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TWO NEW SPECIES OF ORIBATID MITES (ACARI, ORIBATIDA) OF THE GENUS *XENILLUS* ROBINEAU-DESVOIDY (LIACARIDAE) FROM ECUADOR

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Two new species of oribatid mites of the genus *Xenillus* (Oribatida, Liacaridae) are described from Ecuador. *Xenillus paracolumbianus* Ermilov sp. n. differs from *Xenillus columbianus* Balogh 1984 by: body ornamentation; the length of the interlamellar and notogastral setae c_1 and c_2; and the number of genital setae. *Xenillus paramutabilis* Ermilov sp. n. differs from *Xenillus mutabilis* Mahunka et Mahunka-Papp 1999 by: the length of the interlamellar setae and notogastral setae c_1, c_2, p_1, p_2 and p_3; as well as the number of genital setae.

Keywords: liacarid mites, new species, morphology, systematics, Neotropical region

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Presently, oribatid mites (Acari, Oribatida) of the family Liacaridae (=Xenillidae, see Norton, Behan-Pelletier, 2009) are briefly studied in Ecuador, where only a few species have been recorded (e.g., Balogh, Balogh, 1985; Balogh, 1986; Illig et al., 2007; Ermilov, Kalúz, 2012). During the taxonomic identification of the Ecuadorian liacarids, which were received from the Canadian National Collection (Ottawa, Canada), I found two new species belonging to the genus *Xenillus* Robineau-Desvoidy 1839 (nominative subgenus). The main goal of my paper is to describe and illustrate these new species.

The genus *Xenillus* was proposed by Robineau-Desvoidy (1839), with *Xenillus clypeator* Robineau-Desvoidy, 1839 as type species. The genus comprises two subgenera and 77 species, which are distributed in the Holarctic, Oriental and Neotropical regions (Subías, 2004, updated 2018). The main generic traits have been summarized by several authors (e.g., Grobler et al., 2003; Weigmann, 2006). Identification keys to the species from the Neotropical region have been created by Balogh and Balogh (1988, 2002).

METHODS

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. The 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 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 according to the sequence genu–tibia–tarsus. Morphological terminology used in this paper 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. Drawings were made with a camera lucida attached to the transmission light microscope, Leica DM 2500.

The following abbreviations are used: *lam* – lamella; *lr* – lateral ridge; *tu* – tutorium; *ro*, *le*, *in*, *bs*, *ex* – rostral, lamellar, interlamellar, bothridial and exobothridial setae, respectively; *D* – dorsophragma; *P* – pleurophragma; *c*, *la*, *lm*, *lp*, *h*, *p* – notogastral setae; *ia*, *im*, *ip*, *ih*, *ips* – notogastral lyrifissures; *gla* – opisthonotal gland opening; *h*, *m*, *a* – subcapitular setae; *v*, *l*, *d*, *cm*, *acm*, *ul*, *sul*, *vt*, *lt* – palp setae; ω – palp and leg solenidion; *Pd I* – pedotectum I; *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c* – epimeral setae; *dis* – discidium; *cp* – circumpedal carina; *g*, *ag*, *an*, *ad* – genital, aggenital, anal and adanal setae, respectively; *iad* – adanal lyrifissure; *p.o.* – preanal organ; *Tr*, *Fe*, *Ge*, *Ti*, *Ta* – leg trochanter, femur, genu, tibia, tarsus, respectively; *p.a.* – leg porose area; σ, φ – leg solenidia; ε – leg famulus.

SYSTEMATICS

Xenillus paracolumbianus Ermilov sp. n. (Figs 1–2)

M a t e r i a l. The holotype (♂) and 4 paratypes (2♀♀, 2♂♂): Ecuador, Chirimachay Matadero River, drift net sample, 14.I.1977 (P. Turcotte); 2 paratypes (2♀♀): same data, but collected on 12.IX.1976.

The holotype is deposited in the Canadian National Collection, Ottawa, Canada; six paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All in ethanol with drop of glycerol.

D i a g n o s i s. Body size: 597–863 × 365–564. Surface microgranulate; in addition, prodorsum, notogaster and ventral side with large, dense foveoles. Lamellar cusps parallel, distally with slightly developed inner and outer teeth and concavity between them. Rostral, lamellar and interlamellar setae thickened, erect, barbed; *in* longest. Bothridial setae long, clavate, with cilia distally. Notogastral setae (except short humeral setae) of medium size, thickened, erect, barbed; c_1 shorter than c_2. Epimeral and anogenital setae setiform, slightly barbed. Adanal lyrifissures paraanal.

D e s c r i p t i o n. *Measurements*. Body length: 597 (holotype), 597–863 (paratypes); notogaster width: 365 (holotype), 365–564 (paratypes). Females larger than males: 713–863 × 431–564 versus 597–647 × × 365–415.

Integument (Figs 1*a*–1*d*; 2*a*, 2*g*). Body light brown to brown. Surface densely microgranulate (diameter of granules up to 1). Surface of prodorsum, notogaster and ventral side with large, dense foveoles (diameter of foveoles up to 16). Surface of rostrum, subcapitular mentum, leg femora III and IV, lamellae (partially) and tutoria (partially) with small, sparse foveoles (diameter of foveoles up to 6).

Prodorsum (Figs 1*a*, 1*c*). Rostrum with rectangular ledge, two incisions and two lateral triangular teeth. Basal part of lamellae as long as half of prodorsum (without cusps). Lamellar cusps of medium size, parallel, distally with slightly developed inner and outer teeth (inner tooth larger than outer tooth) and concavity between them. Inner sides of lamellar cusps connected basally by one small, triangular interlamellar tubercle. Rostral (57–69), lamellar (53–65) and interlamellar (102–114) setae thickened, erect, barbed; *ro* usually slightly divergent mediodistally, *le* distinctly thicker than *ro*. Bothridial setae (82–94) clavate, with long stalk and short head, having several cilia distally. Exobothridial setae represented by alveoli. Tutoria long, ridge-like. Lateral ridges present.

Notogaster (Figs 1*a*, 1*c*, 1*d*). Anterior notogastral margin straight. Dorsophragmata poorly visible, fused into one semi-oval structure. Eleven pairs of notogastral setae developed, all thickened, erect, barbed (mostly mediodistally); c_1 (24–28) shortest, c_2 (36–41) and other setae (61–73) longer. Lyrifissures and opisthonotal gland openings well visible.

Gnathosoma (Figs 1*c*; 2*a*–2*c*). Subcapitulum longer than wide (164–180 × 118–131). Subcapitular setae setiform, barbed, *m* (41–45) longer than *h* (36–41) and *a* (24–32). Two pairs of adoral setae (20–28) comparatively thickened, heavily barbed. Palps (98–106) with setation 0–2–1–3–9(+ω); solenidion bacilliform, not pressed to palptarsi surface. Postpalpal setae (8) spiniform, smooth. Chelicerae (180–192) with two setiform, barbed setae, *cha* (65–73) longer than *chb* (36–41). Trägårdh's organ of chelicerae elongate triangular.

Epimeral and lateral podosomal regions (Figs 1*b*, 1*c*). Epimeral setal formula: 3–1–3–3. Epimeral setae setiform, slightly barbed, *1b* and *3b* (32–41) longer than other setae (20–28). Discidia triangular. Circumpedal carinae distinct.

Anogenital region (Figs 1*b*–1*d*). Six pairs of genital (24–28), one pair of aggenital (32–36), two pairs of anal (32–36) and three pairs of adanal (ad_1, ad_2, 49–61; ad_3, 36–41) setae setiform, slightly barbed. Adanal lyrifissures located close and parallel to anal plates. Setae ad_1 postanal, ad_2 and ad_3 paraanal; ad_3 inserted laterally to *iad*. Ovipositor typical for *Xenillus* (Ermilov, 2010), elongated (182 × 65), lobes (118) shorter than distal section (beyond middle fold) (164). Twelve setae on lobes and six coronal setae thorn-like, smooth; $\psi_1 \approx \tau_1$ (20) longer than $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (16) and *k* (12).

Legs (Figs 3*d*–3*g*). Median claw thicker than lateral claws, all slightly barbed on dorsal sides. Dorsoparaxial porose areas on all femora and on trochanters III, IV distinct. Formulas of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–4–2–4–16) [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.

R e m a r k s. In general morphological traits (bothridial setae long, clavate, with cilia distally; lamellar cusps with slightly developed inner and outer teeth; notogastral setae of medium size, thickened, erect, barbed), the new species is most similar to *Xenillus columbianus* Balogh 1984 from Colombia (Balogh, 1984). However, the new species differs from the latter by (features associated with *X. columbianus* are listed in parentheses): 1) the presence of large, dense foveoles on the notogaster and on the ventral side (versus foveoles comparatively small, scattered); 2) the notogastral setae c_2 being longer than c_1 (versus c_1 and c_2 being similar in length); 3) the interlamellar setae being longer than the bothridial and the dorsal notogastral setae (versus interlamellar setae being not longer than bothridial and dorsal notogastral setae); and 4) the presence of six pairs of genital setae (versus five pairs of genital setae).

Table 1. Leg setation and solenidia of *Xenillus paracolumbianus* Ermilov sp. n. and *Xenillus paramutabilis* Ermilov 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"*	(*l*), σ	(*l*), (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*), *l"*, ω_1, ω_2
III	*l'*, *v'*	*d*, *l'*, *ev'*	*l'*, σ	*l'*, (*v*), φ	(*ft*), (*tc*), (*it*), (*p*), (*u*), (*a*), *s*, (*pv*)
IV	*v'*	*d*, *ev'*	*d*, *l'*	*l'*, (*v*), φ	*ft"*, (*tc*), (*p*), (*u*), (*a*), *s*, (*pv*)

Roman letters refer to normal setae (except ε – famulus), Greek letters refer to solenidia. Single apostrophe (') marks setae on the anterior, and double apostrophe (") – setae on the posterior sides of a given leg segment. Parentheses refer to a pair of setae.

Etymology. The specific name *paracolumbianus* refers to the similarity between the new species and *X. columbianus* Balogh 1984.

Xenillus paramutabilis Ermilov sp. n.
(Fig. 3)

Material. The holotype (♀) and 4 paratypes (3♀♀, 1♂): Ecuador, Chirimachay Matadero River, drift net sample, 18.III.1977 (P. Turcotte); 2 paratypes (2♂♂): same data, but collected on 14.I.1977.

The holotype is deposited in the Canadian National Collection, Ottawa, Canada; six paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All in ethanol with drop of glycerol.

Diagnosis. Body size: 730–1062 × 415–614. Surface microgranulate; in addition, prodorsum, notogaster and ventral side with large, dense foveoles. Lamellar cusps parallel, distally with slightly developed inner and outer teeth and concavity between them. Rostral, lamellar and interlamellar setae thickened, erect, barbed; *in* longest. Bothridial setae very short, globular, roughened. Notogastral setae (except short humeral setae) of medium size, thickened, erect, barbed; c_1 shorter than c_2. Epimeral and anogenital setae setiform, slightly barbed. Adanal lyrifissures paraanal.

Description. *Measurements*. Body length: 962 (holotype), 730–1062 (paratypes); notogaster width: 531 (holotype), 415–614 (paratypes). Females larger than males: 962–1062 × 730–763 versus 531–614 × × 415–431.

Integument (Figs 1*a*–1*d*). Body light brown to brown. Surface densely microgranulate (diameter of granules up to 1). Surface of prodorsum, notogaster and ventral side with large, dense foveoles (diameter of foveoles up to 16). Surface of rostrum, subcapitular mentum, leg femora III and IV, lamellae and tutoria (partially) with small, sparse foveoles (diameter of foveoles up to 6).

Prodorsum (Figs 1*a*, 1*c*). Rostrum with rectangular ledge, two incisions and two lateral triangular teeth. Basal part of lamellae as long as half of prodorsum (without cusps). Lamellar cusps of medium size, parallel, distally with slightly developed inner and outer teeth (inner tooth larger than outer tooth) and concavity between them. Inner sides of lamellar cusps connected basally by one small, triangular interlamellar tubercle. Rostral (57–69), lamellar (53–61) and interlamellar (82–90) setae thickened, erect, barbed; *ro* distinctly divergent mediodistally, *le* slightly thicker than *ro*. Bothridial setae (28–32) globular, with minute stalk and longer, roughened head. Exobothridial setae represented by alveoli. Tutoria long, ridge-like. Lateral ridges present.

Notogaster (Figs 1*a*, 1*c*, 1*d*). Anterior notogastral margin straight. Dorsophragmata poorly visible, fused into one semi-oval structure. Eleven pairs of notogastral setae developed, all thickened, erect, barbed (mostly mediodistally); c_1 (16–32) shortest, c_2 (36–61) and other setae (57–73) longer. Lyrifissures and opisthonotal gland openings well visible.

Gnathosoma (Fig. 3*c*). Similar to *X. paracolumbianus* Ermilov sp. n. Subcapitulum longer than wide (205–225 × 143–155). Subcapitular setae setiform, barbed, *m* (53–61) longer than *h* (36–45) and *a* (32–41). Two pairs of adoral setae (24–28) comparatively thickened, heavily barbed. Palps (114–123) with setation 0–2–1–3–9(+ω); solenidion bacilliform, not pressed to palptarsi surface. Postpalpal setae (10) spiniform, smooth. Chelicerae (237–245) with two setiform, barbed setae, *cha* (77–86) longer than *chb* (49–53). Trägårdh's organ of chelicerae elongate triangular.

Epimeral and lateral podosomal regions (Figs 1*b*, *1c*). Epimeral setal formula: 3–1–3–3. Epimeral setae setiform, slightly barbed, *1b* (32–41) longer than other setae (20–32). Discidia triangular. Circumpedal carinae distinct.

Anogenital region (Figs 1*b*, *1c*, 1*d*). Six pairs of genital (24–32), one pair of aggenital (36–49), two pairs of anal (36–49) and three pairs of adanal (ad_1, ad_2, 49–61; ad_3, 36–49) setae setiform, slightly barbed.

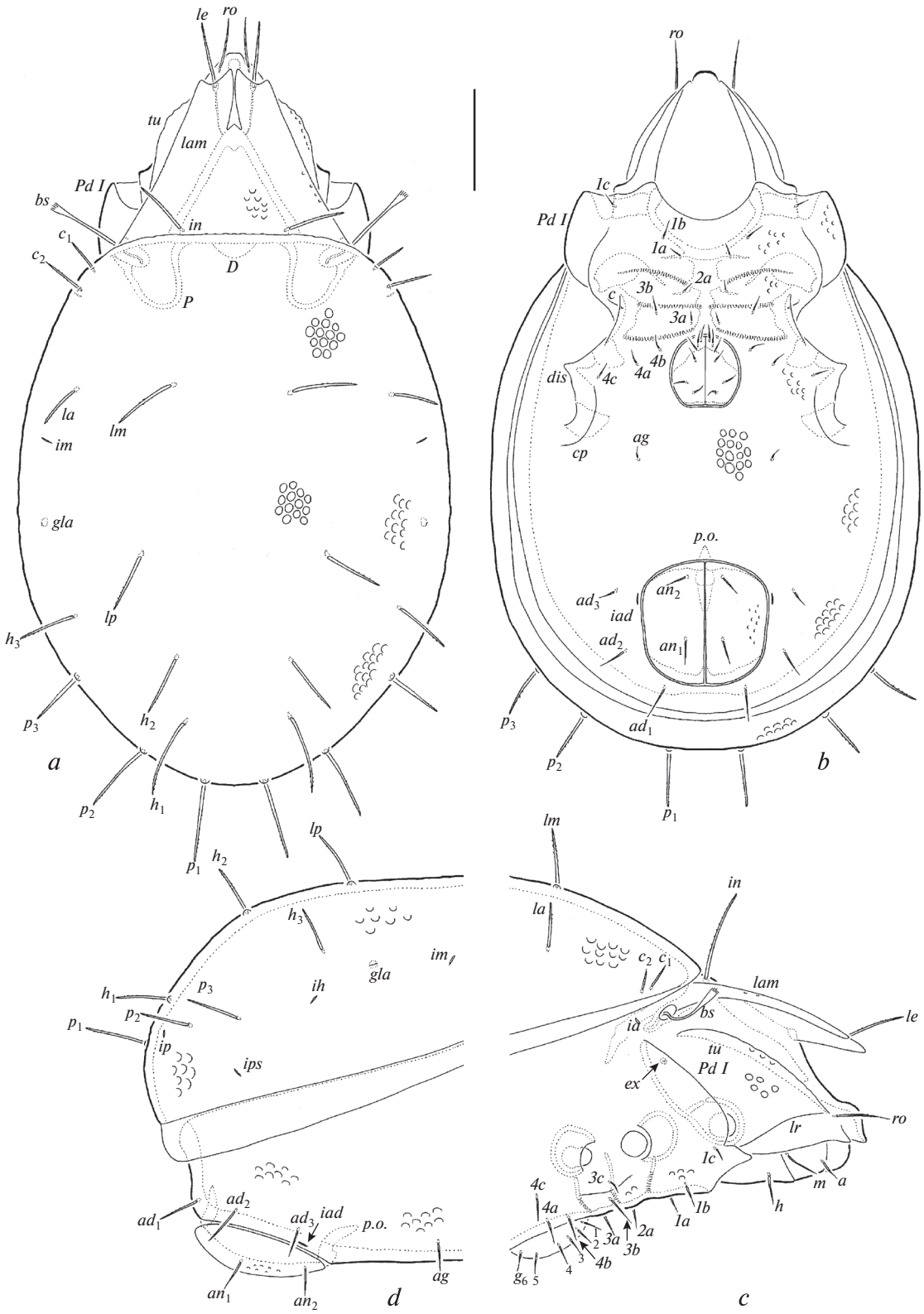

Fig. 1. *Xenillus paracolumbianus* Ermilov sp. n., adult: *a* – dorsal view (legs not shown); *b* – ventral view (gnathosoma and legs not shown); *c* – anterior part of body, lateral view (legs not shown); *d* – posterior part of body, lateral view. Scale bar 100 μm.

Fig. 2. *Xenillus paracolumbianus* Ermilov sp. n., adult: *a* – subcapitulum, ventral view; *b* – anterior part of chelicera, right, antiaxial view; *c* – palp, left, antiaxial view; *d* – leg I, without trochanter, right, antiaxial view; *e* – trochanter, femur and genu of leg II, left, antiaxial view; *f* – trochanter, femur and genu of leg III, left, antiaxial view; *g* – leg IV, left, antiaxial view. Scale bar (μm): *a*, *b*, *d*–*g* – 50; *c* – 20.

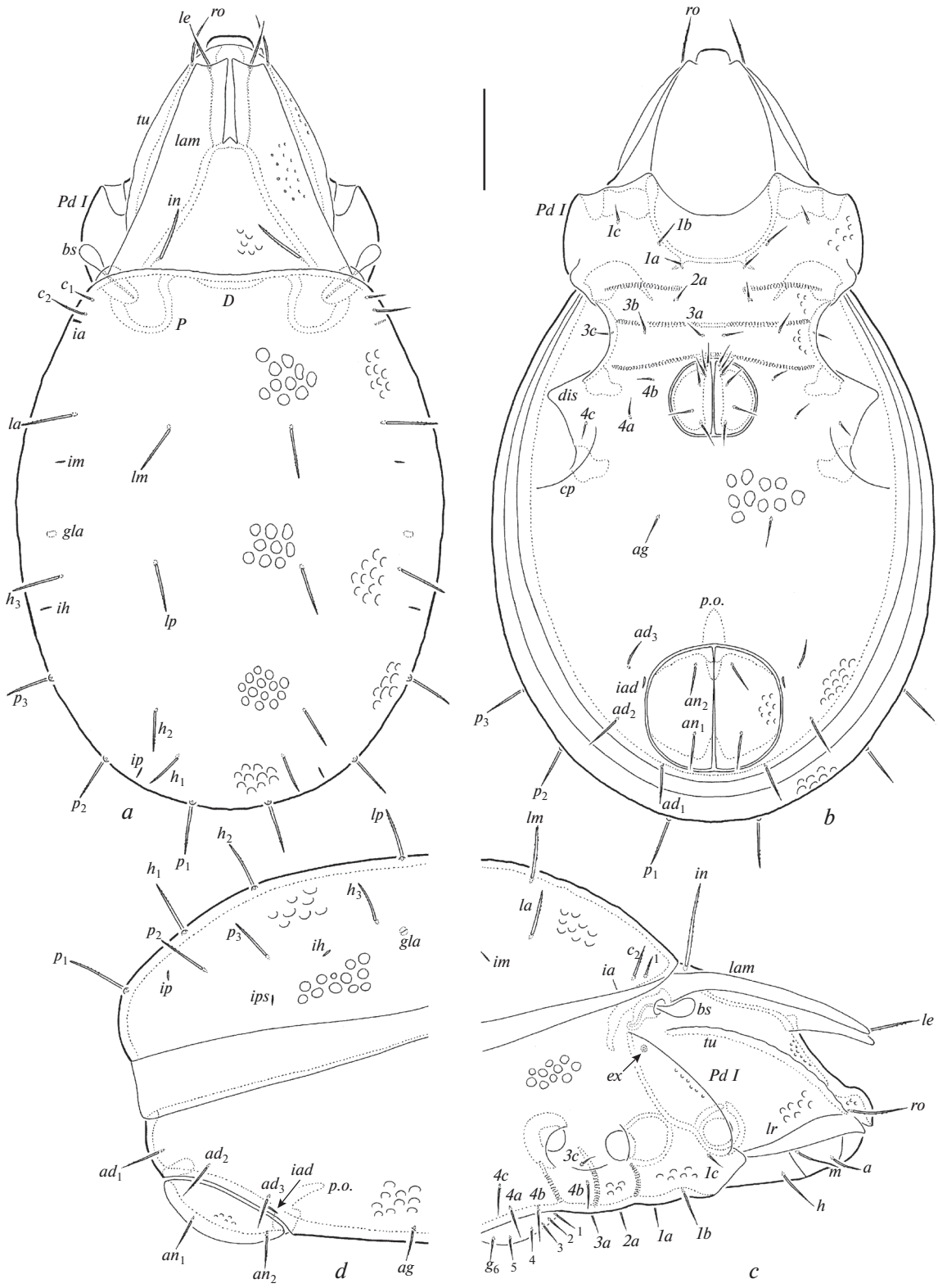

Fig. 3. *Xenillus paramutabilis* Ermilov sp. n., adult: *a* – dorsal view (legs not shown); *b* – ventral view (gnathosoma and legs not shown); *c* – anterior part of body, lateral view (legs not shown); *d* – posterior part of body, lateral view. Scale bar 100 μm.

Adanal lyrifissures located close and parallel to anal plates. Setae ad_1 postanal, ad_2 and ad_3 paraanal; ad_3 inserted anterolaterally to *iad*. Ovipositor typical for *Xenillus* (see Ermilov, 2010), elongated (360 × 69), lobes (135) shorter than distal section (beyond middle fold) (225). Twelve setae on lobes and six coronal setae thorn-like, smooth; $\psi_1 \approx \tau_1$ (24) longer than $\psi_2 \approx \tau_a \approx \approx \tau_b \approx \tau_c$ (20) and *k* (12).

Legs. Similar to those of *X. paracolumbianus* Ermilov sp. n. Median claw thicker than lateral claws, all slightly barbed on dorsal sides. Dorsoparaxial porose areas on all femora and on trochanters III, IV distinct. Formulas of leg setation and solenidia: I (1–5–3–4–20) [1–2–2], II (1–4–2–4–16) [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.

Remarks. In general morphological traits (bothridial setae very short, globular; lamellar cusps with slightly developed inner and outer teeth; dorsal notogastral setae of medium size, thickened, erect, barbed), the new species is most similar to *Xenillus mutabilis* Mahunka et Mahunka-Papp 1999 from Hungary (Mahunka, Mahunka-Papp, 1999). However, the new species differs from the latter by (features associated with *X. mutabilis* are listed in parentheses): 1) the presence of thickened interlamellar setae of medium size (versus interlamellar setae being setiform and very long); 2) notogastral setae c_2 being longer than c_1 (versus c_1 and c_2 being similar in length); 3) posterior notogastral setae (p_1, p_2, p_3) being similar to the dorsal notogastral setae in length (versus posterior notogastral setae being distinctly shorter than dorsal notogastral setae); and 4) having six pairs of genital setae (versus five pairs of genital setae).

Etymology. The specific name *paramutabilis* refers to the similarity between the new species and *Xenillus mutabilis* Mahunka et Mahunka-Papp 1999.

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ДВА НОВЫХ ВИДА ПАНЦИРНЫХ КЛЕЩЕЙ (ACARI, ORIBATIDA) РОДА *XENILLUS* ROBINEAU-DESVOIDY (LIACARIDAE) ИЗ ЭКВАДОРА

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Два новых вида панцирных клещей рода *Xenillus* (Oribatida, Liacaridae) описаны из Эквадора. *Xenillus paracolumbianus* Ermilov sp. n. отличается от *Xenillus columbianus* Balogh 1984 орнаментом тела, длиной межламеллярных и нотогастральных щетинок c_1 и c_2 и числом генитальных щетинок. *Xenillus paramutabilis* Ermilov sp. n. отличается от *Xenillus mutabilis* Mahunka et Mahunka-Papp 1999 длиной межламеллярных и нотогастральных щетинок c_1, c_2, p_1, p_2 и p_3 и числом генитальных щетинок.

Ключевые слова: liacarids, новый вид, морфология, систематика, Неотропическая область