

TWO NEW SPECIES OF ORIBATID MITES (ACARI, ORIBATIDA) FROM SOUTHERN VIETNAM

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ABSTRACT: Two new species of oribatid mites, *Papillacarus luteus* Ermilov sp. n. and *Multioppia pseudoglabra* Ermilov sp. n., are described from forest soils of southern Vietnam. *Papillacarus luteus* sp. n. is morphologically most similar to *P. cruzae* Corpuz-Raros, 1979 and *P. ramirezae* Corpuz-Raros, 1979; however, it differs from both by the length of centro-dorsal notogastral setae. *Multioppia pseudoglabra* sp. n. is morphologically most similar to *Multioppia glabra* (Mihelčič, 1955), however, it differs from the latter by the localization of notogastral setae *lm* and morphology of notogastral setae.

KEY WORDS: Oribatida, new species, *Papillacarus*, *Multioppia*, Vietnam

INTRODUCTION

This work is part of the taxonomic study of oribatid mites (Acari, Oribatida) collected in 2013–2014 in the forest zones of Southern Vietnam (see Ermilov and Anichkin 2014a–g; Ermilov et al. 2014a–c, e–g; Niedbala and Ermilov 2014). The main goal of this paper is to describe and illustrate two new species; one belonging to the genus *Papillacarus* Kunst, 1959 (Lohmanniidae), and another to *Multioppia* Hammer, 1961 (Oppiidae).

The genus *Papillacarus* comprises more than 30 species, which are distributed in the Pantropical and Subtropical regions (Subías 2004, updated 2014). The main generic characters were summarized by Balogh (1961), Wallwork (1962), Aoki (1965), and Balogh and Balogh (1987, 1988, 1992). At present, eight species of this genus are known in the Vietnamese mite fauna (Ermilov et al. 2012d). The identification key to them was recently presented by Ermilov et al. (2012d).

The genus *Multioppia* comprises more than 45 species, which have a cosmopolitan distribution (Subías 2004, updated 2014). The main generic characters were summarized by Subías and Balogh (1989), and Vasiliu and Ivan (2009). At present, one species of this genus was known in the Vietnamese mite fauna (Mahunka 1988).

MATERIAL AND METHODS

The collection locality and habitat are given in the “*Material examined*” section for each species, respectively.

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 ventral plate. The notogastral

width refers to the maximum width 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.

General terminology used in this paper follows that of Grandjean (summarized by Norton and Behan-Pelletier 2009).

Drawings were prepared with the aid of a drawing tube using the Carl Zeiss compound microscope “Axioskop-2 Plus”.

TAXONOMY

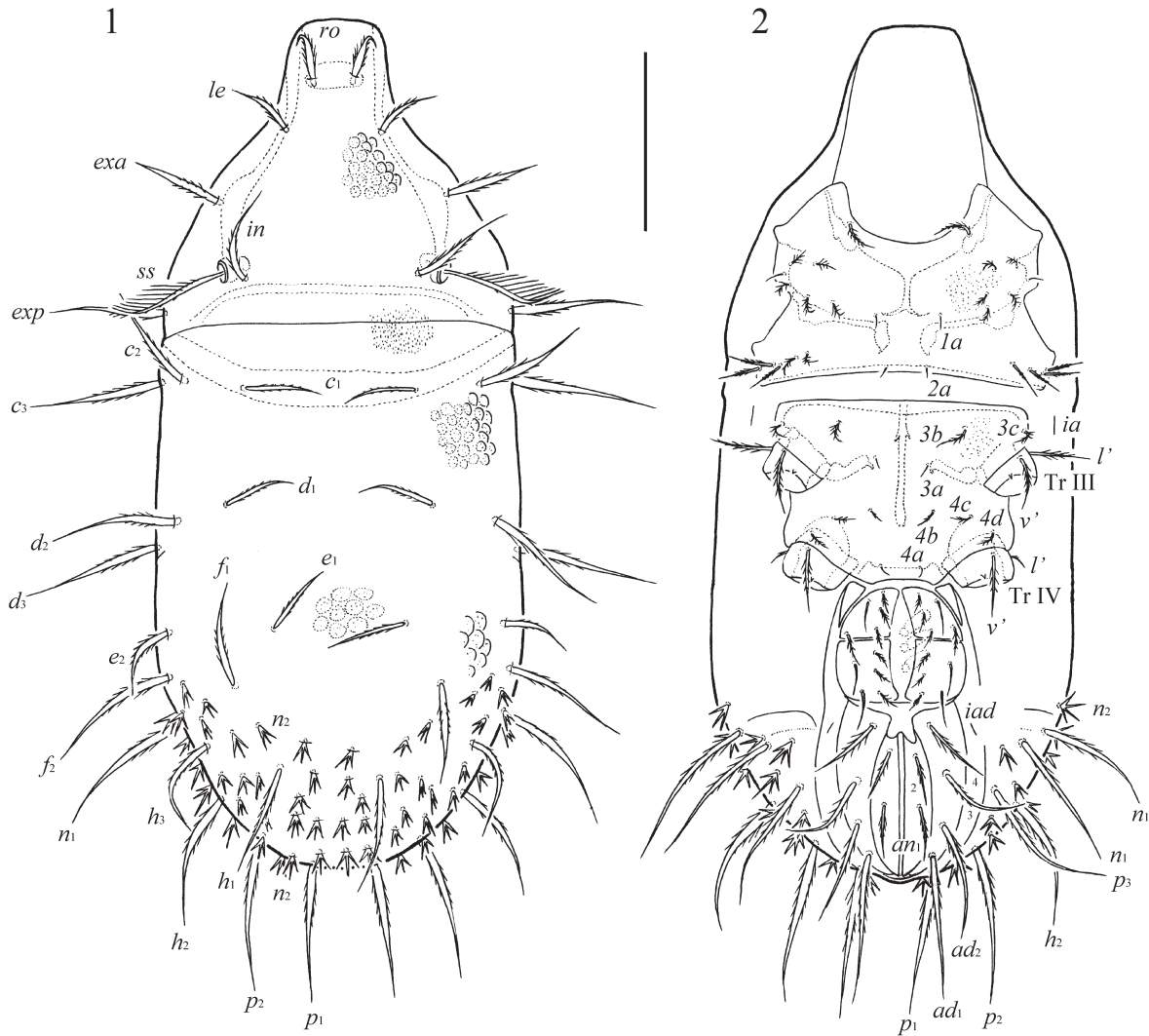
Papillacarus luteus Ermilov sp. n.

Figs 1–11

Diagnosis. Body size: 448–481 × 215. Surface of prodorsum and notogaster with tubercles forming polygonal network. Prodorsal, notogastral and two pairs of neotrichal setae thickened in medio-basal part, with short cilia, and thin, smooth apex. Bothridial setae pectinate, with 10 to 12 branches. More than 40 pairs of neotrichal setae with very short basal part and with three to five spiniform branches. Three pairs of subcapitular setae *m* present. Epimeral setal formula: 8–5(6)–3–4.

Description. *Measurements.* Body length: 481 (holotype), 448–481 (three paratypes); notogaster width: 215 (holotype and three paratypes).

Integument. Body color yellow. Body and legs densely microfoveolate. Surface of prodorsum and notogaster also with tubercles (length up to 16), forming polygonal network (poorly visible in one paratype).



Figs 1–2. *Papillacarus luteus* Ermilov sp. n.: 1 — dorsal view; 2 — ventral view (gnathosoma and legs except trochanters III and IV not illustrated). Scale bar 100 μ m.

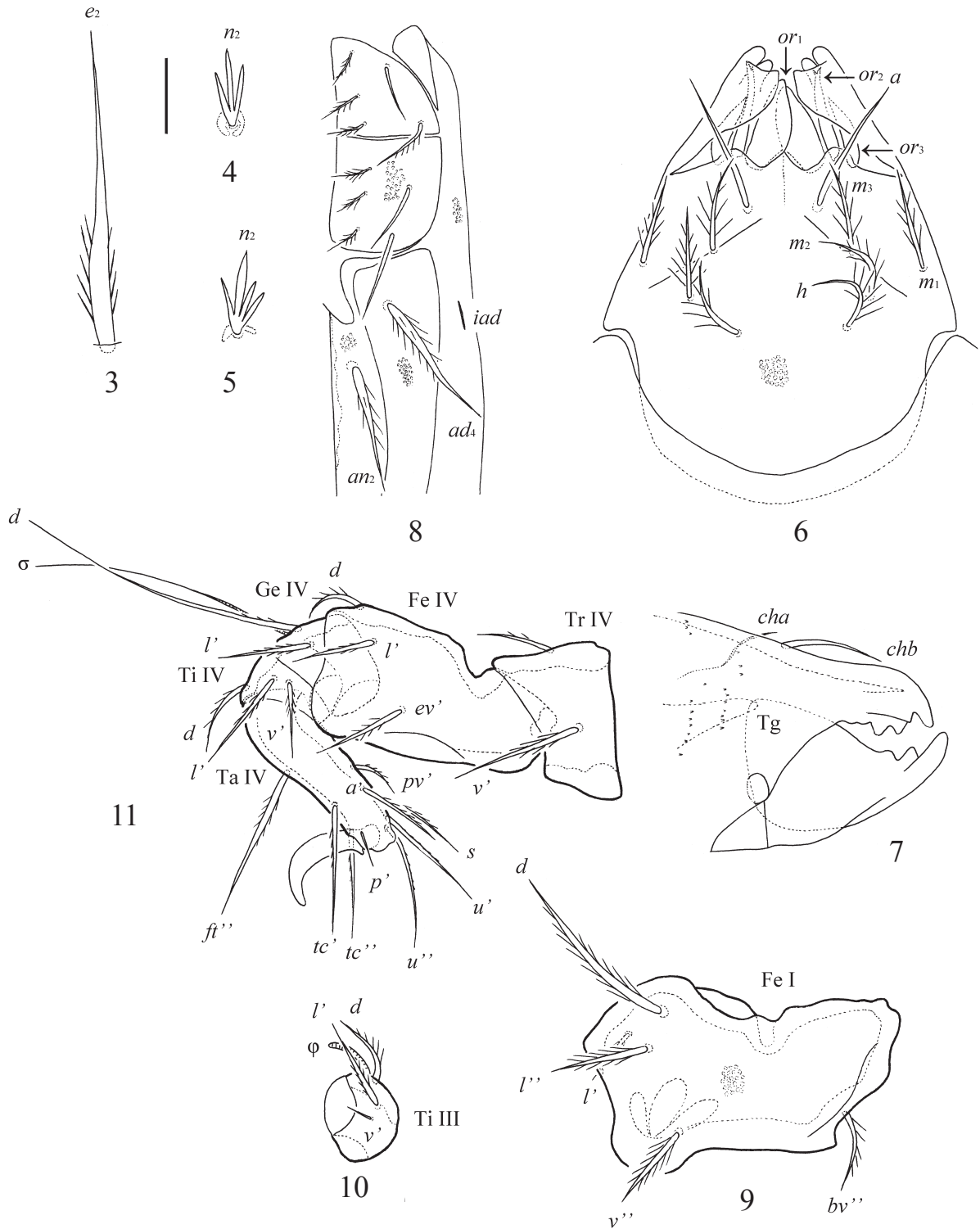
Prodorsum. Roughly triangular in dorsal view, occupying about 1/3 of dorsal length. Rostrum truncated. Rostral (*ro*, 61–65), lamellar (*le*, 73–77), interlamellar (*in*, 73–77) and both pairs of exobothridial (*exa*, 61–65; *exp*, 77–82) setae thickened in medio-basal part, with short cilia, and thin, smooth apex. Bothridial setae (*ss*, 94–102) pectinate, with 10 to 12 branches on one side, and three barbs on the opposite side. Postbothridial transverse band (S_b) present.

Notogaster. Anterior border of the notogaster straight. Transverse bands not found. Sixteen pairs of primary notogastral setae and more than 40 pairs of additional neotrichal setae present. Notogastral setae thickened in medio-basal part, with short cilia, and thin, smooth apex. Centro-dorsal setae (*c*₁, *d*₁, *e*₁, 45–49; *f*₁, *h*₁, 61–65) and *e*₂ (28–32) shorter than the other setae (77–82). Neotrichal setae of two types: two pairs (*n*₁, 77–82)

similar to notogastral setae in morphology, other neotrichal setae (*n*₂, 20–24) with very short basal part and with three to five spiniform branches. Lyrifissures present, but they well visible only in dissected specimens.

Gnathosoma. Generally, morphology of subcapitulum, palps and chelicerae typical for *Papillacarus* (see Ermilov and Anichkin 2011; Ermilov et al. 2012d). Subcapitulum longer than wide (114–123 \times 86–94), with one pair of lateral tubercles. Subcapitular setae *h*, *m*₁, *m*₂ and *m*₃ (24–28) setiform, ciliate; *a* longer (36), simple, smooth. Three pairs of adoral setae present: *or*₁ (24–28) wide, lobe-formed, smooth; *or*₂ (28–32) thickened, with tooth in distal part, blunt-ended; *or*₃ (16–20) slightly lobe-formed, pointed distally, smooth. Palps (53) with setation 0–1–0–1–10(+ ω). Distal three setae fused basally. Solenidion longer than palptarsus, thick, not fused with *acm*. Chelic-

Two new species of oribatid mites from southern Vietnam



Figs 3–11. *Papillacarus luteus* Ermilov sp. n.: 3 — notogastral seta e_2 ; 4, 5 — neotrichal setae of type n_2 ; 6 — subcapitulum, ventral view; 7 — anterior part of chelicera; 8 — left genital plate and anterior part of ano-adanal region; 9 — femur I, left, antiaxial view; 10 — tibia III, right, antiaxial view; 11 — leg IV, right, antiaxial view. Scale bar 20 μm .

erae (123) with two setae, *chb* (28–36) setiform, smooth, longer than *cha* (6–10), thorn-like. Trägårdh's organ short, tapered.

Epimeral region. Epimere III and anterior part of epimere IV separated medially by longitu-

dinal sternal apodeme. Epimeral setal formula: 8–5(6)–3–4. Medial setae *1a*, *2a*, *3a* and *4a* and one pair of lateral setae of epimere I short (8–12), setiform, smooth. Other setae ciliate; anterior pair of epimere I (28–32) longer than three to four

Table 1.
Leg setation and solenidia of *Papillacarus luteus* Ermilov sp. n.

| Leg | Trochanter | Femur | Genu | Tibia | Tarsus |
|-----|----------------------|--|---------------------------------------|---|---|
| I | – | <i>d</i> , (<i>l</i>), <i>bv</i> "', <i>v</i> "' | (<i>l</i>), σ' , $d\sigma$ " | (<i>l</i> ₁), <i>l</i> ₂ "', <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>), <i>m</i> , <i>n</i> , ε , ω_1 , $ft''\omega_2$ |
| II | – | <i>d</i> , (<i>l</i> ₁), <i>l</i> ₂ "', <i>bv</i> "', <i>v</i> "' | (<i>l</i>), $d\sigma$ | (<i>l</i> ₁), <i>l</i> ₂ "', <i>v</i> ' φ | (<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), ω_1 , ω_2 |
| III | <i>l</i> ' φ | <i>d</i> , <i>l</i> ₁ ' φ , <i>l</i> ₂ ' φ , <i>ev</i> ' | <i>l</i> ' φ , $d\sigma$ | <i>d</i> , <i>l</i> ' φ , <i>v</i> ' φ | <i>ft</i> "', (<i>tc</i>), <i>it</i> ' (<i>u</i>), <i>a</i> ' φ , <i>s</i> , <i>pv</i> ' |
| IV | <i>l</i> ' φ | <i>d</i> , <i>l</i> ' φ , <i>ev</i> ' | <i>l</i> ' φ , $d\sigma$ | <i>d</i> , <i>l</i> ' φ , <i>v</i> ' φ | <i>ft</i> "', (<i>tc</i>), <i>p</i> ' (<i>u</i>), <i>a</i> ' φ , <i>s</i> , <i>pv</i> ' |

Roman letters refer to normal setae (ε — famulus), Greek letters refer to solenidia, $d\sigma$ and $ft\omega$ — seta and solenidion coupled. One apostrophe (') marks setae on anterior and double apostrophe (") setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

pairs of lateral setae on epimere II (20–24) and others (16–18).

Anogenital region. Transverse genital furrow distinct. Antero-lateral pair and two pairs of postero-lateral genital setae longer (28–32) simple, smooth; other seven pairs of setae (16–20) with short cilia. Two pairs of anal setae (*an*₁, *an*₂, 32–41) setiform, ciliate. Anterior pair of adanal setae (*ad*₄, 41–53) similar to anal setae in morphology, other three pairs (*ad*₁, 73–77, *ad*₂, 69–73, *ad*₃, 57–65) thickened in medio-basal part, with short cilia, and thin, smooth apex. One pair of ventrolateral bands present. Lyrifissures *iad* distinct.

Legs. Generally, morphology of leg segments, setae and solenidia typical for *Papillacarus* (see Ermilov and Anichkin 2011, Ermilov et al. 2012d). All legs with one claw, with small tooth on ventral side. Femora with large ventral ridge. Formulas of leg setation and solenidia: leg I (0–5–3–4–18) [2–1–2], leg II (0–6–3–4–13) [1–1–2], leg III (2–4–2–3–9) [1–1–0], leg IV (2–3–2–3–9) [1–0–0]; homology of setae and solenidia indicated in Table 1. Famulus (ε) tubercle-like.

Material examined. Holotype and two paratypes: Southern Vietnam, Dong Nai Province, Dong Nai Culture and Nature Reserve, 11°18'N, 107°04'E, dipterocarp forest, ferralitic soil, 12.03.2014 (collected by A.E. Anichkin and S.G. Ermilov). One paratype: southern Vietnam, Binh Phuoc Province, Bu Gia Map National Park, 12°11'31,28"N, 107°12'13,06"E, 601 m a.s.l., dipterocarp forest, dark loamy soil, 13–14.09.2013 (collected by A.E. Anichkin and S.G. Ermilov).

Type deposition. The holotype is deposited in the collection of the Senckenberg Institution Frankfurt, Germany; three paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology. The word *luteus* is Latin meaning “yellow” and refers to the yellow color of the body of a new species.

Remarks. *Papillacarus luteus* Ermilov sp. n. is most similar to *P. cruzae* Corpuz-Raros, 1979 and *P. ramirezae* Corpuz-Raros, 1979 from the Philippines (see Corpuz-Raros 1979) in having the strong notogastral neutrichy, short and branched neutrichal setae and long, setiform lateral notogastral setae. However, the new species differs clearly from both by the notogastral setae *c*₁, *d*₁ and *e*₁ of medium size, shorter than lateral setae in two times (versus shorter in several times in *P. cruzae* and *P. ramirezae*). Also, the new species differs from *P. cruzae* by the smaller number of neutrichal setae (less than 50 pairs versus more than 60 pairs in *P. cruzae*), and from *P. ramirezae* by the truncated rostrum (versus with central tooth in *P. ramirezae*).

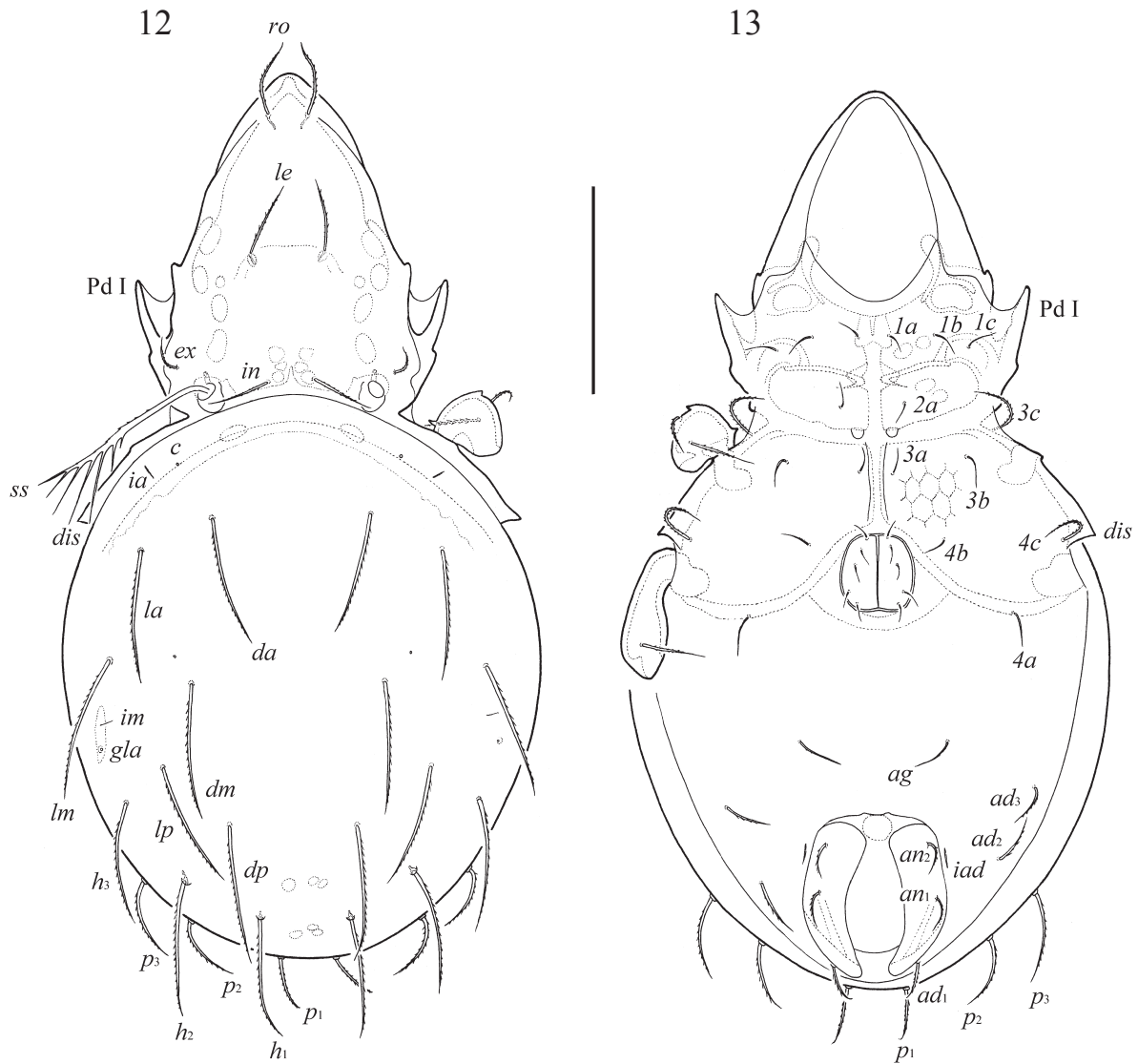
Multioppia pseudoglabra Ermilov sp. n.

Figs 12–21

Diagnosis. Body size: 431–481 × 232–249. Rostrum rounded. Rostral, lamellar and interlamellar setae simple, barbed, little differ in length. Bothridial setae with thickened medio-distal part, having seven to eight branches unilaterally. Twelve pairs of long, setiform, densely barbed notogastral setae and one pair of setal alveoli (*c*). Setae *lm* inserted postero-laterally to *la*. Epimeral setae *3c* and *4c* barbed and longer than smooth others. Genital setae smooth, aggenital and adanal setae barbed.

Description. Measurements. Body length: 464 (holotype), 431–481 (five paratypes); notogaster width: 249 (holotype), 232–249 (five paratypes).

Integument. Body color light brown to brown. Body surface smooth.



Figs 12–13. *Multiopppia pseudoglabra* Ermilov sp. n.: 12 — dorsal view; 13 — ventral view (gnathosoma and legs except right trochanters III and IV not illustrated). Scale bar 100 μ m.

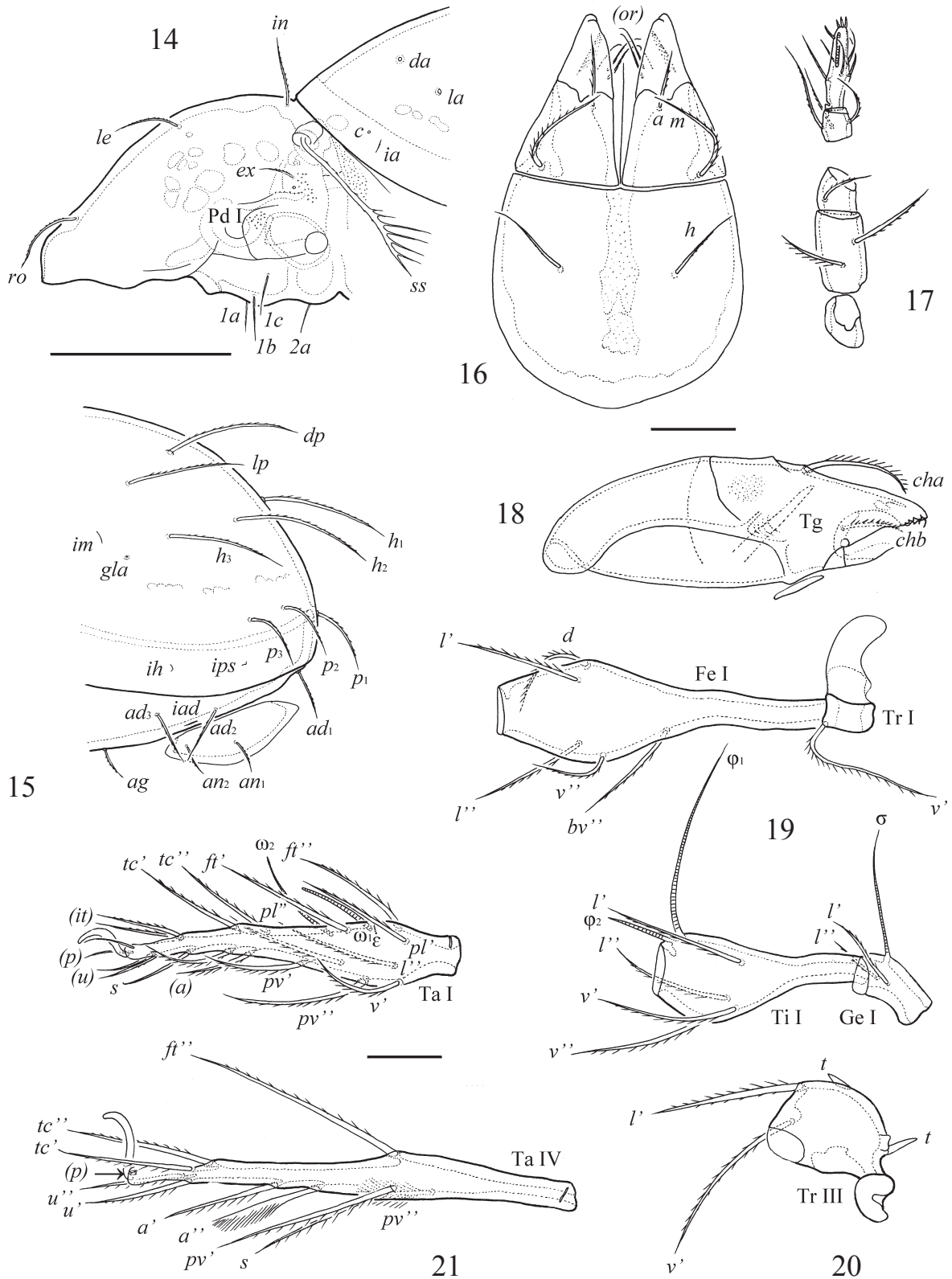
Prodorsum. Rostrum rounded. Lamellar and translamellar lines absent. Rostral (41–49), lamellar (36–41), interlamellar (41–49) and exobothridial (20–24) setae simple, barbed; lamellar and exobothridial setae thinner than others. Bothridial setae (86–94) with thickened medio-distal part (well developed head absent), having seven to eight branches on one side, and several small barbs on the opposite side. Interbothridial region with three pairs of muscle sigillae. Postbothridial present, rounded distally.

Notogaster. Anterior margin convex. One pair of alveoli (setae *c*) and twelve pairs of long (p_1 – p_3 , 41–53; others 65–73), setiform, densely barbed (more than nine barbs visible) notogastral setae present. Setae *lm* inserted postero-laterally to *la*. Lyrifissures *ia*, *im*, *ip*, *ih* and *ips* distinct.

Opisthonotal gland openings (*gla*) located posteriorly to *im*.

Gnathosoma. Generally, morphology of subcapitulum, palps and chelicerae typical for *Multiopppiinae* (see Ermilov and Anichkin 2013). Subcapitulum longer than wide (94–98 \times 65). Subcapitular setae setiform; *h* (20) with attenuate tip, indistinctly barbed, *m* (24–28) and *a* (16–20) barbed. Two pairs of adoral setae (12) thin, smooth. Palps (61–65) with setation 0–2–1–3–9(+ ω). Solenidion thickened, blunt-ended, pressed to the palptarsus surface. Chelicerae (94–98) with two setiform, barbed setae, *cha* (26–28) longer than *chb* (16). Trägårdh's organ long, tapered.

Epimeral and lateral podosomal regions. Epimeral setal formula: 3–1–3–3. Setae setiform;



Figs 14–21. *Multioppia pseudoglabra* Ermilov sp. n.: 14 — lateral view of prodorsum and anterior part of notogaster; 15 — lateral view of posterior part of notogaster; 16 — subcapitulum, ventral view; 17 — palp; 18 — chelicera; 19 — leg I, right, paraxial view; 20 — trochanter III, left, paraxial view; 21 — tarsus IV, right, antiaxial view. Scale bars (14, 15) 100 μ m, (16–21) 20 μ m.

3c and 4c (41–45) barbed, others smooth (1a, 2a, (Pd I) scale-lake in lateral view. Discidia (dis) well developed, pointly triangular.
3a, 4b, 16–20; 1b, 1c, 3b, 4a, 28–32). Pedotecta I

Table 2.

Leg setation and solenidia of *Multioppia pseudoglabra* Ermilov sp. n.

| Leg | Trochanter | Femur | Genu | Tibia | Tarsus |
|-----|------------|-------------------|--------|---|---|
| I | v' | d, (l), bv'', v'' | (l), 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), 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 | fi'', (tc), (p), (u), (a), s, (pv) |

See Table 1 for explanations.

Anogenital region. Five pairs of genital setae (g_1 – g_5 , 12–16) thin, smooth. One pair of aggenital (ag , 36–45), two pairs of anal (20–24) and three pairs of adanal (ad_1 , 28–41; ad_2 , ad_3 , 36–45) setae setiform, barbed. Adanal lyrifissures located in paraanal position.

Legs. Generally, morphology of leg segments, setae and solenidia typical for Multioppiinae (see Ermilov and Anichkin 2013). Trochanters III with two teeth (small, lateral tooth and elongated, posterior tooth). Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [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 2. Seta p setiform on tarsus I and very small, thorn-like on tarsi II–IV. Famulus straight, with indistinct swollen distally, blunt-ended.

Material examined. Holotype and three paratypes: southern Vietnam, Dong Nai Province, Dong Nai Culture and Nature Reserve, 11°18'N, 107°04'E, dipterocarp forest, ferralitic soil, 12.03.2014 (collected by A.E. Anichkin and S.G. Ermilov). One paratype: Southern Vietnam, Binh Phuoc Province, Bu Gia Map National Park, 12°11'31,28"N, 107°12'13,06"E, 601 m a.s.l., dipterocarp forest, dark loamy soil, 13–14.09.2013 (collected by A.E. Anichkin and S.G. Ermilov). One paratype: southern Vietnam, Binh Phuoc Province, Bu Gia Map National Park, 12°12'06,72"N, 107°12'16,00"E, 398 m a.s.l., mixed wood-bamboo forest in the middle of the slope of the hill, dark loamy soil, 13–14.09.2013 (collected by A.E. Anichkin and S.G. Ermilov).

Type deposition. The holotype is deposited in the collection of the Senckenberg Institution Frankfurt, Germany; five paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology. The prefix *para* is Latin meaning “near” and refers to similarity between the new species and the species *Multioppia glabra* (Mihelčič, 1955).

Remarks. *Multioppia pseudoglabra* Ermilov sp. n. is most similar to *Multioppia glabra* (Mihelčič, 1955) from Europe (see Moritz 1971; Seniczak 1975; Vasiliu and Ivan 2009) in having body of medium size, long and ciliate notogastral setae, prodorsal setae of medium size, and barbed and thickened bothridial setae with seven to eight branches unilaterally. However, the new species differs from the latter by localization of notogastral setae lm (postero-laterally versus in postero-medially or medially in *M. glabra*) and densely ciliate notogastral setae (versus sparse ciliate in *M. glabra*).

ACKNOWLEDGEMENTS

The author extends many thanks to Dr. Josef Starý (Institute of Soil Biology, České Budějovice, Czech Republic), Dr. Umukusum Shtanchaeva (Universidad Complutense de Madrid, Madrid, Spain), Prof. Dr. Luis S. Subías (Universidad Complutense de Madrid, Madrid, Spain) and Prof. Dr. Gerd Weigmann (Free University of Berlin, Institute of Zoology, Berlin, Germany) for consultations, and Dr. Alexander E. Anichkin (Institute of Ecological and Evolutionary Problems, RAS, Moscow, Russia) for sampling assistance. The reported study was supported by the Russian Foundation for Basic Research (project 14-04-31183 mol_a).

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