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CONTRIBUTION TO THE KNOWLEDGE OF THE ORIBATID MITE GENUS *ARCOZETES* HAMMER 1958 (ACARI, ORIBATIDA, CERATOKALUMMIDAE), WITH THE DESCRIPTION OF A NEW SPECIES FROM PERU

© 2022 г. S. G. Ermilov[a], *, L. S. Subías[b], **, U. Ya. Shtanchaeva[b], ***

[a] *Tyumen State University, Tyumen, 625003 Russia*

[b] *Complutense University, Madrid, 28040 Spain*

**e-mail: ermilovacari@yandex.ru*

***e-mail: subias@bio.ucm.es*

****e-mail: umukusum@mail.ru*

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A new species of the genus *Arcozetes* (Oribatida, Ceratokalummidae) is described, based on material collected from Peru. In addition, the generic traits, as well the distribution of and habitat data for the known species of *Arcozetes* are presented.

Keywords: taxonomy, morphology, diagnosis, distribution, Neotropical region

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The oribatid mite genus *Arcozetes* of the family Ceratokalummidae (Acari, Oribatida) was proposed by Hammer (1958) with *Arcozetes bicuspidatus* Hammer 1958 as type species. At present, the genus comprises two species that are known from the Neotropical region (Subías, 2004, online version 2021).

During our taxonomic identification of Peruvian mites (Neotropical region), we found a new species of *Arcozetes* (making it the third identified representative). The goals of this paper are: to describe and illustrate the new species; to present an updated generic diagnosis; to provide the distribution and habitat data on the known species of *Arcozetes*.

METHODS

Observation and documentation. 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 notogaster. Notogastral width refers to the maximum width of the notogaster (behind pteromorphs) in dorsal view. 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. Drawings were made with a camera lucida using a Leica transmission light microscope "Leica DM 2500".

Terminology and conventions. 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 and notations. Prodorsum: *ro*, *le*, *in*, *bs* = rostral, lamellar, interlamellar, and bothridial seta, respectively; *D* = dorsophragma; *P* = = pleurophragma; *tu* = tutorium; *Ad* = dorsosejugal porose area. Notogaster: *Aa*, *A1*, *A2*, *A3* = porose areas; *c*, *la*, *lm*, *lp*, *h*, *p* = setae; *ia*, *im*, *ip*, *ih* = lyrifissures; *gla* = opisthonotal gland opening. Gnathosoma: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *as* = = axillary saccule; ω = palp solenidion; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. Epimeral and lateral podosomal regions: *1a*, *1b*, *1c*, *2a*, *3a*, *3c*, *4a*, *4b* = = epimeral setae; *Ah* = humeral porose area; *gt* = genal tooth; *dis* = discidium; *cpc* = circumpedal carina. Anogenital region: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal seta, respectively; *iad* = adanal lyrifissure; *Ap* = postanal porose area; *po* = preanal organ. Legs: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, tarsus, respectively; ω, φ, σ = solenidia; ε = famulus; *ft* = seta.

TAXONOMY

Generic traits of *Arcozetes* (adult)

With character states of the Ceratokalummidae (Balogh, Balogh, 1988; Norton, Behan-Pelletier, 2009). *Size*. Small, length less than 300. *Integument*. Without heavy sculpturing and ornamentation. *Prodorsum*. Rostrum bidentate. Lamellae narrow, their cusps short, connected medially, with short outer tooth and long inner tooth. Translamella absent. Rostral, lamellar and interlamellar setae well developed. Bothridium with scales. Dorsophragmata fused medially. Tutorium with triangular tip. Dorsosejugal porose area present. *Notogaster*. Pteromorph rounded laterally, without anterior projection. Octotaxic system as four pairs of small porose areas. Notogastral setation: 10 pairs of short, setiform setae. Posterior notogastral tectum developed. *Gnathosoma*. Subcapitulum diarthric, "galumnid" type. Axillary saccule present. Palp setation: 0–2–1–3–9(+ω). Solenidion bacilliform, attached to eupathidium along length. *Lateral podosomal and epimeral regions*. Genal tooth elongate triangular. Pedotectum I as a large lamina. Custodium, discidium and circumpedal carina present. Humeral porose area *Ah* present, *Am* not observed. Epimeral setal formula: 3–1–2–2. *Anogenital region*. Five pairs of genital, one pair of aggenital, two pairs of anal, and two pairs of adanal setae. Postanal porose area present. *Legs*. All leg tarsi with three claws. Porose area present on femora I–IV and trochanters III, IV.

Arcozetes longicornutus Ermilov, Subías et Shtanchaeva sp. n. (Figs 1–4)

M a t e r i a l. Holotype (♀) and six paratypes (2♂♂, 4♀♀): South America, Amazonian Peru, 09°37′ S, 74°56′ W, Huánuco Department, Puerto Inca Province, Yuyapichis District, Área de Conservación Privada, Panguana (biological field station), near Rio Yuyapichis (river), 230–260 m a.s.l., upper soil and leaf litter in the primary evergreen lowland rainforest, 23.IV.2016–09.V.2016 (S. Friedrich, F. Wachtel and D. Hauth). Mites were extracted using Winkler's apparatus in laboratory conditions during 10 days from samples into 75% ethanol.

The holotype is deposited in the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru; six paratypes are deposited in the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in ethanol with a drop of glycerol.

D i a g n o s i s. Body size: 215–249 × 149–166. Inner teeth of lamellar cusps bent in median part. Rostral seta long, setiform, barbed; lamellar and interlamellar setae slightly thickened, straight, barbed; *in* longest. Bothridial seta with short stalk and long, narrowly elongate, fusiform head. Notogastral, epimeral and anogenital setae short, setiform, thin, smooth; p_1 longer than others. All notogastral porose areas small, rounded. Postanal porose area narrowly elongate oval. Leg seta *l''* on tibia II thorn-like.

D e s c r i p t i o n. *Measurements*. Body length: 249 (holotype), 215–249 (paratypes); notogaster width: 166 (holotype), 149–166 (paratypes). No differences between males and females in body size.

Integument. Body colour light brown to brown. Surface nearly smooth. Lamella and pedotectum I slightly striate.

Prodorsum. Rostrum bidentate (visible in anterodorsal view), teeth strong. Distal part of lamella with two well-developed teeth (outer tooth short, triangular; inner tooth long, thorn-like, slightly bent in median part) and deep U-shaped indentation between them. Rostral seta (28–32) setiform, barbed. Lamellar (41–45) and interlamellar (65–69) setae slightly thickened, straight, barbed. Bothridial seta (36–41) fusiform, with short stalk and elongate, slightly barbed, narrowed distally head. Exobothridial seta not observed. Dorsosejugal porose area diffuse.

Notogaster. Anterior margin slightly convex medially. Pteromorph rounded laterally. Ten pairs of notogastral setae (p_1: 16; others: 8) setiform, thin, smooth. Porose areas rounded (4–6). Opisthonotal gland opening and all lyrifissures distinct (except *ips* not observed).

Gnathosoma. Subcapitulum size: 57–61 × 41–45. Subcapitular setae (*a*, *m*, *h*: 10–12) and adoral (6) setae setiform, thin, smooth. Palp (length: 41–45) with setation 0–2–1–3–9(+ω). Postpalpal seta (4) spiniform, smooth. Axillary saccule distinct, slightly elongated. Chelicera length: 61–65. Cheliceral setae (*cha*: 16; *chb*: 12) setiform, barbed.

Epimeral and lateral podosomal regions. Epimeral setae (*1a*, *1c*, *2a*, *3a*: 8; others: 12) setiform, thin, smooth. Discidium triangular. Circumpedal carina long, reaching epimere I, distally connected with custodium. Humeral porose area *Ah* oval, poorly visible.

Anogenital region. Genital (g_1: 16; others: 8), aggenital (8), anal (8), and adanal (8) setae setiform, thin, smooth. Adanal lyrifissure distinct. Postanal porose area narrowly elongate oval, poorly visible.

Legs. All claws slightly barbed on dorsal side. Porose area on femora I–IV and on trochanters III, IV present, but poorly visible. Formulas of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–5–2–4–15) [1–1–2], III (1–2–1–3[2]–15) [1–1–0], IV (0–2–2–2–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus of tarsus I short, stick-like, slightly swollen and blunt-ended api-

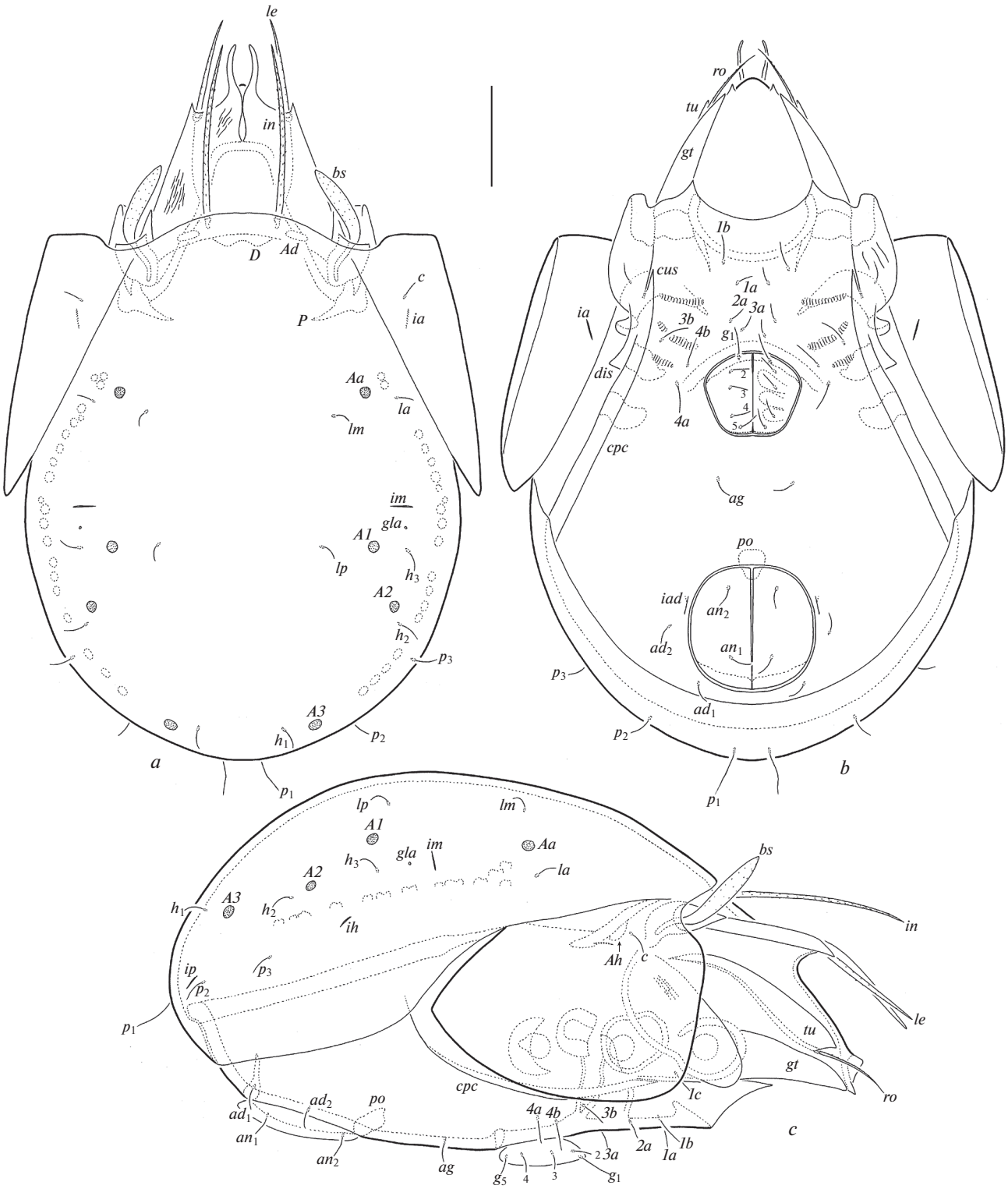

Fig. 1. *Arcozetes longicornutus* sp. n., adult: *a* – dorsal view, *b* – ventral view (gnathosoma and legs not shown), *c* – lateral view (gnathosoma and legs not shown). Scale bar 50 μm.

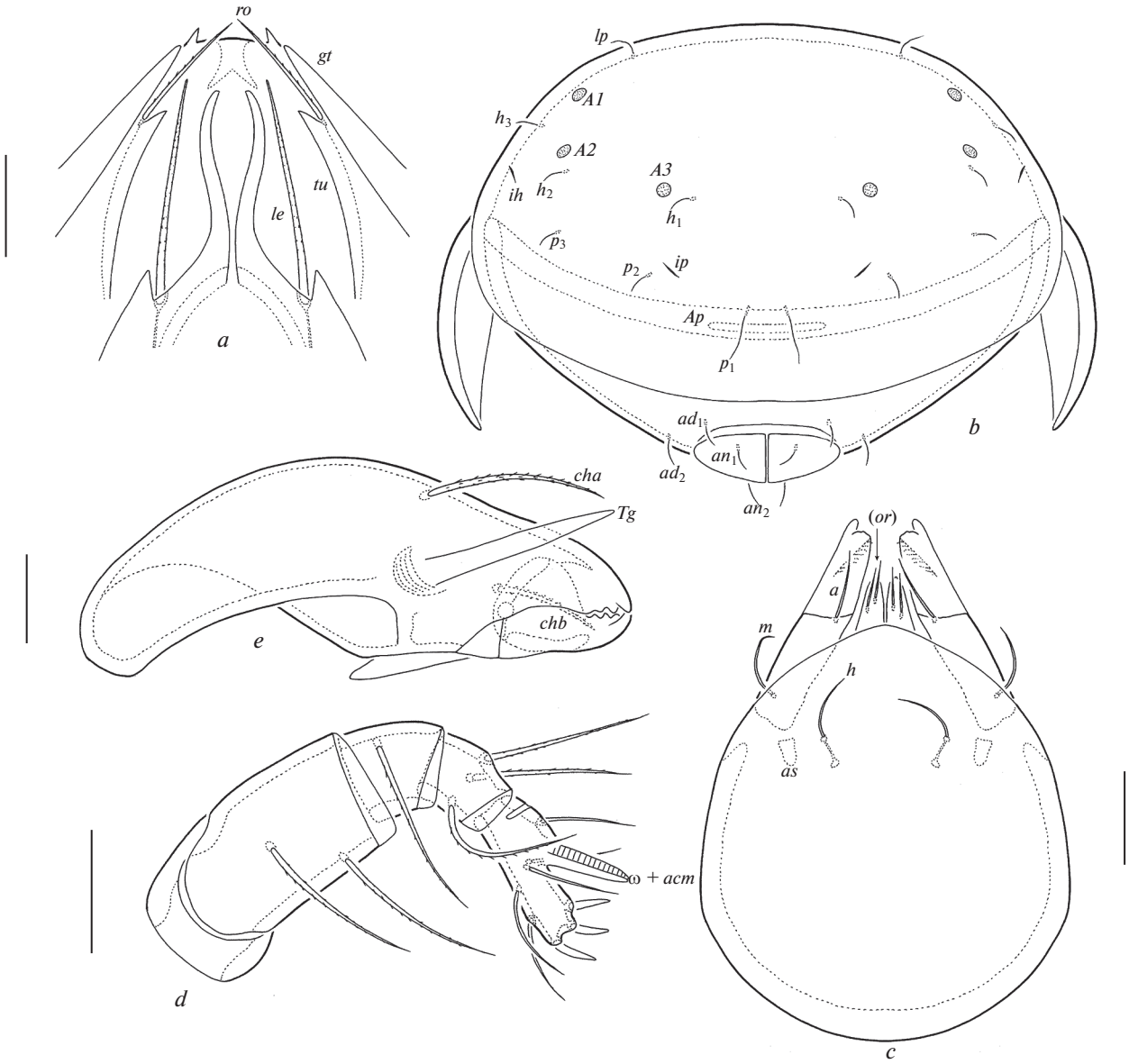

Fig. 2. *Arcozetes longicornutus* sp. n., adult: *a* — anterior part of prodorsum, dorsoanterior view; *b* — posterior view; *c* — subcapitulum, ventral view; *d* — palp, right, antiaxial view; *e* — chelicera, left, paraxial view. Scale bar (μm): *a* — 20; *b* — 50; *c*–*e* — 10.

cally, inserted between solenidia ω_1 and ω_2. Seta *s* of tarsus I eupathidial, located before setae *a*. Seta *l*'' on tibia II thorn-like. Solenidia ω_1, ω_2 on tarsus II and σ on genu III thickened, distally rounded; other solenidia setiform.

R e m a r k s. *Arcozetes longicornutus* sp. n. differs from the other members of *Arcozetes* in the morphology of the following characters: lamellar cusp, head of bothridial seta and setae *le* and *in*. The new species also differs from the other members of the genus in the length of its body and in the length of its notogastral setae (Table 2).

E t y m o l o g y. The specific name refers to the long inner tooth of the lamellar cusp.

DISTRIBUTION OF *ARCOZETES*

The species of *Arcozetes* are known only from the Neotropical region (Subías, 2004, online version 2021). The type species, *A. bicuspidatus* was described from Argentina in slightly moist liverworts, on a slope leading down to a deep dry arroyo, shaded by shrubs, at Quebrada de Gallinato, near Salta (Hammer, 1958). Later, it was recorded from Bolivia: 1) in moss

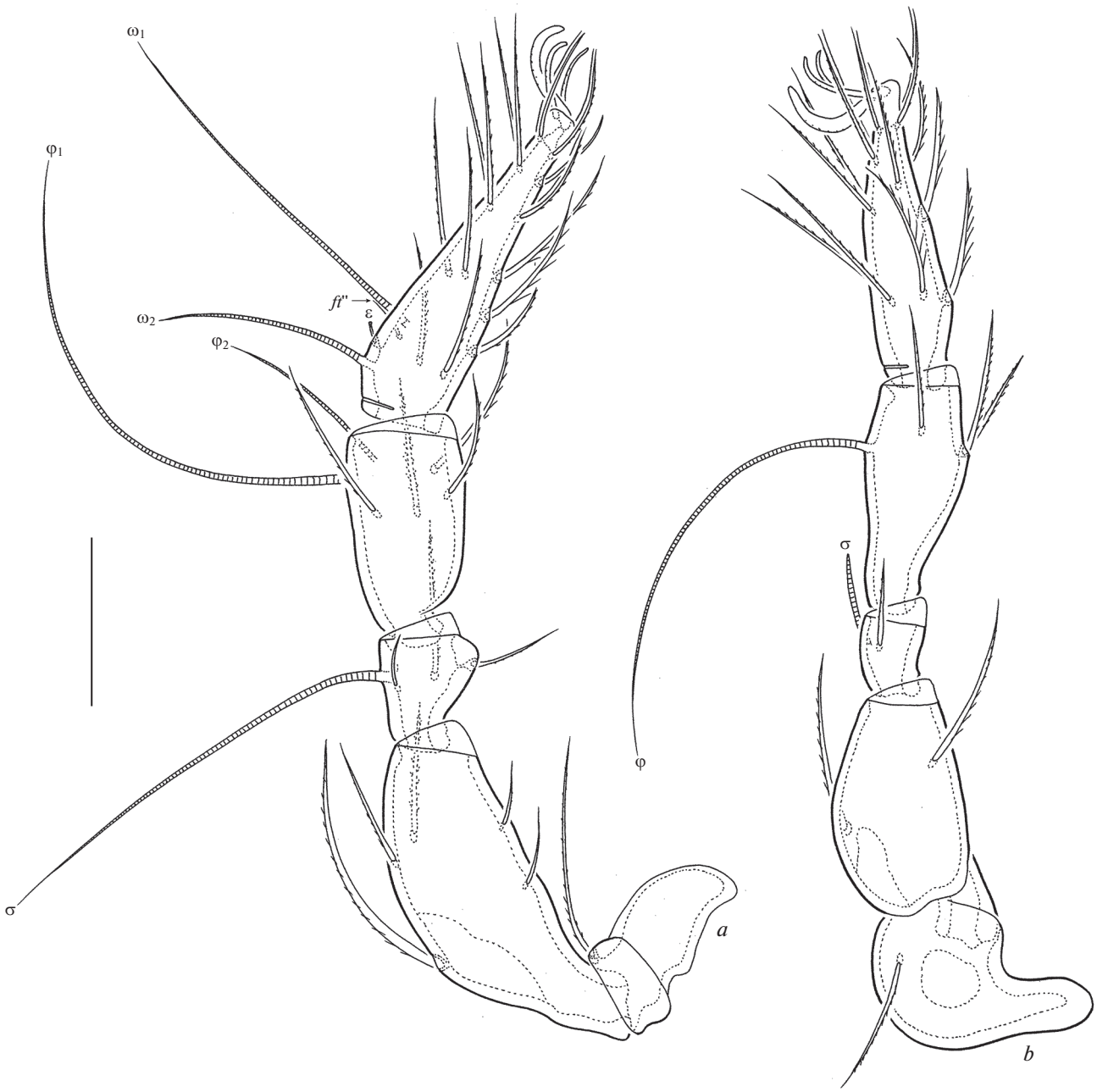

Fig. 3. *Arcozetes longicornutus* sp. n., adult: *a* – leg I, right, antiaxial view; *b* – leg III, left, antiaxial view. Scale bar 20 μm.

growing in a steep rocky declivity, shaded by vegetation, between Alcoche and Puerto Linares, Alto Beni region, and 2) in moss growing on a roadside cliff, 25 km from Alcoche, Alto Beni region (Balogh, Mahunka, 1969). This species was also recorded from Peru (Hammer, 1961): 1) in low green moss on the vertical side of a water drain, located along the road, below a tall *Eucalyptus* tree, at the site of Cajamarca; 2) in a one-centimeter-high luxurious moss, in oozing water, below shrubs, at Tambomachay; 3) in moist moss and liverworts growing on walls, in wet moss growing in oozing water on a cliff, and it was very common in thin moist moss on the ground – all at Machu Picchu. *A. bicuspidatus* was also recorded from Ecuador: 1) in moss growing on shrubs and tree branches, about 10 m above the Alamo River, 6 km from Nono; 2) in litter and soil, as well as in the debris and moss cover associated with a decomposing tree stump, in a forest patch located on the way to San Francisco de las Pampas, Guayas Province (Balogh, 1988); 3) in a moist vegetation zone, on the Galapagos archipelago (Schatz, 1998).

Fig. 4. *Arcozetes longicornutus* sp. n., adult: *a* – leg II, right, antiaxial view; *b* – leg IV, left, antiaxial view. Scale bar 20 μm.

Table 1. Leg setation and solenidia of adult *Arcozetes longicornutus* sp. n.

Leg	Tr	Fe	Ge	Ti	Ta
I	*v*'	*d*, (*l*), *bv*", *v*"	(*l*), *v*', σ	(*l*), (*v*), φ_1, φ_2	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), *v*', (*pl*), *l*", ε, ω_1, ω_2
II	*v*'	*d*, (*l*), *bv*", *v*"	(*l*), σ	(*l*), (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), ω_1, ω_2
III	*l*'	*d*, *ev*'	*l*', σ	*l*', (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*)
IV	–	*d*, *ev*'	*d*, *l*'	(*v*), φ	*ft*", (*tc*), (*p*), (*u*), (*a*), *s*, (*pv*)

Notes. 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. Parentheses refer to a pair of setae.

Table 2. Distinctive morphological characters of *Arcozetes* spp.

Character	*A. bicuspidatus*	*A. rotundatus*	*A. longicornutus*
Inner teeth of lamellar cusps	Medium size, straight, parallel	Medium size, straight, parallel	Long, slightly bent in median part
Head of bothridial seta	Elongate fusiform, distally with short setiform tip	Elongate clavate, distally rounded	Elongate fusiform, distally narrowed
Setae *le* and *in*	Setiform	Setiform	Slightly thickened
Body length	270	240–255	215–249
Notogastral setae	Similar in length	Similar in length	p_1 longer than others

Arcozetes rotundatus was described from Venezuela: "in and around a forest stream litter and soil" located in a seasonal rain forest at Parque Nacional Henri Pittier (Mahunka, 2006). Also, it was recorded by us from Peru (first record of this species in this country) in the upper soil and leaf litter, in the primary evergreen lowland rainforest, Churubamba District, Huánuco Province.

The new species, *A. longicornutus* was sampled from Peru: in the upper soil and leaf litter, in the primary evergreen lowland rainforest located in Panguana (Área de Conservación Privada), near Rio Yuyapichis, Yuyapichis District, Puerto Inca Province.

Additionally, one unknown species of *Arcozetes* was recorded from Panama: in moss and ferns, in the tropical wet forest, Cerro Gaital Mountains, near El Valle de Antón, Cordillera Central (Schatz, 2006).

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К ИЗУЧЕНИЮ ПАНЦИРНЫХ КЛЕЩЕЙ РОДА *ARCOZETES* HAMMER 1958 (ACARI, ORIBATIDA, CERATOKALUMMIDAE) С ОПИСАНИЕМ НОВОГО ВИДА ИЗ ПЕРУ

С. Г. Ермилов[1, *], Л. С. Субиас[2, **], У. Я. Штанчаева[2, *]**

[1]Тюменский государственный университет, Тюмень, 625003 Россия

[2]Университет Комплутенсе, Мадрид, 28040 Испания

**e-mail: ermilovacari@yandex.ru*

***e-mail: subias@bio.ucm.es*

****e-mail: umukusum@mail.ru*

Представлено описание нового вида рода *Arcozetes* (Ceratokalummidae) из Перу. Суммированы родовые признаки, а также данные о распространении и биотопическом предпочтении известных видов *Arcozetes*.

Ключевые слова: панцирные клещи, таксономия, морфология, диагноз, распространение, Неотропическая область