

УДК 595.4

MAKAROVIELLA EXIGUA (ACARI, ORIBATIDA, LICNOBELBIDAE), A NEW GENUS AND SPECIES FROM CUBA

© 2023 г. S. G. Ermilov*

Tyumen State University, Tyumen, 625003 Russia

*e-mail: ermilovacari@yandex.ru

Received March 24, 2023

Revised March 29, 2023

Accepted March 30, 2023

A new oribatid mite genus collected from Cuba — *Makaroviella* gen. n. (Oribatida, Licnobelbidae), with *Makaroviella exigua* sp. n. as type species — is proposed and described. It can be distinguished from both known licnobelbid genera (*Flabellobelba* and *Licnobelba*) mostly by: the number and the localization of notogastral setae, the localization of rostral setae and adanal setae ad_1 , and the absence of lateral enantiophyses. An identification key to the known species of Licnobelbidae is provided.

Keywords: oribatid mites, Plateremaeoidea, taxonomy, morphology, identification key, Neotropical region

DOI: 10.31857/S0044513423080044, **EDN:** YZHCIF

Licnobelbidae is a small family of oribatid mites (Acari, Oribatida, Plateremaeoidea), which was proposed by Grandjean (1965). It comprises two genera with three species: *Flabellobelba* Pérez-Íñigo 1994 (one species) and *Licnobelba* Grandjean 1931 (two species). The family diagnosis has been summarized by Paschoal (1988), Pérez-Íñigo (1994), Norton and Behan-Pelletier (2009); the generic traits have been summarized by Grandjean (1931), Paschoal (1988), Pérez-Íñigo (1994), Subías and Shtanchaeva (2023). The taxonomic history of licnobelbid species has been provided by Pérez-Íñigo (1993, 1994). The representatives of the family are distributed mostly in the Palearctic region but *Licnobelba caesarea* (Berlese 1910) is also known from Mexico (Subías, 2022).

Among the oribatid mite materials collected from the forest leaf litter in Cuba, I found a new species of Licnobelbidae belonging to a new genus. The main goals of this paper are: to describe *Makaroviella* gen. n., with *Makaroviella exigua* sp. n. as type species, based on adults; and to provide an identification key for the known species of the family.

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 gastronotum. Notogastral width refers to the maximum width of the notogaster 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”. Images were obtained with an AxioCam ICc3 camera using a Carl Zeiss transmission light microscope “Axio Lab.A1”.

Terminology. Morphological terminology used in this paper follows that of Grandjean (1931, 1934, 1965), Ermilov and Starý (2021), Ermilov and Salavatulin (2022); Norton (1977) for leg setal nomenclature; Norton and Behan-Pelletier (2009) for overview.

Abbreviations. *Prodorsum*: *car* = carina; *A* = enantiophysis; *Ap* = posterior tubercle of enantiophysis; *ro*, *le*, *in*, *bs*, *ex* = rostral, lamellar, interlamellar, bothridial, and exobothridial seta, respectively. *Notogaster*: *h*, *p* = setae; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. *Scalps*: *LaS*, *PnS*, *DnS*, *TnS* = larval, proto-, deuto- and tritonymphal scalp, respectively; *dm*, *dp*, *lp*, *h*, *p* = setae. *Gnathosoma*: *rp* = process of rutellum; *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *sup*, *inf*, *cm*, *ul*, *su*, *vt*, *lt* = palp setae; ω = palp solenidium; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a–1c*, *2a*, *3a–3c*, *4a–4c* = epimeral setae; *P* = propodolateral apophysis; *dis* = discidium. *Anogenital region*: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal seta, respectively; ψ , τ , *k* = setae of ovipositor; *iad* = adanal lyrifissure; *po* =

= preanal organ. *Legs*: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively; ω , ϕ , σ = solenidia; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae; *sac* = sacculi.

TAXONOMY

Makaroviella Ermilov gen. n.

Type species: *Makaroviella exigua* sp. n.

Generic diagnosis (adult). *Size*. Length less than 300. *Integument*. Without heavy sculpturing or ornamentation. Cerotegument tuberculate. *Prodorsum*. Rostrum rounded. Enantiophysis present. Rostral and lamellar setae medium-sized, setiform, *ro* located anteriorly to *le*; interlamellar and exobothridial setae short, simple. Bothridial seta elongate leaf-shaped. *Notogaster*. Scalps tightly attached to the notogaster. Three pairs of short, setiform setae; setae of *h*-row located distinctly above setae of *p*-row. Lyrifissures *ia*, *im* and *ip* long. Opisthonotal gland opening located on the notogastral surface (not on the tubercle). *Gnathosoma*. Subcapitulum diarthric. Two pairs of adoral setae present. Palp setation: 0–2–1–3–9(+1 ω); solenidium bacilliform, strongly inclined, directed to the base of *acm*. Chelicera chelate-dentate. *Epimeral and lateral podosomal regions*. Epimeral setal formula: 3–1–3–3. Propodolateral apophysis well developed. Discidium present. *Anogenital region*. With seven pairs of genital, one pair of aggenital, two pairs of anal, and three pairs of adanal setae; all adanal setae located laterally to anal plate. Adanal lyrifissure long, located parallel and close to anal aperture. *Legs*. Heterotridactylous; claws comparatively small. Femora I–IV and trochanters III, IV with sacculi.

Differential diagnosis. The genus *Makaroviella* differs from both other known genera of Licnobelbidae – *Flabellobelba* and *Licnobelba* – in the following traits.

1. Number and localization of notogastral setae. *Makaroviella* has three pairs of notogastral setae (*h*₁, *p*₁, *p*₂), all in the posterior part of the notogaster, setae of *h*-row located distinctly above setae of *p*-row. *Flabellobelba* has two pairs of notogastral setae (*p*₂, *p*₃), all in the posterolateral parts of the notogaster, located in one transverse row. *Licnobelba* has four (*lp*, *h*₁, *p*₁, *p*₂) or five (*lp*, *h*₁, *p*₁, *p*₂, *p*₃) pairs of notogastral setae; of these, setae of *h*- and *p*-rows are in the posterior part of the notogaster, located in one transverse row, *lp* shifted in dorsolateral notogastral parts.

2. Localization of rostral setae. In *Makaroviella*, they are located anteriorly to lamellar setae. In *Flabellobelba* and *Licnobelba*, they are located laterally to lamellar setae.

3. Lateral enantiophysis. In *Makaroviella*, it is absent. In *Flabellobelba* and *Licnobelba*, it is present.

4. Localization of adanal seta *ad*₁. In *Makaroviella*, this seta is located laterally to anal aperture. In *Flabel-*

lobelba and *Licnobelba*, it is located posteriorly to anal aperture.

Additionally, *Makaroviella* differs from *Flabellobelba* in the morphology of bothridial seta (very short stalk and long head versus very long stalk and short head). *Makaroviella* differs from *Licnobelba* in the number of genital setae (seven pairs versus six pairs), and the absence (versus presence) of strong thorn-like structure extending from the bothridium.

Also, *Makaroviella* is similar to some representatives of the genus *Pedrocortesella* Hammer 1961 (Licnodamaeidae) in the presence of scalps and in a similar localization of notogastral setae (*h*₁ above *p*₁); however, their body has heavy sculpturing/ornamentation, usually a greater number of notogastral setae, and a weak scalp attachment to the notogaster.

Etymology. The generic name is dedicated to Dr. Olga L. Makarova, a well-known acarologist from the Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia, for her extensive contributions to our knowledge of the taxonomy, biogeography and ecology of mites.

Makaroviella exigua Ermilov sp. n.

(Figs 1–4)

Type material. Holotype (♀) and nine paratypes (6♂, 3♀): Cuba, 22°6' N, 81°6' W, leaf litter in a riparian mixed forest (unknown date and collector; collection of the Tyumen State University Museum of Zoology, Tyumen, Russia).

The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; nine 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: 240–270. Body covered by layer of dense tuberculate cerotegument. Dorsolateral part of prodorsum with longitudinal carina. Enantiophysis present, formed by the posterior part of carina and the opposite tubercle. Bothridial seta with short stalk and long, leaf-shaped head which is covered by dense microsculptures. Posterolateral part of bothridium slightly protruding. Notogastral, epimeral, anogenital, and scalpal setae short, setiform (except anal setae slightly phylliform). Subcapitular mentum with transverse ridge posteriorly to insertions of *h*. Tubercles of parastigmatic enantiophysis absent. Discidium present. Leg femora I–III and trochanter III with one sacculi; femur IV and trochanter IV with two sacculi.

Description. Measurements. Body length: 270 (holotype), 240–255 (male paratypes), 270 (female paratypes); notogaster width: 135 (holotype), 120 (male paratypes), 135 (female paratypes).

Integument. Body color light brown. Body, setae and legs covered by layer of dense tuberculate cerote-

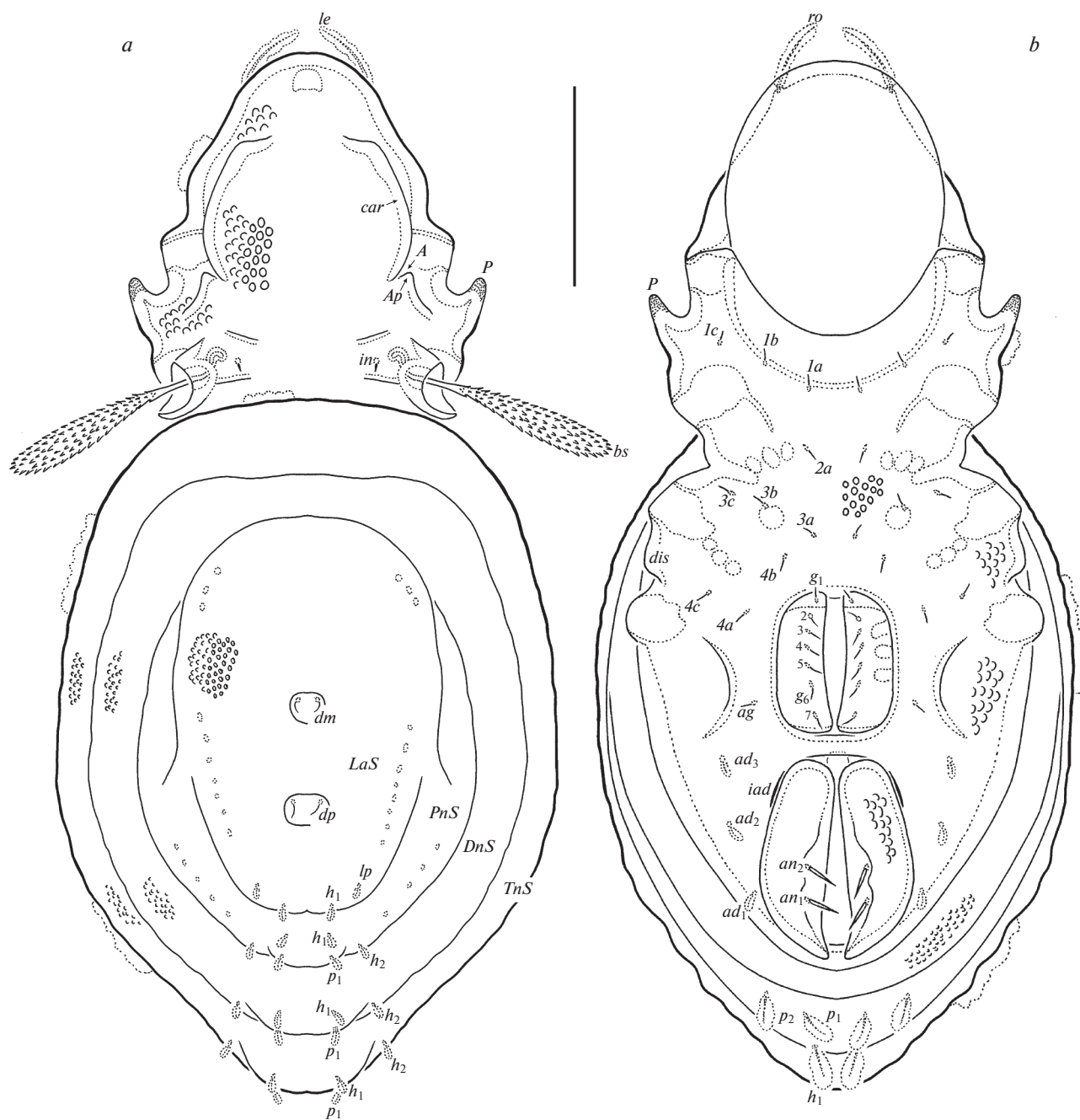


Fig. 1. *Makaroviella exigua* sp. n., adult: a — dorsal view, b — ventral view (gnathosoma and legs not shown). Scale bar 50 μ m.

gument (diameter of large tubercles up to 6; diameter of small tubercles less than 1). Surface of notogaster microtuberculate sculpturing (visible under high magnification).

Prodorsum. Rostrum broadly rounded. Dorsolateral part with longitudinal carina which is slightly convex to the outside; a pair of carinae are well separated. Enantiophysis present, formed by the posterior part of carina and the opposite tubercle. Rostral and lamellar setae (19–22) setiform, roughened; interlamellar (4)

and exobothridial (4–6) setae setiform, smooth; bothridial seta (49–56) with short stalk and long, elongate leaf-shaped head covered by dense microscales. Posterolateral part of bothridium slightly protruding.

Notogaster. Scalps present in all specimens, without heavy reticulate/foveolate ornamentation. Larval scalp with four pairs (*dm*, *dp*, *lp*, *h₁*), nymphal scalps with three pairs (*h₁*, *h₂*, *p₁*) of observed setae; all setae short (4–6), setiform, smooth. Notogastral setae (*h₁*, *p₁*, *p₂*) short (4–6), setiform, smooth. Opisthonotal

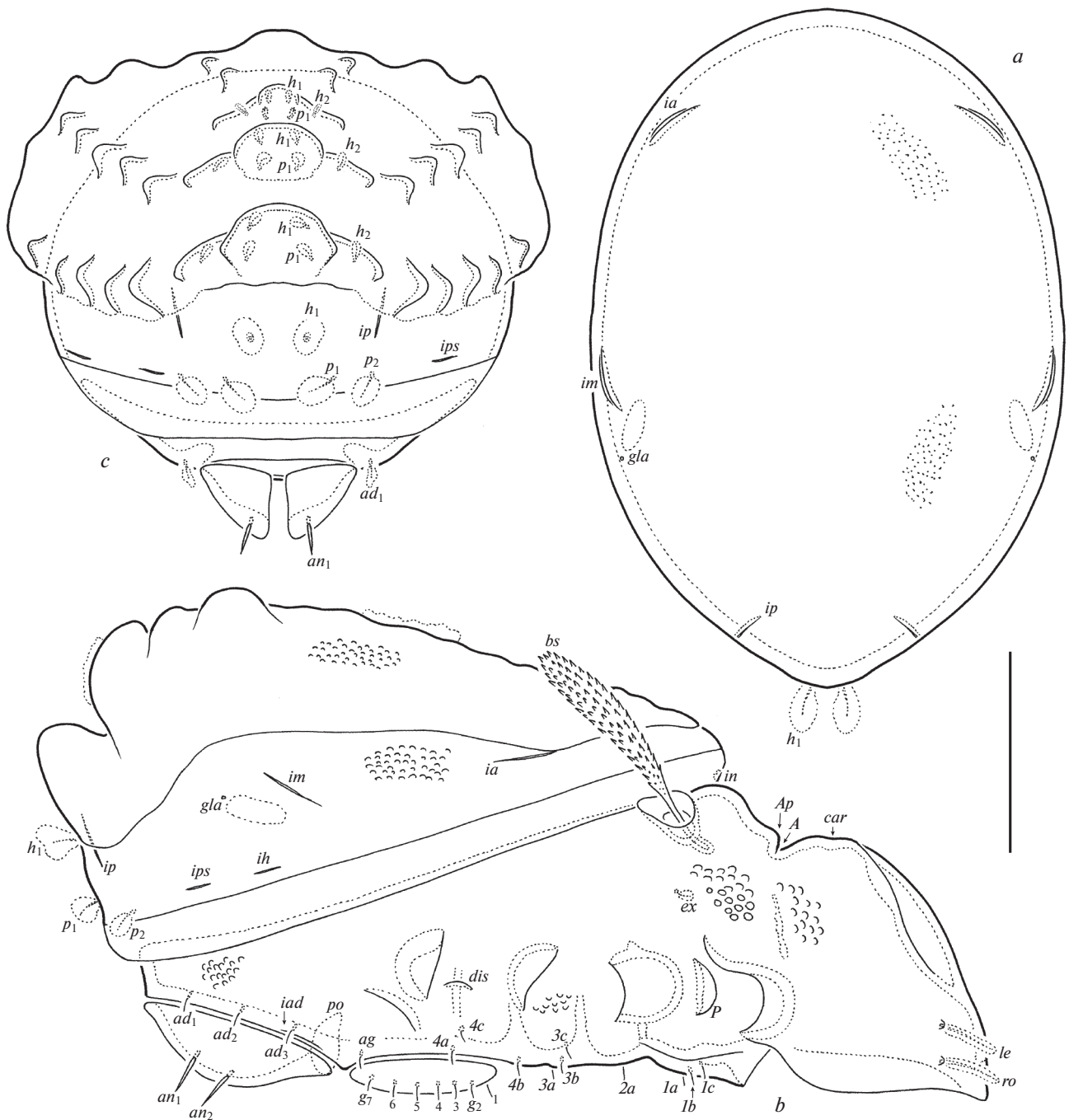


Fig. 2. *Makaroviella exigua* sp. n., adult: *a* – notogaster, dorsal view (scalps not shown); *b* – right lateral view (gnathosoma and legs not shown); *c* – posterior view. Scale bar 50 μ m.

gland elongate oval; opening small, poorly observed. All lyrifissures distinct, located on slight elongate tubercles.

Gnathosoma. Subcapitulum size: 67–71 $\times$ 52–56; subcapitular (*a*: 13–15; *m*: 9–11; *h*: 7–9) and adoral (*or*₁: 9–11; *or*₂: 4–6) setae setiform, smooth; rutellum with posteromedial process; mentum with transverse ridge posteriorly to insertions of *h*. Palp length: 45–49;

postpalpal seta (4) spiniform, smooth. Chelicera length: 67–71; setae (*cha*: 22–26; *chb*: 13–15) setiform, slightly barbed.

Epimeral and lateral podosomal regions. All setae (4–6) setiform, smooth. Tubercles of parastigmatic enantiophysis absent. Discidium poorly visible, with rounded top.

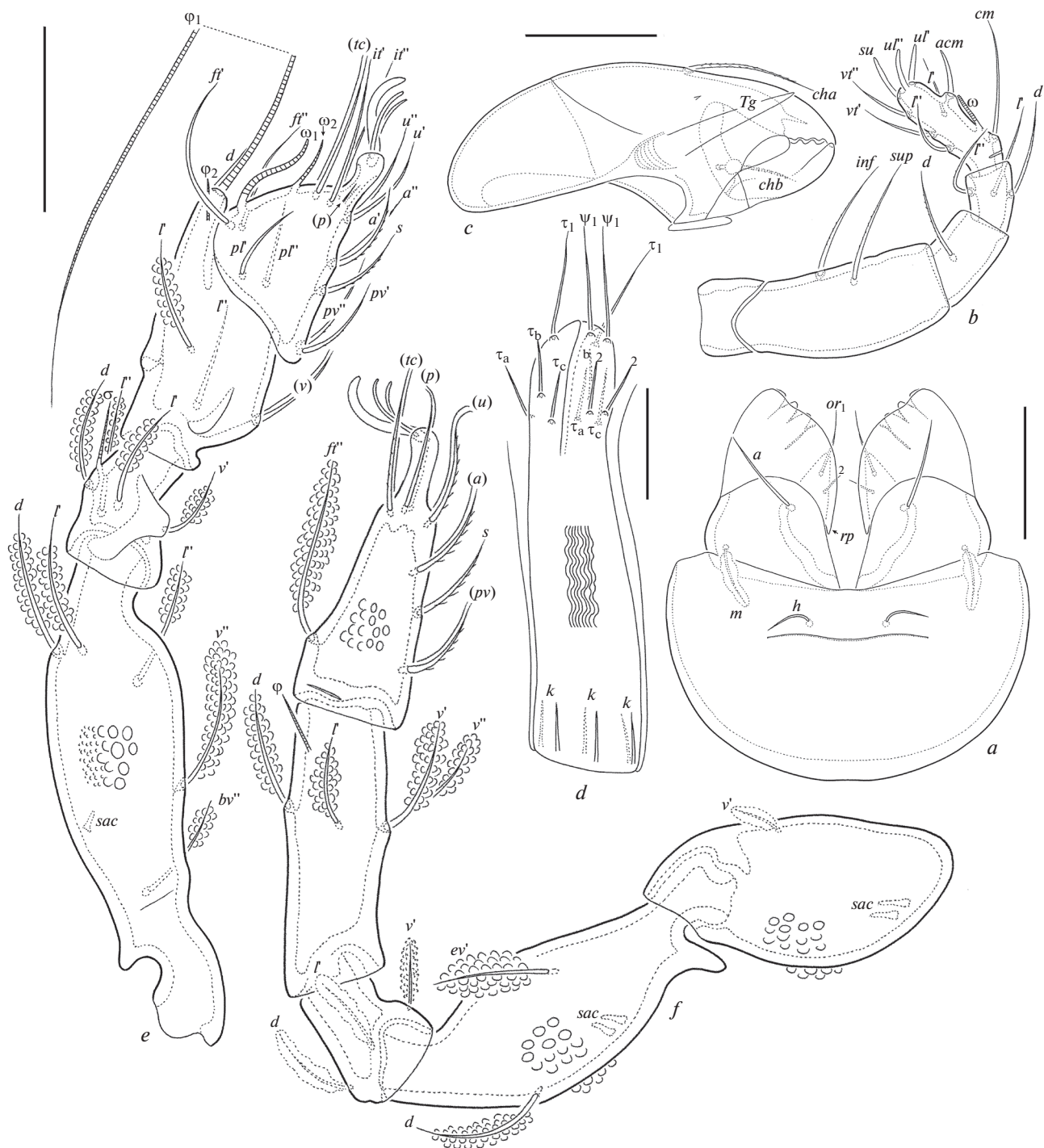


Fig. 3. *Makaroviella exigua* sp. n., adult: *a* – subcapitulum, ventral view; *b* – palp, left, antiaxial view; *c* – chelicera, left, paraxial view; *d* – ovipositor, lateral view; *e* – leg I (trochanter not shown), left, paraxial view; *f* – leg IV, left, antiaxial view. Scale bar, μm : *a*, *c*–*f* – 20; *b* – 10.

Anogenital region. Genital, aggenital and adanal setae (4–6) setiform, smooth; anal seta (11–13) slightly phylliform, smooth. Anal lyrifissure not observed; adanal lyrifissure long, located parallel and very close to anal aperture. Slight depression located laterally to

genital aperture. Ovipositor elongated ($82\text{--}86 \times 19$), all three blades (26–30) shorter than length of distal section (beyond middle fold; 56); setae of blades (ψ_1 , τ_1 ; 19; ψ_2 , τ_a , τ_2 , τ_c ; 11) and coronal setae (11) rod-like, smooth.

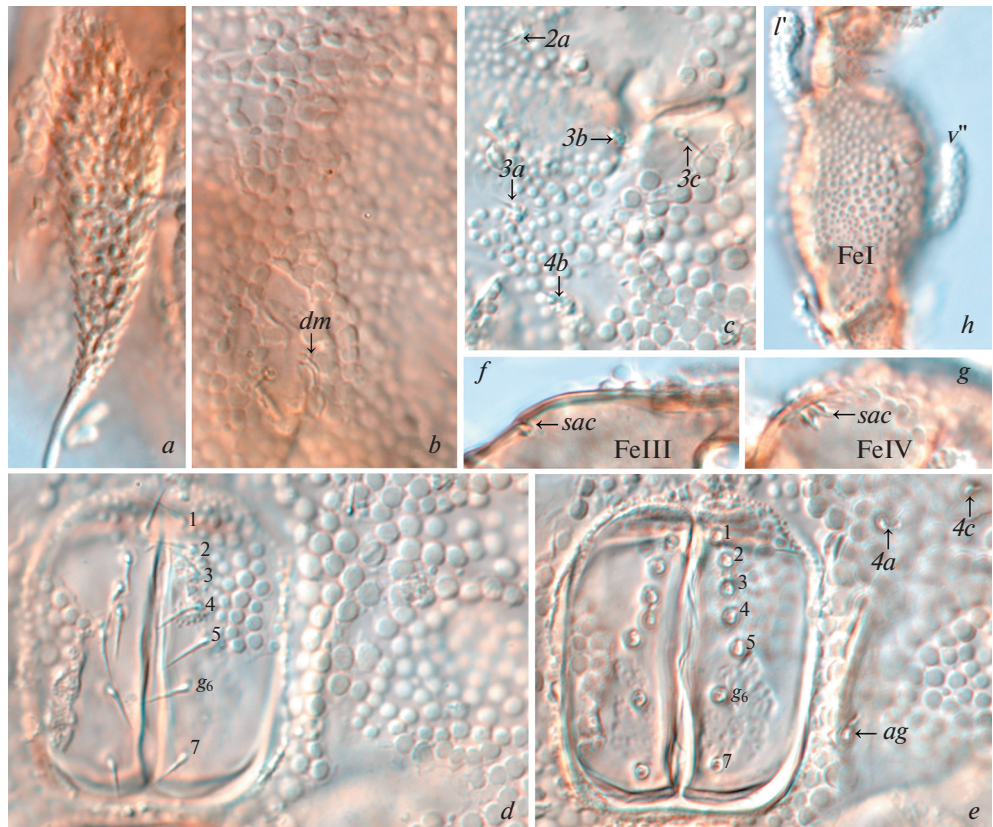


Fig. 4. *Makaroviella exigua* sp. n., adult, microscope images: *a* – bothridial seta; *b* – cerotegument on larval scalp; *c* – cerotegument in epimeral region; *d* – genital plates; *e* – genital plates, deep focus; *f* – sacculus on leg femur III; *g* – sacculi on leg femur IV; *h* – cerotegument on leg femur I. Magnification: 10 × 100.

Legs. Claws smooth. Tibia I with dorsodistal cylindrical apophysis bearing two solenidia and seta. Femora I–III and trochanter III with one dorsal sacculus; femur IV and trochanter IV with two dorsal sacculi. Formulas of leg setation and solenidia: I (1–5–4–5–18) [1–2–2], II (1–5–4–5–15) [1–1–2], III (2–3–3–4–15) [1–1–0], IV (1–2–3–4–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus sunken; seta *s* on tarsus I setiform, barbed (not eupathidial), located between paired setae *a* and *pv*. Solenidion ϕ_1 on tibia I long, subflagellate; other solenidia short of medium-sized, rod-like or slightly bacilliform.

E t y m o l o g y. The specific epithet *exigua* is Latin for “small” and alludes to the body size.

KEY TO KNOWN SPECIES OF LICNOBELBIDAE

- 1 Four or five pairs of notogastral setae, *lp* present; six pairs of genital setae; bothridium with strong thorn-like structure extending from the bothridium2
 – Two or three pairs of notogastral setae, *lp* absent; seven pairs of genital setae; bothridium without thorn-like structure extending from the bothridium3

Table 1. Leg setation and solenidia of adult *Makaroviella exigua* sp. n.

Leg	Tr	Fe	Ge	Ti	Ta
I	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i> , <i>v''</i>	<i>d</i> , (<i>l</i>), <i>v'</i> , σ	(<i>l</i>), (<i>v</i>), $d\phi_1$, ϕ_2	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), (<i>pl</i>), ε (sunken), ω_1 , ω_2
II	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i> , <i>v''</i>	<i>d</i> , (<i>l</i>), <i>v'</i> , σ	<i>d</i> , (<i>l</i>), (<i>v</i>), ϕ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), ω_1 , ω_2
III	<i>l'</i> , <i>v'</i>	<i>d</i> , <i>l'</i> , <i>ev'</i>	<i>d</i> , <i>l'</i> , <i>v'</i> , σ	<i>d</i> , <i>l'</i> , (<i>v</i>), ϕ	(<i>ft</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>d</i> , <i>l'</i> , (<i>v</i>), ϕ	<i>ft''</i> , (<i>tc</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)

Notes. Roman letters refer to normal setae, Greek letters – to solenidia (except ε = famulus); $d\phi$ – seta and solenidion coupled; single prime (') designates setae on the anterior and double prime (') setae on the posterior side of a given leg segment; parentheses refer to a pair of setae.

2 Four pairs of notogastral setae, p_3 absent; tritonymphal scalp with anterior process; prodorsum without cerotegumental network pattern; longitudinal and transverse prodorsal carinae forming H-structure; prodorsal enantiophysis well developed; notogastral lyrifissure *im* short; body length: 266–450 *Licnobelba latiflabellata* (Paoli 1908) [see Paoli, 1908; Grandjean, 1931 – as *L. alestensis*; Mihelčič, 1957 – as *L. montana*; Pérez-Íñigo, 1970 – as *L. montana*; Seniczak et al., 2012]. Distribution: Western Palaearctic (except North) and West of Eastern Palaearctic.

– Five pairs of notogastral setae, p_3 present; tritonymphal scalp without anterior process; prodorsum with cerotegumental network pattern; longitudinal and transverse prodorsal carinae absent; prodorsal enantiophysis poorly observed; notogastral lyrifissure *im* long; body length: 250–302 *Licnobelba caesarea* (Berlese 1910) [see Berlese, 1910; Grandjean, 1931; Pérez-Íñigo, 1970, 1994; Ayyildiz, Toluk, 2016]. Distribution: Mediterranean, Mexico.

3 Two pairs of notogastral setae, all located in the posterolateral parts, in one transverse row; rostral seta located laterally to lamellar seta; bothridial seta with very long stalk and short head; prodorsal enantiophysis formed by two tubercles; prodorsum with cerotegumental network pattern; lateral enantiophysis present; adanal seta ad_1 located posteriorly to anal aperture; body length: 400–418 *Flabellobelba almeriensis* (Ruiz, Kahwash et Subías 1990) [see Ruiz et al., 1990; Pérez-Íñigo, 1994]. Distribution: Spain.

– Three pairs of notogastral setae, all located in the posterior part of the notogaster, setae of *h*-row located distinctly above setae of *p*-row; rostral seta located anteriorly to lamellar seta; bothridial seta with very short stalk and long head; prodorsal enantiophysis formed by posterior part of carina and the opposite tubercle; prodorsum without cerotegumental network pattern; lateral enantiophysis absent; adanal seta ad_1 located laterally to anal aperture; body length: 240–270 *Makaroviella exigua* sp. n. Distribution: Cuba.

ACKNOWLEDGEMENTS

I cordially thank Drs. L.S. Subías and U.Ya. Shtanchaeva for consultations and Dr. D.V. Sharapov for English language editing.

FUNDING

This research was partially supported by the cooperative agreement No. FEWZ-2021-0004 from the Russian Ministry of Science and Higher Education.

REFERENCES

- Ayyildiz N., Toluk A., 2016. Contributions to the Turkish oribatid mite fauna (Acari: Oribatida) // Turkish Journal of Entomology. V. 40. № 1. P. 73–85.
- Berlese A., 1910. Acari nuovi. Manipulus V–VI // Redia. V. 6. P. 199–234.
- Ermilov S.G., Salavatulin V.M., 2022. Ontogenetic instars of *Gymnodamaeus uslaminorum* sp. nov. (Acari, Oribatida, Gymnodamaeidae) from Russia // International Journal of Acarology. V. 48. № 2. P. 98–105.
- Ermilov S.G., Starý J., 2021. New faunistical and taxonomic data on oribatid mites of the superfamily Plateremaeoidea (Acari, Oribatida) of Bolivia // Systematic and Applied Acarology. V. 26. № 7. P. 1361–1373.
- Grandjean F., 1931. Le genre *Licneremaeus* Paoli (Acariens) // Bulletin de la Société zoologique de France. V. 56. P. 221–250.
- Grandjean F., 1934. Oribates le l'Afrique du Nord (2me Série) // Bulletin de la Société d'histoire naturelle de l'Afrique du Nord. V. 25. P. 235–252.
- Grandjean F., 1965. Nouvelles observations sur les Oribates (4e série) // Acarologia. V. 7. № 1. P. 91–112.
- Mihelčič F., 1957. Oribatiden Südeuropas VII // Zoologischer Anzeiger. V. 159. P. 44–68.
- 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 // In: Dindal D.L., editor. 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.
- Paoli G., 1908. Monografia del genere *Dameosoma* Berl. e generi affini // Redia. V. 5. P. 31–91.
- Paschoal A.D., 1988. A revision of the families Licnodamaeidae and Licnobelbidae (Acari: Oribatei) with a re-characterization of the genera *Licnodamaeus* and *Licnobelba* // Revista Brasileira de Zoologia. V. 3. № 6. P. 397–403.
- Pérez-Íñigo C., 1970. Acaros Oribátidos de suelos de España Peninsular e Islas Baleares (Acari, Oribatei). Parte II // Eos. V. 45. P. 241–317.
- Pérez-Íñigo C., 1993. Redescription of *Licnobelba latiflabellata* (Paoli, 1908) (Acari, Oribatei, Licnobelbidae) // Redia. V. 76. № 2. P. 317–326.
- Pérez-Íñigo C., 1994. Redescriptions of *Licnobelba caesarea* (Berlese, 1910) and *Flabellobelba almeriensis* (Ruiz, Kahwash and Subías, 1990). The genus *Flabellobelba* n.g. and redefinition of the Family Licnobelbidae (Acari, Oribatei) // Redia. V. 57. № 2. P. 241–250.
- Ruiz E., Kahwash M.A.M., Subías L.S., 1990. Cuatro nuevos Gymnodamaeoides del Sur de España. (Acari, Oribatida, Gymnodamaeidae) // Boletín de la Real Sociedad Española de Historia Natural. V. 85. № 1–4. P. 39–49.

- Seniczak S., Ayyıldız N., Seniczak A., 2012. Setal losses in the dorsal hysterosoma of Plateremaeoidea (Acari: Oribatida) in the light of ontogenetic studies // Journal of Natural History. V. 46. № 7–8. P. 411–451.
- Subías L.S., 2022. Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acariformes: Oribatida) del mundo (excepto fósiles) // Monografías Electrónicas S.E.A. V. 12. P. 1–538.
- Subías L.S., Shtanchaeva U.Ya., 2023. Claves de familias, géneros y subgéneros de ácaros oribátidos del mundo (Acari, Oribatida) // Monografías Electrónicas S.E.A. V. 13. P. 1–290.

MAKAROVIELLA EXIGUA (ACARI, ORIBATIDA, LICNOBELBIDAE) – НОВЫЕ РОД И ВИД С КУБЫ

С. Г. Ермилов*

Тюменский государственный университет, Тюмень, 625003 Россия

*e-mail: ermilovacari@yandex.ru

Описан новый род панцирных клещей *Makaroviella* gen. n. (Oribatida, Licnobelbidae) с типовым видом *Makaroviella exigua* sp. n. с Кубы. От обоих известных родов (*Flabellobelba* и *Licnobelba*) семейства отличается главным образом числом и расположением нотогастральных щетинок, расположением ростральных щетинок и аданальных щетинок ad_1 , а также отсутствием боковых энантиофизисов. Составлен идентификационный ключ к известным видам Licnobelbidae.

Ключевые слова: панцирные клещи, Plateremaeoidea, таксономия, морфология, идентификационный ключ, Неотропическая область