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Article

Taxonomic contribution to the knowledge of the oribatid mite genus *Orbiculobates* (Acari, Oribatida, Plasmobatidae)

Sergey G. Ermilov

Tyumen State University, Institute of Environmental and Agricultural Biology (X-BIO), Tyumen, Russia; E-mail: ermilovacari@yandex.ru

ABSTRACT
The genus *Orbiculobates* (Oribatida, Plasmobatidae) is recorded in Mexico for the first time. A new species — *O. bicornutus* **sp. nov.** — is described, based on adults collected from leaf litter in secondary semi-evergreen tropical forest. An identification key to the known species of *Orbiculobates* is presented.

KEY WORDS: Key, Mexico, morphology, plasmobatid mites, taxonomy.

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INTRODUCTION

The oribatid mite family Plasmobatidae (Acari, Oribatida) comprises three genera differing from each other mostly by the notogaster surface (e.g. Subías and Shtanchaeva 2023): tuberculate in *Malgachebates* Fernández, Cleva & Theron, 2011, smooth in *Orbiculobates* Grandjean, 1961 and foveolate in *Plasmobates* Grandjean, 1929. The plasmobatid genus *Solenozetes* Grandjean, 1931 differs from *Plasmobates* mostly by number of genital setae, therefore, previously I do not maintain generic status of the former and consider representatives of it within *Plasmobates*; Subías (2022) included *Solenozetes* as a subgenus of *Plasmobates*.

This work is part of my ongoing study of Mexican mite fauna (e.g., Ermilov & OConnor 2020; Ermilov & Yurtaev 2023a, b). During taxonomic identification of Plasmobatidae, I found specimens belonging to a new species of *Orbiculobates* described below under the name *O. bicornutus* **sp. nov.** Presently, species of *Orbiculobates* have not been registered in Mexico; hence, the new species is the first identified representative of the genus in fauna of this country.

Orbiculobates was proposed by Grandjean (1961), with *Plasmobates orbiculus* Grandjean, 1929 as type species. The genus comprises five species, which are distributed in the Neotropical region (four species) and Western Samoa (one species) (Subías 2022). Some main generic traits have been provided by Grandjean (1961) and Fernández *et al*. (2013). Additional goal of the paper is to present an identification key to the known species of *Orbiculobates*.

METHODS

Observation and documentation – Specimens were mounted in lactic acid, on temporary cavity

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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 in dorsal view; lengths of body setae were measured in lateral aspect. Exuvial scalps were removed from the notogaster with a dissecting needle. 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 DM 2500 transmission light microscope. For SEM microscopy alcohol preserved mites were dusted with silver and scanned with the aid of a JEOL–JSM-6510LV SEM microscope.

Terminology – Morphological terminology used in this paper mostly follows that of Grandjean (1929, 1961), Norton (1977) for leg setal nomenclature, and Norton and Behan-Pelletier (2009) for overview.

Abbreviations – *Prodorsum*: *inc* = incision; *rb* = rostral bulge; *f* = furrow; *car* = dorsolateral carina; *lrc* = laterorostral carina; *ro*, *le*, *in*, *bs* = rostral, lamellar, interlamellar, and bothridial setae, respectively. *Notogaster*: *dep* = depression; *c*, *h*, *p* = setae; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. *Gnathosoma*: *sc* = subcapitular carina; *a*, *m*, *h* = subcapitular setae; *d*, *l*, *v*, *cm*, *acm*, *ul*, *su*, *vt*, *lt* = palp setae; ω = palp solenidion; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *4a*, *4c* = epimeral setae; *vhs* = ventral horn-like structure; *sac* = saccule; *z* = aperture of supracoxal gland; *P* = propodolateral apophysis; *lhs* = lateral horn-like structure. *Anogenital region*: *g*, *an*, *ad* = genital, anal and adanal setae, respectively; *iad* = adanal lyrifissure; *ac* = anal carina; *po* = preanal organ. *Legs*: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively; *tp* = trochanteral process; *fp* = femoral process; ω, φ, σ = solenidia; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *p*, *u*, *a*, *s*, *pv* = setae; *pa* = porose area.

TAXONOMY

Family Plasmobatidae
Orbiculobates Grandjean, 1961

Type species: *Plasmobates orbiculus* Grandjean, 1929

Orbiculobates bicornutus sp. nov. (Figs. 1–14)

http://zoobank.org/urn:lsid:zoobank.org:act:12B42200-E81F-4C51-A466-D894860AB413

Type material

Holotype (female) and seven paratypes (four males and three females): Mexico, 20° 33' N, 87° 13' W, Quintana Roo, Municipio de Solidaridad, vicinities of Playa del Carmen, leaf litter under trees and bushes in secondary semi-evergreen tropical forest (data and collector unknown; collection of the Tyumen State University Museum of Zoology, Tyumen, Russia).

Type deposition

The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; seven paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in ethanol with a drop of glycerol.

Diagnosis

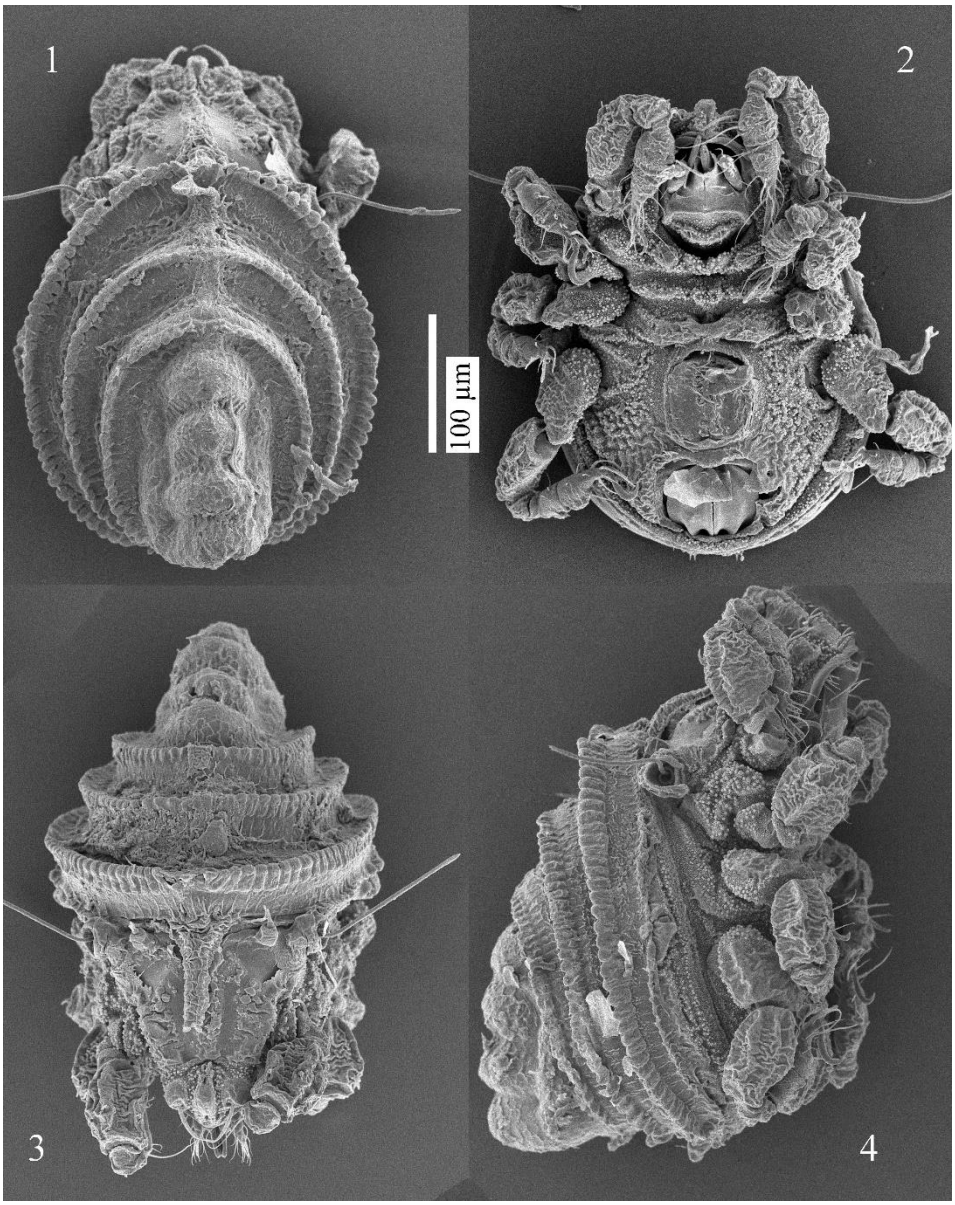
Body length: 360–390. Rostral seta slightly phylliform (dilated in medial part); lamellar seta

setiform; interlamellar seta bifurcate; bothridial seta long, bacilliform, with small, slightly visible lanceolate head. Tritonymphal exuvial scalp with anterior long band-like protrusion. Notogaster flattened, with U-shaped depression. Seven pairs of notogastral setae; h_1 and p_1 located close to each other on one tubercle. Opisthonotal gland opening slightly protruding. Epimeral region with two strong transverse opposite horn-like structures. Epimeral setal formula: 3–1–2–2. Propodolateral apophysis tubercle-like. Lateral side of body with horn-like structure directed backwards. Seven pairs of genital setae present; aggenital setae absent. Anal plate with longitudinal carina. Leg trochanters I, II and femora I–IV with triangular posterior process.

Description

Measurements – Body length: 375 (holotype), 360–390 (paratypes); notogaster width: 255 (holotype), 240–270 (paratypes). No distinct differences between males and females in body size.

Integument – Body color brown. Surface nearly smooth, covered by thick layer cerotegument including dense microgranules; cerotegument partially forming tuberculate, ridge-like and blocky-shaped structures. Exuvial scalps reticulate.



Figures 1–4. *Orbiculobates bicornutus* **sp. nov.** (adult) SEM micrographs – 1. Dorsal view; 2. Ventral view; 3. Dorso-anterior view; 4. Right lateral view.

Prodorsum – Rostrum incised medially. Rostral bulge large, with deep, very narrow, longitudinal furrow. Dorsolateral carina well-developed. Rostral seta (37–45) slightly phylliform (dilated in medial part), with attenuate tip, slightly barbed, located on large tubercle; lamellar seta (7–9) setiform, thin, slightly roughened, located on small tubercle; interlamellar seta (22–26) bifurcate, slightly barbed, located on large tubercle; bothridial seta (120–124) bacilliform, with small, slightly visible lanceolate head, roughened; ventral scale of bothridium excavated (Fig. 4); exobothridial seta not observed.

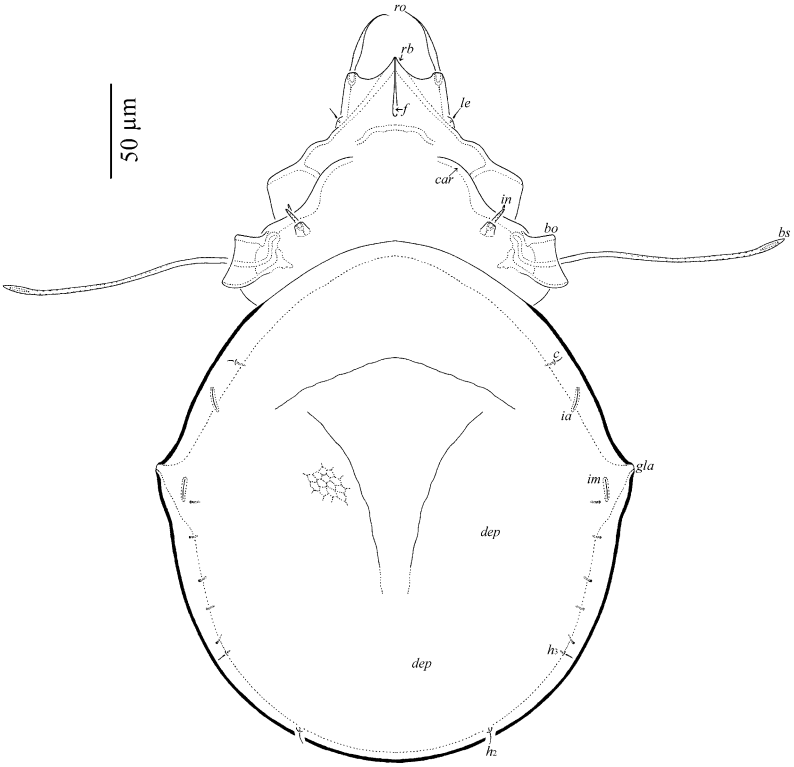


Figure 5. *Orbiculobates bicornutus* **sp. nov.** (adult) – Dorsal view (exuvial scalps not shown).

Notogaster – Tritonymphal exuvial scalp with anterior long band-like protrusion (Fig. 3). Notogaster flattened, with U-shaped depression. Seven pairs of notogastral setae present; all setae (h_1, p_1: 7–9; *c*, h_2, h_3, p_2, p_3: 5–7) setiform, thin, slightly roughened, located on small tubercles; h_1 and p_1 located close to each other, on one tubercle. Opisthonotal gland opening slightly protruding. All lyrifissures distinct.

Gnathosoma – Subcapitulum anarthric; size: 105–109 × 67–71; subcapitular setae (*a*: 30–34; *m*: 13–15; *h*: 20–22) setiform, slightly roughened; *m* thinnest; *h* located on small tubercle; adoral setae absent. Palp length: 67–71; formula: 0–2–1–3–8(+ω); solenidion long, bacilliform, slightly curved; postpalpal seta (6) spiniform, smooth. Chelicera length: 101–109; both cheliceral setae absent.

Epimeral and lateral podosomal regions – Medial region (anteriorly to genital aperture) with two strong transverse opposite horn-like structures located under oval depression. Epimeral setal formula: 3–1–2–2; setae (*3a*: 7–9; others: 5–7) setiform, thin, slightly roughened; *1b* and *1c* located on small tubercles; *3a* and *3b* located in basal part of horn-like structure. Propodolateral apophysis tubercle-like. Lateral side of body with horn-like structure directed backwards.

Anogenital region – Seven pairs of genital, two pairs of anal and three pairs of adanal setae (7–9) setiform, thin, slightly roughened; both aggenital setae absent. Anal plate with longitudinal carina. Adanal lyrifissure distinct.

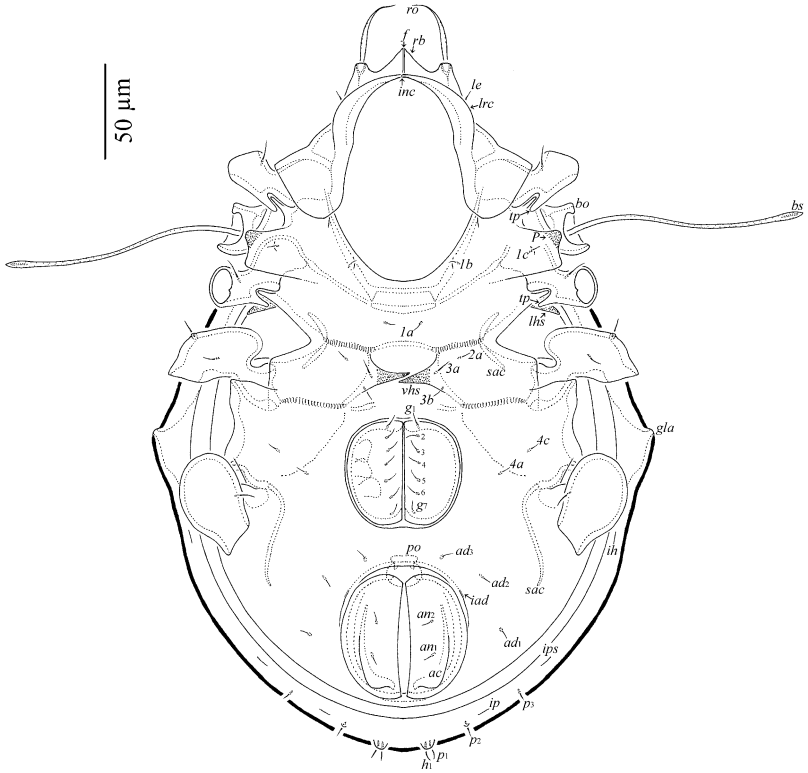
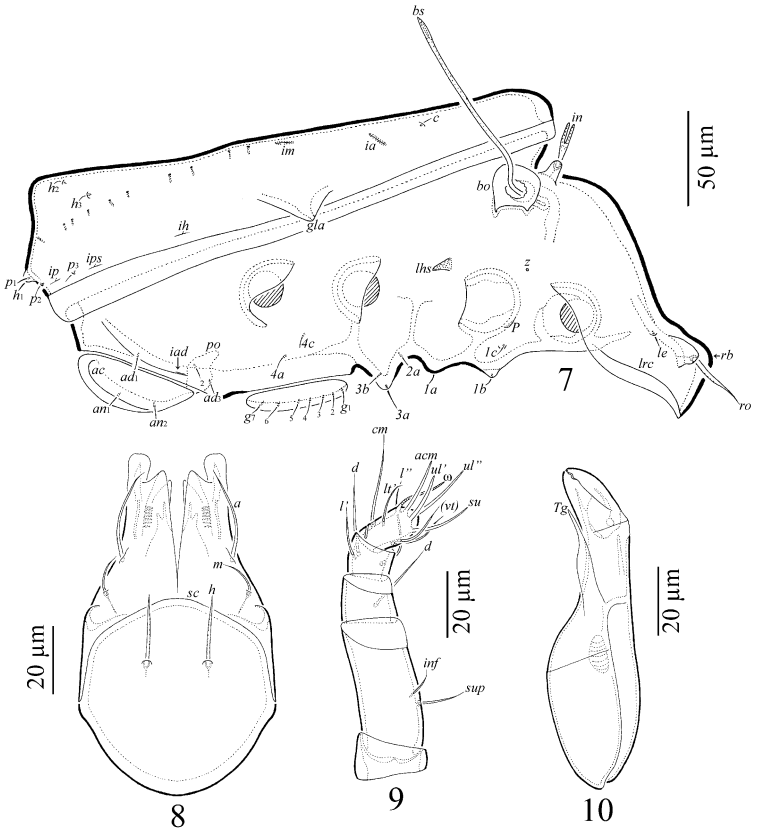
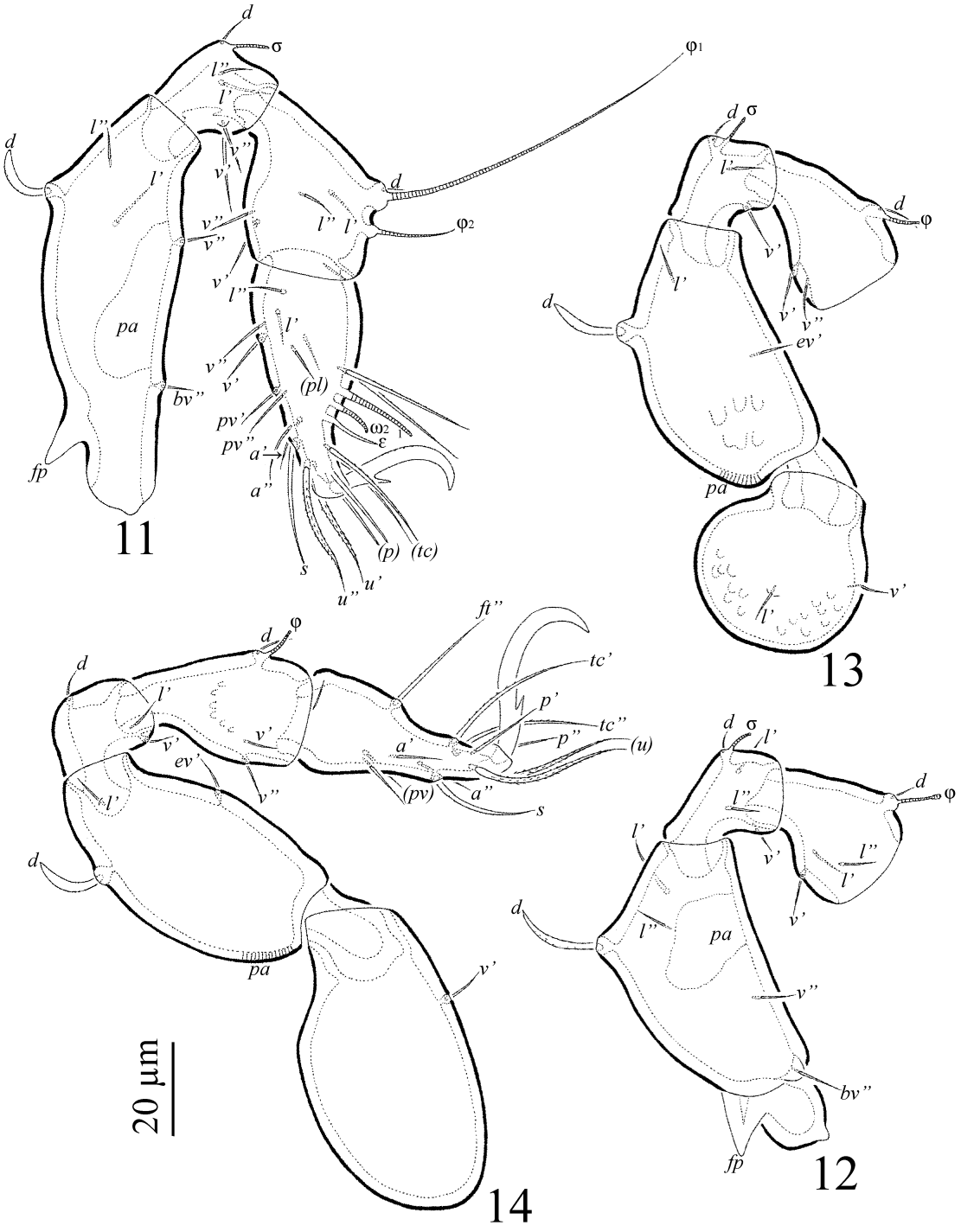


Figure 6. *Orbiculobates bicornutus* **sp. nov.** (adult) – Ventral view (gnathosoma and legs except trochanters not shown).



Figures 7–10. *Orbiculobates bicornutus* **sp. nov.** (adult) – 7. Right lateral view (exuvial scalps, gnathosoma and legs not shown); 8. Subcapitulum, ventral view; 9. Palp, left, paraxial view; 10. Chelicera, left, paraxial view.

Legs – Claw of each leg thick, with strong tooth ventrobasally, slightly barbed on dorsal side. Trochanters I, II and femora I–IV with triangular posterior process. Formulas of leg setation and solenidia: I (1–5–5–5–20) [1–2–2], II (1–5–4–4–14) [1–1–2], III (2–3–3–3–13) [0–1–0], IV (1–3–3–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Solenidia ω_1, ω_2 on tarsi I, II medium-sized, bacilliform; φ_1 on tibia I very long, subflagellate; φ_2 on tibia I medium-sized, setiform; other solenidia short, slightly swollen distally.



Figures 11–14. *Orbiculobates bicornutus* **sp. nov.** (adult) – 11. Leg I (trochanter not shown), right, antiaxial view; 12. Leg II (trochanter and tarsus not shown), right, antiaxial view; 13. Leg III (trochanter not shown), left, antiaxial view; 14. Leg IV, left, antiaxial view.

Table 1. Leg setation and solenidia of adult *Orbiculobates bicornutus* **sp. nov.**

Leg	*Tr*	*Fe*	*Ge*	*Ti*	*Ta*
I	*v'*	*d, (l), bv", v"*	*(l), (v), dσ*	*(l), (v), dφ$_1$, φ$_2$*	*(ft), (tc), (p), (u), (a), s, (pv), (v), (pl), (l),* ε, ω$_1$, ω$_2$
II	*v'*	*d, (l), bv", v"*	*(l), v', dσ*	*(l), v', dφ*	*(ft), (tc), (p), (u), (a), s, (pv), l",* ω$_1$, ω$_2$
III	*l', v'*	*d, l', ev'*	*l', v', dσ*	*(v), dφ*	*(ft), (tc), (p), (u), (a), s, (pv)*
IV	*v'*	*d, l', ev'*	*d, l', v'*	*(v), dφ*	*ft", (tc), (p), (u), (a), s, (pv)*

Note: Roman letters refer to normal setae; Greek letters to solenidia (except ε = famulus); *d*φ and *d*σ – seta and solenidion coupled. Single quotation mark (*'*) designates setae on the anterior and double quotation mark (*"*) setae on the posterior side of a given leg segment; parentheses refer to a pair of setae.

Comparison

In having bifurcate interlamellar seta and bacilliform bothridial seta, *Orbiculobates bicornutus* **sp. nov.** is similar to *O. orbiculus* but differs from the latter by: the form of notogaster (flattened versus convex in *O. orbiculus*); the morphology of rostral seta (dilated in median part versus setiform in *O. orbiculus*); the slightly protruding opisthonotal gland opening (versus strongly protruding, tubular in *O. orbiculus*); the presence of a pair horn-like structure in the epimeral region and a horn-like structure on the lateral side of body (versus absence in *O. orbiculus*); and the absence of spines on anterior margin of the notogaster (versus presence in *O. orbiculus*).

Etymology

The species name *bicornutus* ("horn" in Latin) refers to the presence of two horn-like structures in the epimeral region.

KEY TO KNOWN SPECIES OF *ORBICULOBATES*

1. Bothridial seta with well-developed clavate head; body length: 360 .... *Orbiculobates transvectus* (Grandjean, 1929). Distribution: Lesser Antilles.
– Bothridial seta setiform or with slightly developed elongate head 2
2. Interlamellar seta represented by alveolus 3
– Interlamellar seta represented by seta 4
3. Bothridial seta medium-sized (equal to distance between bothridia), setiform; rostral seta simple; seven pairs of genital setae; aggenital setae present; propodolateral apophysis absent; body length: 384 ..... *Orbiculobates schubarti* (Pérez-Íñigo & Baggio, 1988). Distribution: Brazil.
– Bothridial seta long (clearly longer than distance between bothridia), with slightly developed elongate head; rostral seta stickle-like; six pairs of genital setae; aggenital setae absent; propodolateral apophysis present; body length: 360 .... *Orbiculobates acutirostrum* (Hammer, 1973). Distribution: Western Samoa.
4. Bothridial seta long (clearly longer than distance between bothridia), subflagellate; interlamellar seta simple; notogaster without exuvial scalps; body length: 430 .... *Orbiculobates australis* Balogh & Csiszár, 1963. Distribution: Argentina.
– Bothridial seta medium-sized (equal to distance between bothridia), with slightly developed elongate head; interlamellar seta bifurcate; notogaster with exuvial scalps 5
5. Notogaster flattened; rostral seta dilated in median part; opisthonotal gland opening slightly protruding; one pair horn-like structure in the epimeral region and a horn-like structure on the lateral side of body present; spines on anterior margin of the notogaster absent; body length: 360–390 ..... *Orbiculobates bicornutus* **sp. nov.** Distribution: Mexico.
– Notogaster convex; rostral seta simple; opisthonotal gland opening strongly protruding, tubular; horn-like structures in the epimeral region and on the lateral side of body absent; spines on anterior margin of the notogaster present; body length: 330 .....

.....*Orbiculobates orbiculus* (Grandjean, 1929). Distribution: Antilles.

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اطلاعات آرایه‌شناختی در مورد کنه‌های اوریباتید جنس *Orbiculobates* (Acari, Oribatida Plasmobatidae)

سرگی جی. ارمیلوف

دانشگاه ایالتی تیومن، موسسه زیست‌شناسی محیطی و کشاورزی (X-BIO)، تیومن، روسیه؛ رایانامه: ermilovacari@yandex.ru

چکیده

جنس *Orbiculobates* (Oribatida, Plasmobatidae)، برای نخستین بار در مکزیک ثبت می‌شود. گونه‌ای جدید – ***O. bicornutus* sp. nov.** – بر اساس کنه‌های کامل جمع‌آوری شده از بستر برگ در جنگل‌های استوایی نیمه همیشه سبز ثانویه توصیف می‌شود. کلید شناسایی برای گونه‌های شناخته شده *Orbiculobates* ارایه شده است.

واژگان کلیدی: کلید، مکزیک، ریخت‌شناسی، کنه‌های پلاسموباتید، آرایه‌شناسی.

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