</i>	<i>Ge</i>	<i>Ti</i>	<i>Ta</i>
I	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i> , <i>v''</i>	(<i>l</i>), <i>v'</i> , σ	(<i>l</i>), (<i>v</i>), ϕ_1 , ϕ_2	(<i>fi</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>l''</i> , <i>v'</i> , (<i>pl</i>), ε , ω_1 , ω_2
II	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i>	(<i>l</i>), <i>v'</i> , σ	(<i>l</i>), (<i>v</i>), ϕ	(<i>fi</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>l''</i> , ω_1 , ω_2
III	<i>l'</i> , <i>v'</i>	<i>d</i> , <i>l'</i> , <i>ev'</i>	<i>l'</i> , <i>v'</i> , σ	<i>l'</i> , (<i>v</i>), ϕ	(<i>fi</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)
IV	<i>v'</i>	<i>d</i> , <i>ev'</i>	<i>d</i> , <i>l'</i> , <i>v'</i>	<i>l'</i> , (<i>v</i>), ϕ	<i>fi''</i> , (<i>tc</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)

Roman letters refer to normal setae, Greek letters – to solenidia (except ε = famulus). Prime (') and double-prime (') indicate anterior and posterior setae of a pseudosymmetrical pair; parentheses refer to both members of the pair collectively.

3–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1.

Remarks. In having prolamella, lamellar cusp, one pair of interbothridial tubercles, rounded rostrum, and thickened, erect dorsal notogastral setae, *Anderemaeus friedrichi* sp. n. is most similar to *A. monticola* Hammer 1958 from the Neotropical region (Hammer, 1958). However, the new species can be distinguished by its smaller body size (length: 540–547 versus 650), long bothridial seta without developed head (versus medium-sized, with well-developed head), nine (versus ten) pairs of notogastral setae, and long (versus medium-sized) dorsal notogastral setae.

Etymology. The specific name is dedicated to our friend and colleague, Stefan Friedrich (Ludwig-Maximilians-University Munich, Faculty of Biology, Biocenter LMU, Planegg-Martinsried, Germany).

Anderemaeus paracapitatus Ermilov,
Subías et Shtanchaeva sp. n.
(Fig. 3)

Material. Holotype (♂) and two paratypes (1♂, 1♀): South America, Central Peru, Andes, 09°43'55" S, 76°11'12" W, Huánuco Department, Huánuco Province, Churubamba District, Área de Conservación Privada Unchog, 3580 m a.s.l., upper soil and leaf litter in primary mountain forest, Winkler extraction, 11.IV.2016 (S. Friedrich, F. Wachtel, and D. Hauth).

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 Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis. Body length: 690–735. Cerotegument mostly columnar, amorphous and granular. Rostrum rounded. Lamella with cusp. Prolamella and prelamellar ridge absent. Prodorsal enantiophysis developed. Rostral and lamellar setae medium-sized, setiform, flexible; interlamellar seta long, thickened, erect; bothridial seta shortest on prodorsum, capitate; exobothridial seta represented by alveolus. Interbothridial region with one pair of triangular tubercles. Ten

pairs of notogastral setae present; *c* medium-sized, setiform, flexible, *h*₁ and *p*₁ medium-sized, thickened, slightly dilated distally due to heavy barbs, others long, thickened, erect. Epimeral setae 3*c*, 4*c* medium-sized, setiform, flexible, others short, setiform, erect. Enantiophysis *e*3 not developed, aggenital enantiophysis well developed. Anogenital setae short, setiform, erect. Anal plate with longitudinal ridge.

Description. Measurements. Body length: 705 (holotype), 690, 735 (paratypes); body width: 390 (holotype), 390, 465 (paratypes).

Integument. Body color brown. Cuticle slightly microtuberculate sculpturing; lamella, tutorium, pedotecta I, II, podosomal region, anterior part of epimere I, and lateral part of prodorsum and epimeres I, II partially foveate; notogaster and anogenital region with distinct, sparse foveoles (diameter up to 7). Cerotegument with larger excrescences columnar; smaller excrescences amorphous to irregularly granular; dense cerotegumental tubercles located between bothridium and acetabula II, III.

Prodorsum. Rostrum broadly rounded, with medial bulge in rostral limb between rostral setae. Lamella about two-thirds length of prodorsum, with distinct tubular cusp; pair slightly convergent. Prolamella and prelamellar ridge absent. Tutorium thin, blade-like, with abrupt posterior end, opposing separate tubercle to form prodorsal enantiophysis. Rostral and lamellar setae (67–75) setiform, flexible, smooth; interlamellar seta (105–109) thickened, erect, barbed; bothridial seta (45–49) capitate, with short stalk and larger, roughened head; exobothridial seta represented by alveolus. Interbothridial region with one pair of triangular tubercles. Postbothridial tubercle slightly observed.

Notogaster. Humeral process rectangular. Crista well visible in lateral aspect. Ten pairs of notogastral setae; seta *c* (37–45) setiform, flexible, barbed, *h*₁ (52–64) and *p*₁ (41–56) thickened, slightly dilated distally due to heavy barbs, others (79–101) thickened, erect, barbed. Opisthonotal gland opening and all lyrifissures distinct.

Gnathosoma. Mostly similar to *Anderemaeus friedrichi* sp. n. except sizes: subcapitulum size: 157 × 105; *a*, *m*: 30; *h*: 37; adoral seta: 15; palp length: 94; postpalpal seta: 8; chelicera length: 157; *cha*: 37; *chb*: 22.



Fig. 3. *Anderemaeus paracapitatus* sp. n., adult: *a* — dorsal view (not shown: legs); *b* — ventral view (not shown: gnathosoma, legs); *c* — right lateral view (not shown: gnathosoma, legs). Scale bar 100 μm.

Epimeral and lateral podosomal regions. Epimeral setal formula: 3–1–3–3; setae *3c*, *4c* (49–60) setiform, flexible, barbed, others (*1a*, *1c*, *2a*, *3a*: 26–30; *1b*, *3b*, *4a*, *4b*: 30–34) setiform, erect, roughened. Enantiophysis *e3* absent (anterior tubercle not developed, posterior tubercle developed). Setae *3b* and *3c* inserted on simple tubercles; tubercle with *3c* distant from pedotectum II. Aggenital enantiophysis well developed across epimeral border 4, both tubercles large. Circumpedal carina and discidium well developed.

Anogenital region. Genital (22–26), aggenital (30–34), anal (15–19), and adanal (30–37) setae setiform, erect, roughened. Anal plate with longitudinal ridge. Anal and adanal lyrifissures well visible.

Legs. Mostly similar to *Anderemaeus friedrichi* sp. n. but trochanter IV dorsodistally with strong tooth.

Remarks. In having a short, capitate bothridial seta, *Anderemaeus paracapitatus* sp. n. is most similar to *A. capitatus* J. et P. Balogh 1985 from Colombia (J. Balogh, P. Balogh, 1985). However, the new species can be distinguished by its smaller body size (length: 690–735 versus 746–812), comparatively short (versus medium-sized) notogastral seta *h*₁, triangular (versus semi-oval) interbothridial tubercles, foveolate (versus not foveolate) notogaster and anogenital region, and the presence (versus absence) of lamellar cusp.

Etymology. The name *paracapitatus* refers to the similarity between the new species and *Anderemaeus capitatus* J. et P. Balogh 1985.

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REFERENCES

- Balogh J., Balogh P., 1985. Studies on the Anderemaeidae J. Balogh, 1972 (Acari, Oribatei) // *Opuscula Zoologica Budapest*. V. 19–20. P. 41–48.
- Hammer M., 1958. Investigations on the oribatid fauna of the Andes Mountains. I. The Argentine and Bolivia // *Det Kongelige Danske Videnskabernes Selskab Biologiske Skrifter*. V. 10. № 1. P. 1–129.
- Norton R.A., 1977. A review of F. Grandjean's system of leg chaetotaxy in the Oribatei (Acari) and its application to the family Damaeidae // Dindal D.L., ed. *Biology of oribatid mites*. Syracuse, SUNY College of Environmental Science and Forestry. P. 33–61.
- Norton R.A., Behan-Pelletier V.M., 2009. *Oribatida // A Manual of Acarology* (TX). Lubbock: Texas Tech University Press. P. 430–564.
- Norton R.A., Ermilov S.G., 2019. *Anderemaeus* (Acari, Oribatida) – overview, three new species from South America and reassessment of Anderemaeidae supported by ontogeny // *Zootaxa*. V. 4647. № 1. P. 241–289.
- Travé J., Vachon M., 1975. François Grandjean. 1882–1975 (Notice biographique et bibliographique) // *Acarologia*. V. 17. № 1. P. 1–19.

НОВЫЕ ВИДЫ *ANDEREMAEUS* (ACARI, ORIBATIDA, ANDEREMAEIDAE) ИЗ ПЕРУ

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Род панцирных клещей *Anderemaeus* (Oribatida, Anderemaeidae) впервые зарегистрирован в Перу. Описаны два новых вида рода (*A. friedrichi* sp. n. и *A. paracapitatus* sp. n.). Описание базируется на материалах, собранных в подстилке горных лесов в Андах.

Ключевые слова: панцирные клещи, таксономия, морфология, неотропическая область