

УДК 595.4

TWO NEW SPECIES OF ORIPODOIDEA (ACARI, ORIBATIDA) FROM ETHIOPIA

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Received October 10, 2018

Revised January 13, 2019

Accepted February 27, 2019

Two new species of oribatid mites (Acari, Oribatida) of the superfamily Oripodoidea are described from Ethiopia. *Pilobatella dhatiensis* sp. n. differs from *P. schauenbergi* Mahunka, 1977 by the larger body and long, barbed lamellar and interlamellar setae. *Muliercula walalensis* sp. n. differs from all other species of the genus by the presence of a translamella.

Keywords: oribatid mites, Ethiopian region, systematics, morphology, *Pilobatella*, *Muliercula*

DOI: 10.1134/S0044513419090046

During my taxonomic studies of oribatid mites (Acari, Oribatida) in the Ethiopian Dhati-Walal National Park, I discovered two new species of the superfamily Oripodoidea, one belonging to the genus *Pilobatella* Balogh et Mahunka 1967 (family Haplozetidae), and the other to *Muliercula* Coetzer 1968 (family Scheloribatidae). The primary goal of the paper is to describe and illustrate these new species.

Pilobatella was proposed by Balogh and Mahunka (1967) with *Pilobatella punctulata* Balogh et Mahunka 1967 as type species. Currently, the genus includes 10 species (Ermilov et al., 2012), which are distributed in the Ethiopian and Oriental regions, as well as in northern India. The main diagnostic characteristics were summarized by Balogh and Mahunka (1967) and Balogh and Balogh (1984, 1992), and augmented by Ermilov et al. (2012). An identification key to the known species of *Pilobatella* was presented by Ermilov et al. (2012).

Muliercula was proposed by Coetzer (1968) with *Muliercula muliercula* Coetzer 1968 as type species. Currently, the genus includes 10 species (Subías, 2004, updated 2018), which are registered in the Ethiopian, Neotropical and Oriental regions. The main diagnostic characteristics were summarized by Coetzer (1968). An identification key to the known species (except one) of *Muliercula* was presented by Shtanchaeva et al. (2014).

This work is part of my ongoing study of the oribatid mite fauna of Ethiopia (e.g., Ermilov et al., 2014; Ermilov, 2016; Ermilov and Rybalov, 2018).

METHODS

Litter and fallen leaves were collected by using a stainless steel frame (50 × 50 cm) with a sieve (mesh size 2 × 2 cm). Oribatid mites were extracted into 75% ethanol using Berlese funnels with electric bulbs (150 W) in laboratory conditions.

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 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”.

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 an overview.

The following abbreviations are used: *lam* – lamella; *tlam* – translamella; *slam* – sublamella; *plam* – prolamella; *Al* – sublamellar porose area; *Sl* – sublamellar saccule; *tu* – tutorium; *lr* – lateral ridge; *vlr* – ventrolateral ridge; *ro*, *le*, *in*, *bs*, *ex* – rostral, lamellar, interlamellar, bothridial and exobothridial setae, respectively; *Ad* – sejugal porose area; *D* – dorsophragma; *P* – pleurophragma; *c*, *la*, *lm*, *lp*, *h*, *p* – notogas-

tral setae; *Sa*, *S1*, *S2*, *S3*, *S4* – notogastral saccules; *ia*, *im*, *ip*, *ih*, *ips* – notogastral lyrifissures; *gla* – opisthonotal gland opening; *h*, *m*, *a* – subcapitular setae; *or* – adoral seta; *v*, *l*, *d*, *cm*, *acm*, *ul*, *sul*, *vt*, *lt* – palp setae; ω – palp and leg solenidion; *Pd I*, *Pd II* – pedotecta I, II, respectively; *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; *t* – tooth; *pr* – process; *ap* – apophysis; *p.a.* – leg porose area; σ , ϕ – leg solenidia; *e* – leg famulus; *v*, *ev*, *bv*, *l*, *d*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* – leg setae.

The following abbreviations of the relevant institutional collections are used: SMNH – Senckenberg Museum of Natural History, Görlitz, Germany; TSUMZ – Tyumen State University Museum of Zoology, Tyumen, Russia.

SYSTEMATICS

Family Haplozetidae

Genus *Pilobatella* Balogh et Mahunka 1967

Type species *Pilobatella punctulata* Balogh et Mahunka 1967.

Pilobatella dhatiensis Ermilov sp. n. (Figs 1–3)

Material. Holotype (♀) and five paratypes (3♀, 2♂): Ethiopia, Dhati-Walal National Park, 9°26'35.5" N, 34°48'07.6" E, rarefied forest with needle leaves bush, litter, 27.X.2017 (L.B. Rybalov). Three paratypes (1♀, 2♂): Ethiopia, Dhati-Walal National Park, 9°26'33.7" N, 34°47'22.5" E, mixed deciduous forest in the valley, litter, 27.X.2017 (L.B. Rybalov). Four paratypes (2♀, 2♂): Ethiopia, near Dhati-Walal National Park, 9°25'01.2" N, 34°45'21.3" E, mixed forest on the mountain, litter, 20.X.2017 (L.B. Rybalov).

The holotype (ethanol with a drop of glycerol) is deposited in SMNH; 12 paratypes (ethanol with a drop of glycerol) are deposited in TSUMZ.

Diagnosis. Body size: 531–614 × 249–298. Body surface microgranulate, notogaster and ventral side foveolate. Rostral, lamellar and interlamellar setae long, setiform, barbed; *ro* shortest, *in* longest. Bothridial setae thickened, ciliate. Exobothridial setae of medium size, setiform, erect, barbed. Notogastral setae short, setiform, smooth. Saccules *Sa* with a very long channel, other saccules with a slightly elongate channel. Epimeral and anogenital setae setiform, slightly barbed. Leg tarsi I with 19 setae (*l'* absent). Leg setae *l''* on genua I inserted on an elongate apophysis.

Description. Measurements. Body length: 531 (holotype), 531–614 (paratypes); notogaster width:

257 (holotype), 249–298 (paratypes). No difference between females and males in body size.

Integument. Body color brown. Body surface densely microgranulate (visible under high magnification). Notogaster, ventral side, anal plates and subcapitular mentum and genae sparsely foveolate (diameter of foveoles up to 4).

Prodorsum (Figs 1a, 1b). Rostrum broadly rounded. Lamellae located dorsolaterally, half as long as prodorsum. Translamellar and prolamellar lines absent. Sublamellae thin, half as long as lamellae. Sublamellar porose areas rounded (10–16) or oval (10–16 × 8–12). Tutoria and ventrolateral ridges well-developed. Rostral (49–57), lamellar (65–73) and interlamellar (73–86) setae setiform, barbed; *le* inserted medial and close to lamellar ends. Bothridial setae (102–114) thickened, ciliate. Dorsosejugal porose areas elongate oval (6–8 × 2–4). Exobothridial setae (36–41) setiform, erect, barbed.

Notogaster (Figs 1, 2a). Anterior notogastral margin slightly convex medially. Ten pairs of notogastral setae short (10–12), setiform, thin, smooth. Four pairs of saccules developed, *Sa* with a very long channel, other saccules (*S1*, *S2*, *S3*) with a slightly elongate channel. Distance *S1*–*S1* slightly longer than *S2*–*S2*. Setae *lm* inserted medial to *Sa*, *lp* medial to *S1*. All lyrifissures distinct, *im* located between *Sa* and *S1*, *ip* posterolateral to *h*₁, *ih* and *ips* in lateral position, anterior to *p*₃. Opisthonotal gland openings located posterior to *im*. Circumgastric scissure and circumgastric sigillar band distinct.

Gnathosoma (Figs 2b–2d). Subcapitulum longer than wide (110–114 × 82–86). Subcapitular setae (*a*, *m*, *h*) similar in length (22–24), setiform, slightly barbed; *m* slightly thinner than others. Two pairs of adoral setae (12) setiform, heavily barbed. Palps (length 73–77) with setation 0–2–1–3–9(+ ω). Postpalpal setae (6) spiniform, hardly barbed. Chelicerae (length 127–131) with two setiform, barbed setae, *cha* (41–45) longer than *chb* (26–28). Trägårdh's organ of chelicerae elongate triangular, rounded distally.

Epimeral and lateral podosomal regions (Figs 1b, 2a). Epimeral setal formula: 3–1–3–3. Epimeral setae *3c* and *4c* (20–24) longer than *1b* (16) and others (10–12), all setiform, slightly barbed; *3a* slightly thicker than others. Pedotecta II trapezoid in ventral view. Discidia elongate triangular, rounded distally. Circumpedal carinae comparatively short, reaching level of insertions of acetabula IV.

Anogenital region (Figs 1b–1d, 2a). Six pairs of genital (*g*₁, 20; *g*₂–*g*₆, 10–12), three pairs of aggenital (10–12), two pairs of anal (16) and three pairs of adanal (*ad*₁, *ad*₂, 20–24; *ad*₃, 16) setae setiform, slightly barbed. Adanal lyrifissures located close and parallel to anal plates. Adanal setae *ad*₁ in posterior, *ad*₂ in posterolateral, *ad*₃ in anterolateral positions; *ad*₃ anterior to *iad*. Marginal porose area absent. Preanal organ goblet-

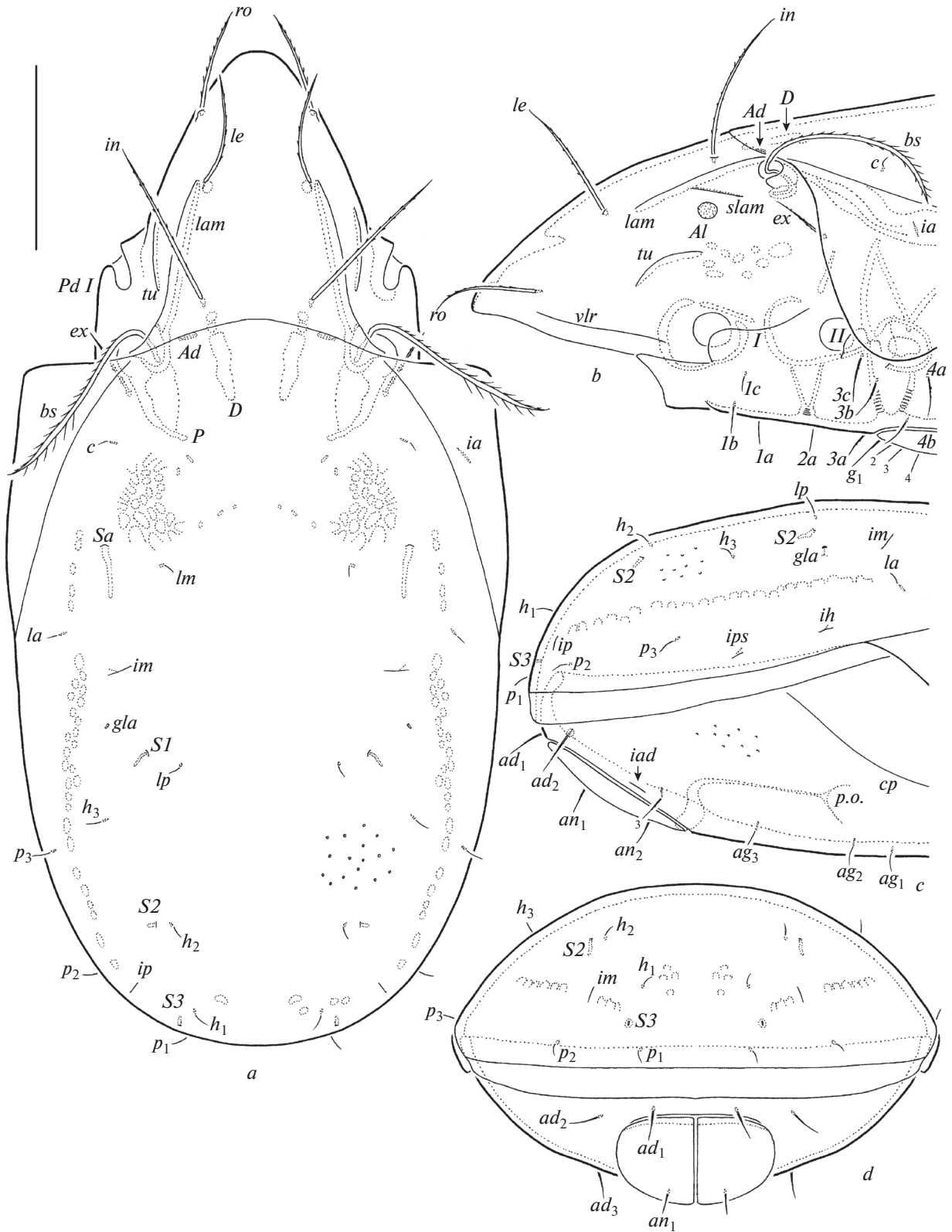


Fig. 1. *Pilobatella dhatiensis* sp. n., adult: a – dorsal view; b – anterior part of body (gnathosoma and legs not illustrated), lateral view; c – posterior part of body, lateral view; d – posterior view. Scale bar 100 µm.

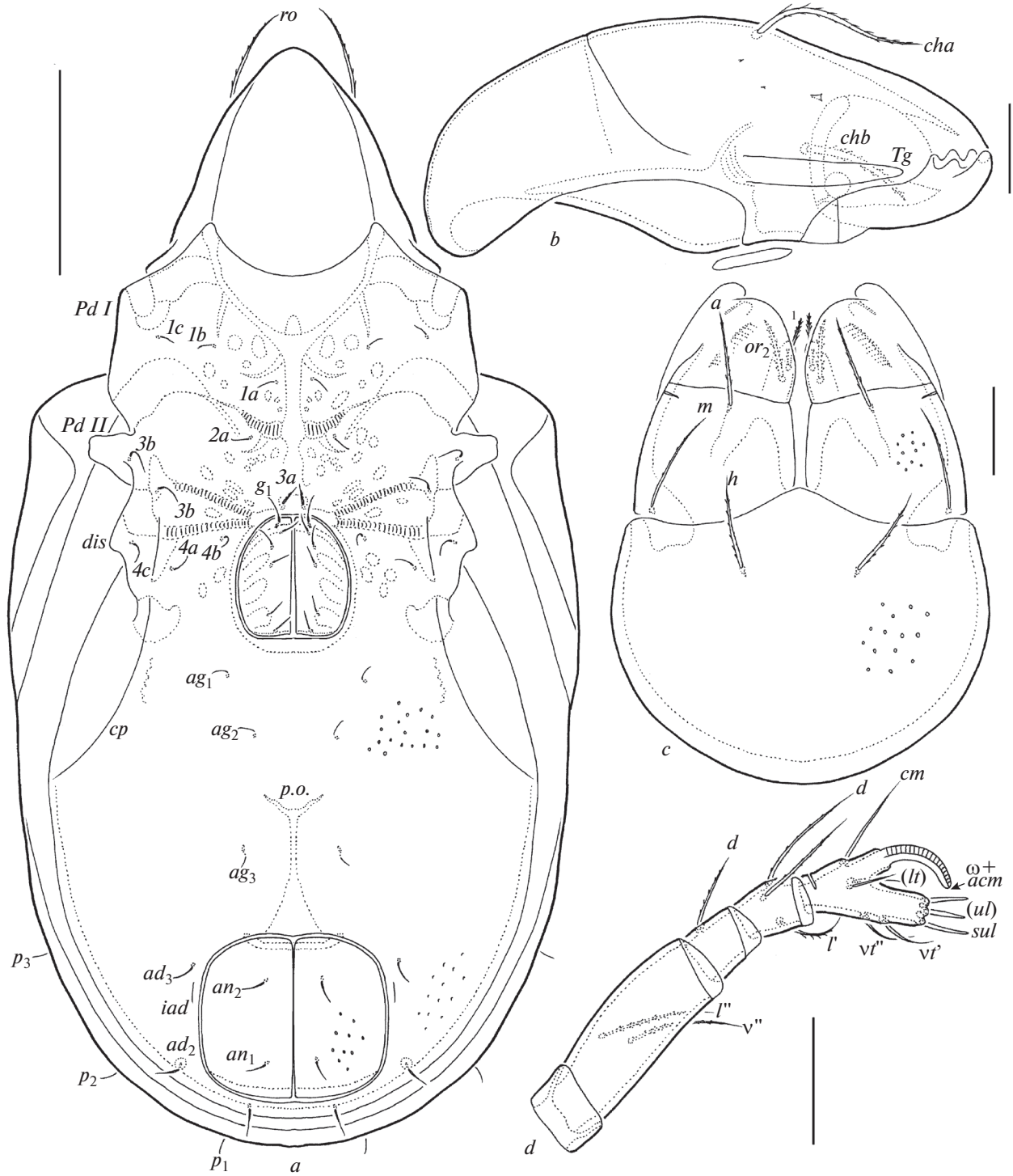


Fig. 2. *Pilobatella dhatiensis* sp. n., adult: *a* – ventral view (gnathosoma and legs not illustrated); *b* – chelicera, left, paraxial view; *c* – subcapitulum, ventral view; *d* – palp, left, paraxial view. Scale bar (μm): *a* – 100; *b–d* – 20.

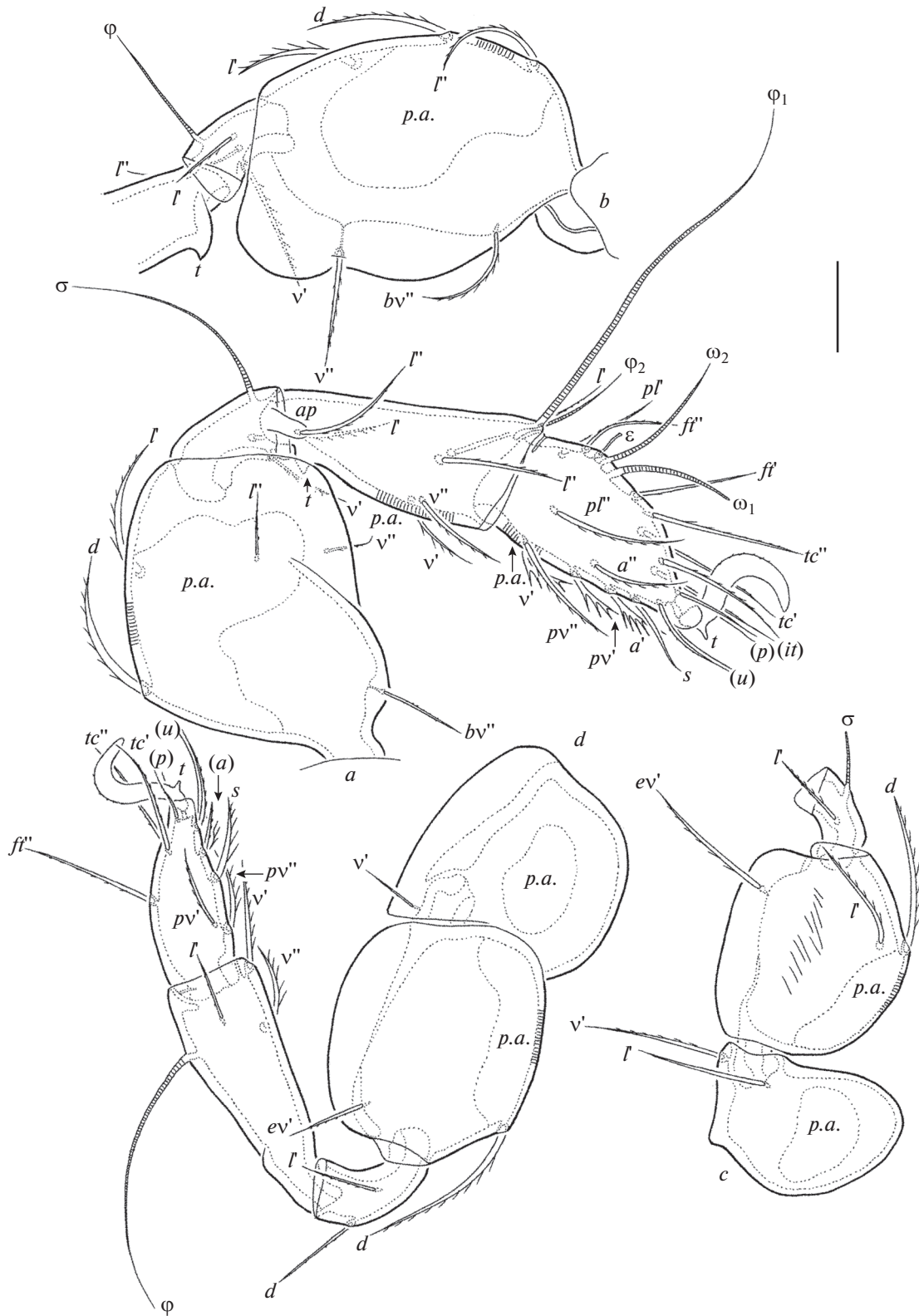


Fig. 3. *Pilobatella dhatiensis* sp. n., adult: *a* – leg I, without trochanter and basal part of femur, right, antiaxial view; *b* – trochanter (covered by pedotectum II partially), femur, genu and basal part of tibia of leg II, left, antiaxial view; *c* – trochanter, femur and genu of leg III, right, antiaxial view; *d* – leg IV, left, antiaxial view. Scale bar: 20 μ m.

Table 1. Leg setation and solenidia of adult *Pilobatella dhatiensis* sp. n. and *Muliercula walalensis* 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>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>pl</i>), <i>v'</i> , ε , ω_1 , ω_2
II	<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	(<i>fi</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>l'</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>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>)

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.

* – Setae *v'* on genua II absent in *M. walalensis* sp. n.

like. Ovipositor elongated (151 × 41), blades (61) shorter than length of distal section (beyond middle fold; 90). Each of the three blades with four smooth setae, $\psi_1 \approx \tau_1$ (28) setiform, $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (12) thorn-like. Six coronal setae spiniform (4).

Legs (Fig. 3). Claw of all tarsi strong, serrate on dorsal side, with tooth ventrobasally. Tibiae of leg I and II with triangular tooth ventrobasally. Femora II slightly bilobed ventrally. Trochanters IV with triangular process dorsoanteriorly. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV well visible. Ventral porose areas in basal parts of tarsi and in distal parts of tibiae distinct only on leg I and II. Formulas of leg setation and solenidia: I (1–5–3–4–19) [1–2–2], II (1–5–3–4–15) [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. Famulus inserted posterior to solenidium ω_2 . Setae *l''* on genua I inserted on elongate apophysis.

Remarks. *Pilobatella dhatiensis* sp. n. is similar to *P. schauenbergi* Mahunka 1977 from the Oriental region (see Mahunka, 1977) in the presence of saccules *Sa* with long channels. However, the former species differs from the latter by larger body size (531–614 × 249–298 versus 348–407 × 188–212); also, lamellar and interlamellar setae are long and barbed in *P. dhatiensis* sp. n. (versus short and heavily ciliated in *P. schauenbergi*).

Etymology. The specific name *dhatiensis* refers to the Ethiopian Dhati-Walal National Park, where the type material was collected.

Family Scheloribatidae

Genus *Muliercula* Coetzer 1968

Type species *Muliercula muliercula* Coetzer 1968.

Muliercula walalensis Ermilov sp. n. (Figs 4–6)

Material. Holotype (♂) and six paratypes (4♀♀, 2♂♂): Ethiopia, Dhati-Walal National Park, 9°26'35.5" N, 34°48'07.6" E, rarefied forest with needle leaves bush, litter, 27.X.2017 (L.B. Rybalov). Twelve paratypes (9♀♀, 3♂♂): Ethiopia, Dhati-Walal

National Park, 9°26'34.6" N, 34°48'02.1" E, bamboo forest, litter, 20.X.2017 (L.B. Rybalov).

The holotype (ethanol with drop of glycerol) is deposited in SMNH; 18 paratypes (ethanol with drop of glycerol) are deposited in TSUMZ.

Diagnosis. Body size: 298–381 × 166–215. Translamella developed, shortly interrupted medially. Prolamellae complete. Tutoria long. Rostral, lamellar and interlamellar setae long, setiform, barbed; *le* longest. Bothridial setae clavate, barbed. Notogastral setae *p*₁ short, setiform, smooth, other setae vestigial. Five pairs of saccules present. Epimeral and anogenital setae setiform, slightly barbed. Leg tarsi I with 19 setae (*l''* absent).

Description. Measurements. Body length: 332 (holotype), 298–381 (paratypes); notogaster width: 174 (holotype), 166–215 (paratypes). Females larger than males: 348–381 × 199–215 versus 298–332 × 166–182.

Integument. Body color light brown to dark brown. Body surface densely microfoveolate (visible only in dissected specimens under high magnification). Notogaster, ventral side, anal plates, subcapitular mentum and genae and anterior part of prodorsum sparsely foveolate (diameter of foveoles up to 2). Podosomal regions microgranulate.

Prodorsum (Figs 4a, 4b). Rostrum slightly protruding, rounded. Lamellae located dorsolaterally, as long as half of prodorsum. Translamella long, shortly interrupted medially. Prolamellae present, complete. Sublamellae thin, half as long as lamellae. Sublamellar saccules present instead of porose areas. Tutoria and ventrolateral ridges well-developed. In addition, lateral ridges present between tutoria and ventrolateral ridges. Rostral (28–36), lamellar (45–53) and interlamellar (36–45) setae setiform, barbed. Bothridial setae (24–32) clavate, barbed. Dorsosejugal porose areas elongate oval (8 × 4). Exobothridial setae (8–12) setiform, slightly barbed.

Notogaster (Figs 4, 5a). Anterior notogastral margin slightly convex medially. Ten pairs of notogastral setae developed, *p*₁ (8–12) setiform, thin, smooth, other setae (1) vestigial. Five pairs of saccules with drop-like channels. Distance *S1–S1* shorter than *S2–S2*. Setae *lm* inserted medial to *Sa*, *lp* posteromedial to

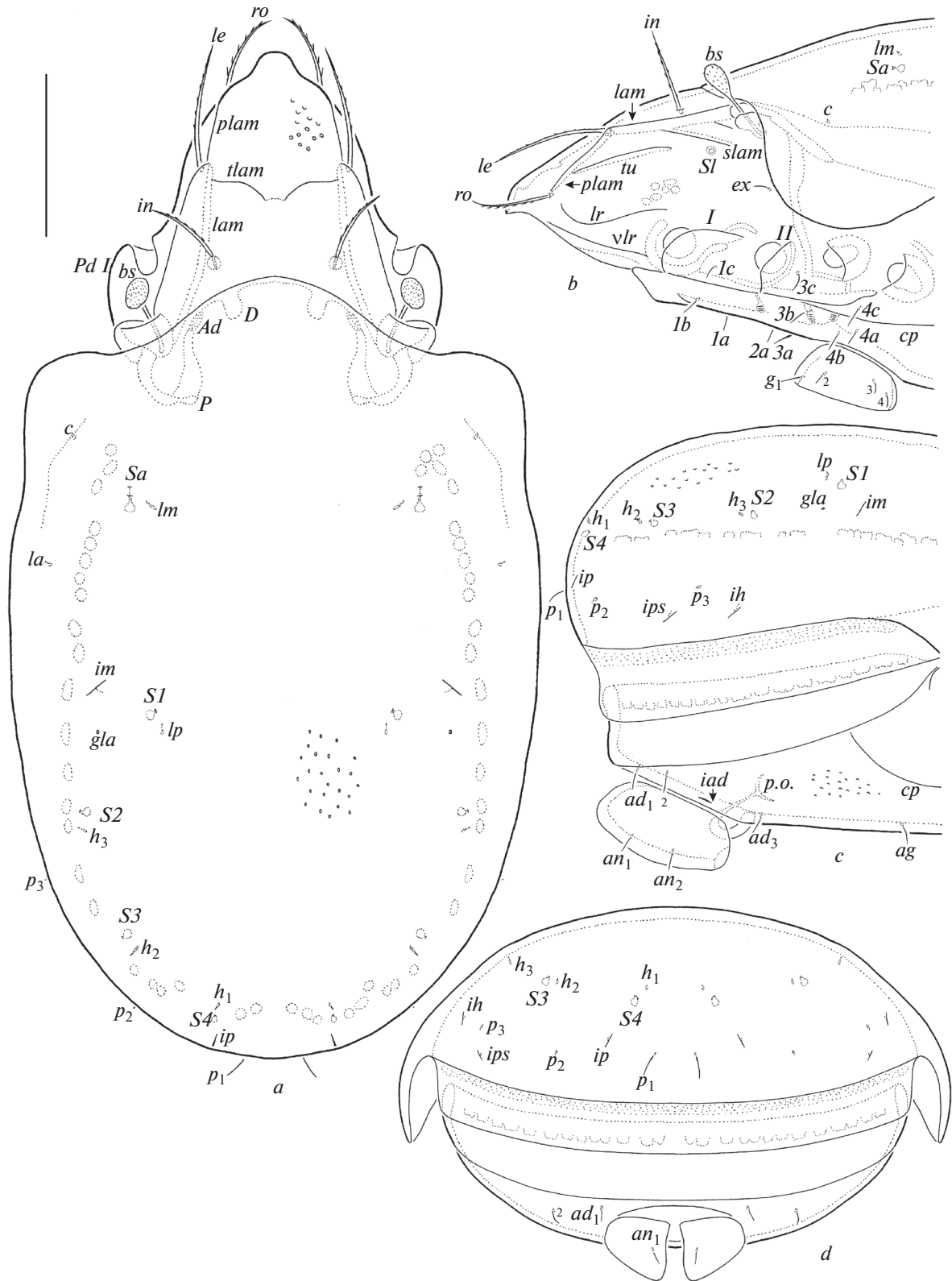


Fig. 4. *Muliercula walalensis* sp. n., adult: *a* – dorsal view; *b* – anterior part of body (gnathosoma and legs not illustrated), lateral view; *c* – posterior part of body, lateral view; *d* – posterior view. Scale bar 50 μ m.

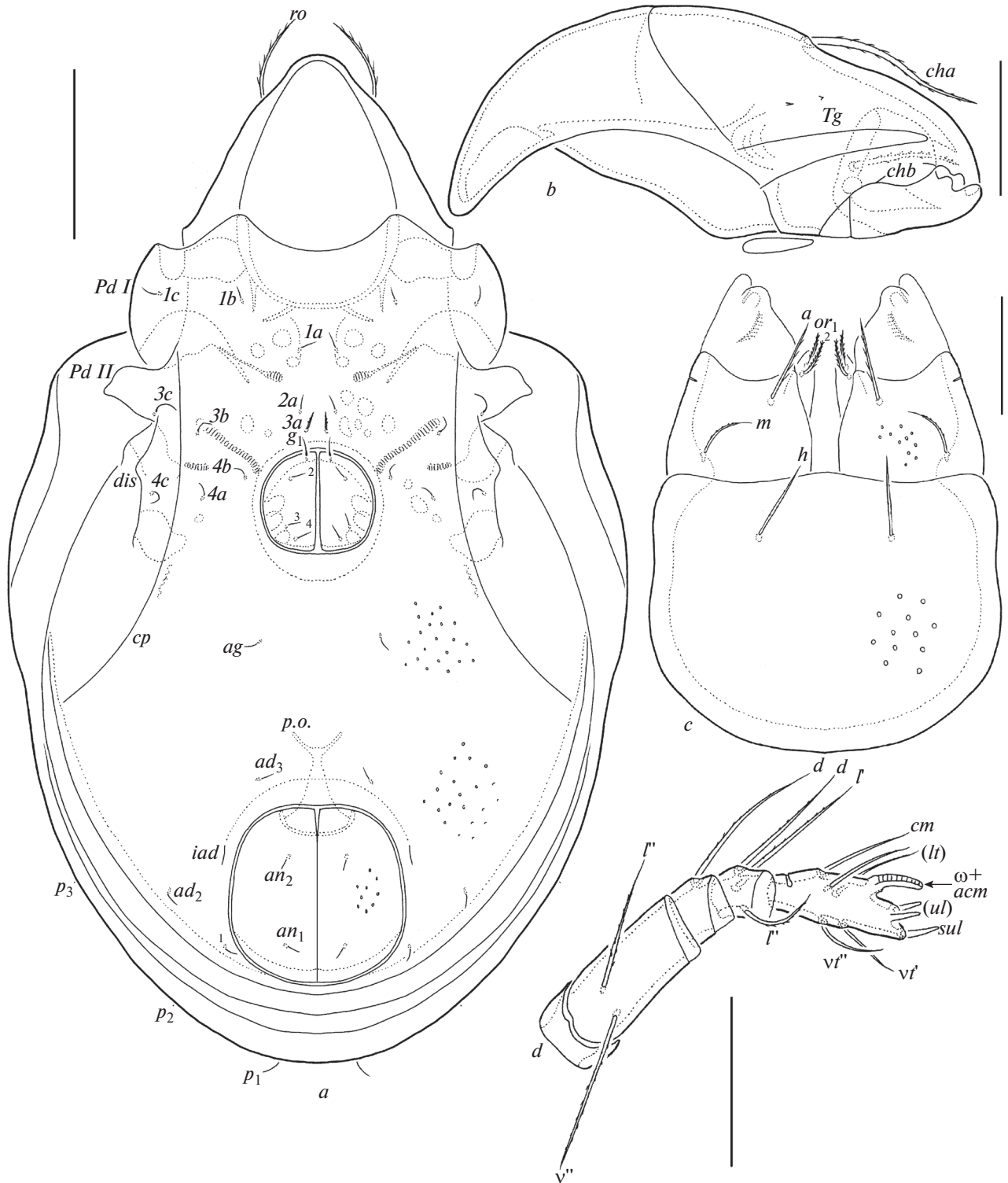


Fig. 5. *Muliercula walalensis* sp. n., adult: *a* – ventral view (gnathosoma and legs not illustrated); *b* – chelicera, left, paraxial view; *c* – subcapitulum, ventral view; *d* – palp, right, antiaxial view. Scale bar (μm): *a* – 50; *b*–*d* – 20.

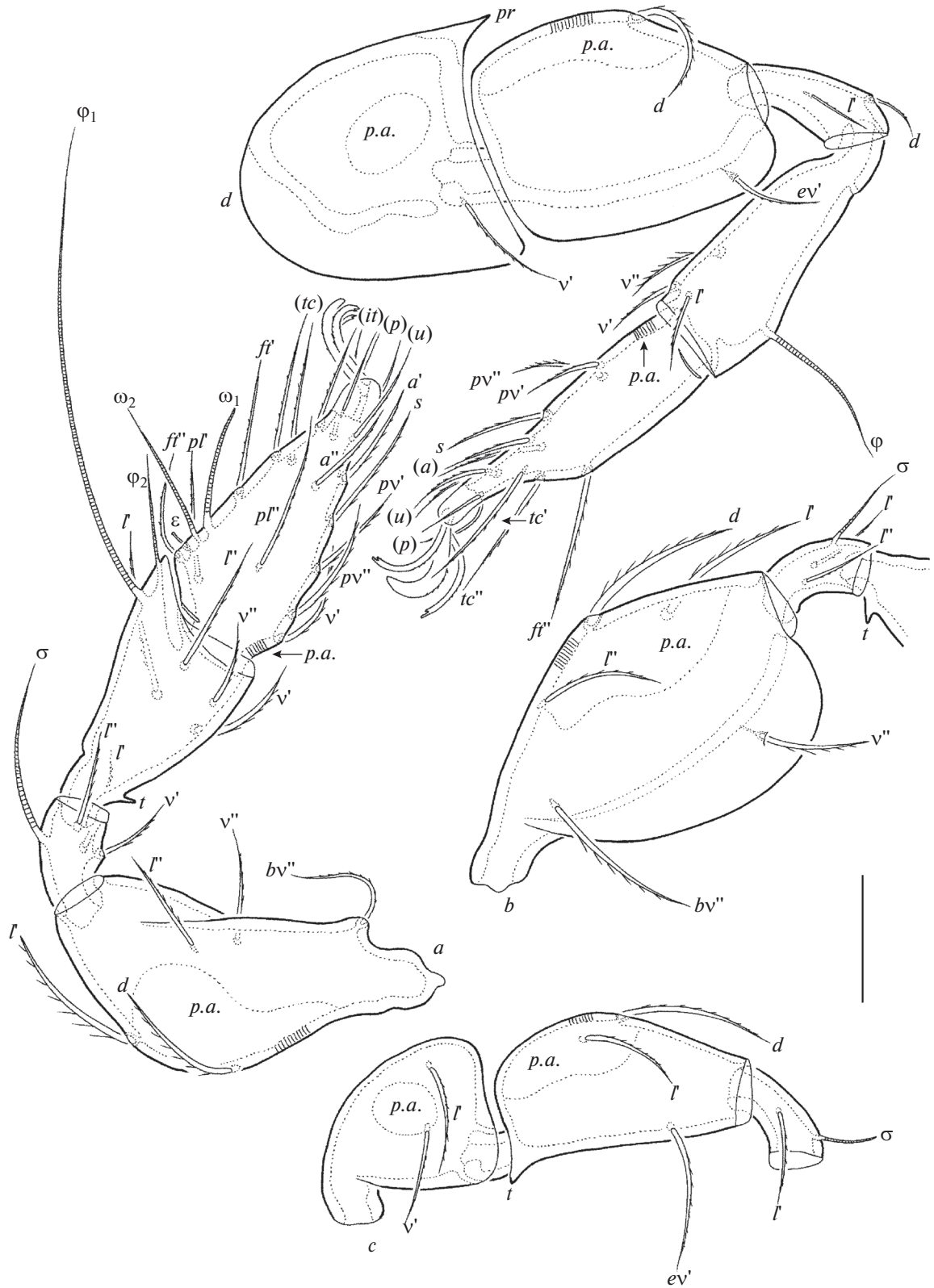


Fig. 6. *Muliercula walalensis* sp. n., adult: *a* – leg I, without trochanter, right, antiaxial view; *b* – femur, genu and basal part of tibia of leg II, right, antiaxial view; *c* – trochanter, femur and genu of leg III, left, antiaxial view; *d* – leg IV, left, antiaxial view. Scale bar 20 μ m.

SI. All lyrifissures distinct, *im* located anterolateral to *SI*, *ip* lateral to h_1 , *ih* and *ips* in lateral position, *ih* anterolateral to p_3 , *ips* posterolateral to p_3 . Opisthotal gland openings located posterior to *im*. Circumgastric scissure and circumgastric sigillar band distinct.

Gnathosoma (Figs 5b–5d). Subcapitulum longer than wide (69–77 × 49–57). Subcapitular setae *a* and *h* (12–14) longer than *m* (8–10), all setiform, barbed. Two pairs of adoral setae (6) setiform, heavily barbed. Palps (length 45–49) with setation 0–2–1–3–9(+ ω). Postpalpal setae (4) spiniform, smooth. Chelicerae (length 69–77) with two setiform, barbed setae, *cha* (24–28) longer than *chb* (16–18). Trägårdh's organ of chelicerae elongate triangular, rounded distally.

Epimeral and lateral podosomal regions (Figs 4b, 5a). Epimeral setal formula: 3–1–3–3. Epimeral setae *3b*, *3c* and *4c* (12–16) longer than others (8–12), all setiform, slightly barbed; *3a* slightly thicker than others. Pedotecta II trapezoid in ventral view. Discidia elongate triangular, rounded distally. Circumpedial carinae long, reaching level of pedotecta II.

Anogenital region (Figs 4b–4d, 5a). Four pairs of genital (g_1 , 8–12; g_2 – g_4 , 6–8), one pair of aggenital (8–12), two pairs of anal (8–12) and three pairs of adanal (8–12) setae setiform, slightly barbed. Adanal lyrifissures located close and parallel to anal plates. Adanal setae ad_1 in posterolateral, ad_2 in lateral, ad_3 in anterior positions; ad_3 anterior to *iad*. Marginal porose area absent. Preanal organ goblet-like. Ovipositor elongated (122 × 32), blades (57) shorter than length of distal section (beyond middle fold; 65). Each of the three blades with four smooth setae, $\psi_1 \approx \tau_1$ (24) setiform, $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (10–12) thorn-like. Six coronal setae spiniform (2).

Legs (Fig. 6). Median claw distinctly thicker than laterals, all serrate on dorsal side; lateral claws with a very small tooth ventrodistally. Tibiae of leg I and II each with a triangular tooth ventrobasally. Femora III each with a triangular tooth ventrobasally. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV well visible. Ventral porose areas in basal parts of tarsi present, ventral porose areas in distal parts of tibiae absent. Trochanters IV each with a triangular process dorsoanteriorly. Formulas of leg setation and solenidia: I (1–5–3–4–19) [1–2–2], II (1–5–2–4–15) [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. Famulus inserted posterior to solenidium ω_2 .

Remarks. *Muliercula walalensis* sp. n. differs from all other species of the genus by the presence of a well-developed translamella (versus translamella being absent in others).

Etymology. The specific name *walalensis* refers to the Ethiopian Dhati-Walal National Park, where the type material was collected.

ACKNOWLEDGEMENTS

I cordially thank Dr. Leonila Corpuz-Raros (Institute of Weed Science, Entomology and Plant Pathology, College of Agriculture and Food, and Museum of Natural History, University of the Philippines Los Baños, Los Baños, Philippines) for valuable comments; Dr. Leonid B. Rybalov (A.N. Severtsov Institute of Ecology and Evolution, Moscow, Russia), who collected material of Oribadoidea in Ethiopia for my study; and Dr. Denis V. Sharapov (Tyumen State University, Tyumen, Russia) for editing the English. The work was performed in the framework of the Joint Russian-Ethiopian Biological Expeditions, financially supported by the Russian Academy of Sciences.

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ДВА НОВЫХ ВИДА ORIPODOIDEA (ACARI, ORIBATIDA) ИЗ ЭФИОПИИ

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Описаны два новых вида панцирных клещей (Acari, Oribatida) надсемейства Oripodoidea из Эфиопии. *Pilobatella dhatiensis* sp. n. отличается от *P. schauenbergi* Mahunka 1977 более крупными размерами тела и длинными, опушенными ламеллярными и межламеллярными щетинками. *Muliercula walalensis* sp. n. отличается от всех видов рода наличием хорошо развитой трансламеллы.

Ключевые слова: панцирные клещи, Эфиопская область, систематика, морфология, *Pilobatella*, *Muliercula*