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A new species of *Scheloribates* (Acari, Oribatida, Scheloribatidae) from Vietnam, with key to the *striolatus*-group

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Abstract

A new species of oribatid mite, *Scheloribates daoensis* **sp. nov.** is described from grass rhizosphere of meadow in the Tam Dao National Park, Northern Vietnam. It is morphologically most similar to *S. striolatus* Balogh, 1960, but differs by the body size, the morphology of bothridial setae, the length of circumpedial carinae and the distance between sacculi *SI–SI*. An identification key to known species/subspecies of *striolatus*-group of *Scheloribates* is provided.

Key words: Scheloribatidae, systematics, morphology, new species, key, Vietnam.

Introduction

Scheloribates Berlese, 1908 is a largest genus of oribatid mites of the family Scheloribatidae. The genus has several subgenera, and the nominal subgenus is currently comprised of 271 species and 20 subspecies, which have a cosmopolitan distribution, collectively (Subías 2004, updated 2016).

During taxonomic survey of oribatid mites from Northern Vietnam, we found a new species belonging to *Scheloribates*. Earlier, only 11 species and one subspecies of this genus were reported from this country (e.g. Ermilov *et al.* 2012; Ermilov & Anichkin 2013, 2014; Ermilov 2015, 2016). The main purpose of the paper is to describe and illustrate a new species and to present an identification key to known representatives of the *striolatus*-group of *Scheloribates*.

Material and Methods

Material examined. Holotype (female) and two paratypes (two males): Northern Vietnam, Tam Dao, 950 m a.s.l., meadow, sample (No. VIE-125) of grass rhizosphere, 17.X.1988 (collected by J. Starý & Nguen Tri Tien).

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 ventral plate. Notogastral width refers to the maximum width behind pteromorphs 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 & Vachon (1975) for references, Norton (1977) for leg setal nomenclature, and Norton & Behan–Pelletier (2009), for overview. Drawings were made with a camera lucida using a Leica transmission light microscope “Leica DM 2500”.

Description of new species

Scheloribates (Scheloribates) daoensis sp. nov.

(Figs 1–11)

Diagnosis. Body size: 465–531 × 265–348. Translamellar line represented by two short, rudimentary parts. Prolamellae complete. Rostral, lamellar and interlamellar setae long, setiform, barbed, *ro* shortest, *in* longest. Bothridial setae spindle-form, barbed unilaterally, apex longer than heads. Notogastral setae minute. Distance between pair of sacculi *S1–S1* longer than that of *S2–S2*. Epimeral and anogenital setae thin, slightly barbed. Lateral leg claws each with small tooth ventrodistally. Leg tarsi I with 19 setae (*v* present, *l* absent).

Description. *Measurements.* Body of medium size, one female larger than two males. Body length: 531 (holotype, female), 465, 481 (two paratypes, two males); notogastral width: 348 (holotype), 265, 298 (two paratypes).

Integument (Figs 1–4). Body color light brown. Body surface microporose (visible under high magnification, × 1000). Lateral parts of prodorsum microgranulate. Notogaster, ventral parts of pedotecta I and lateral sides of anal plates and ano-adanal region heavily striate.

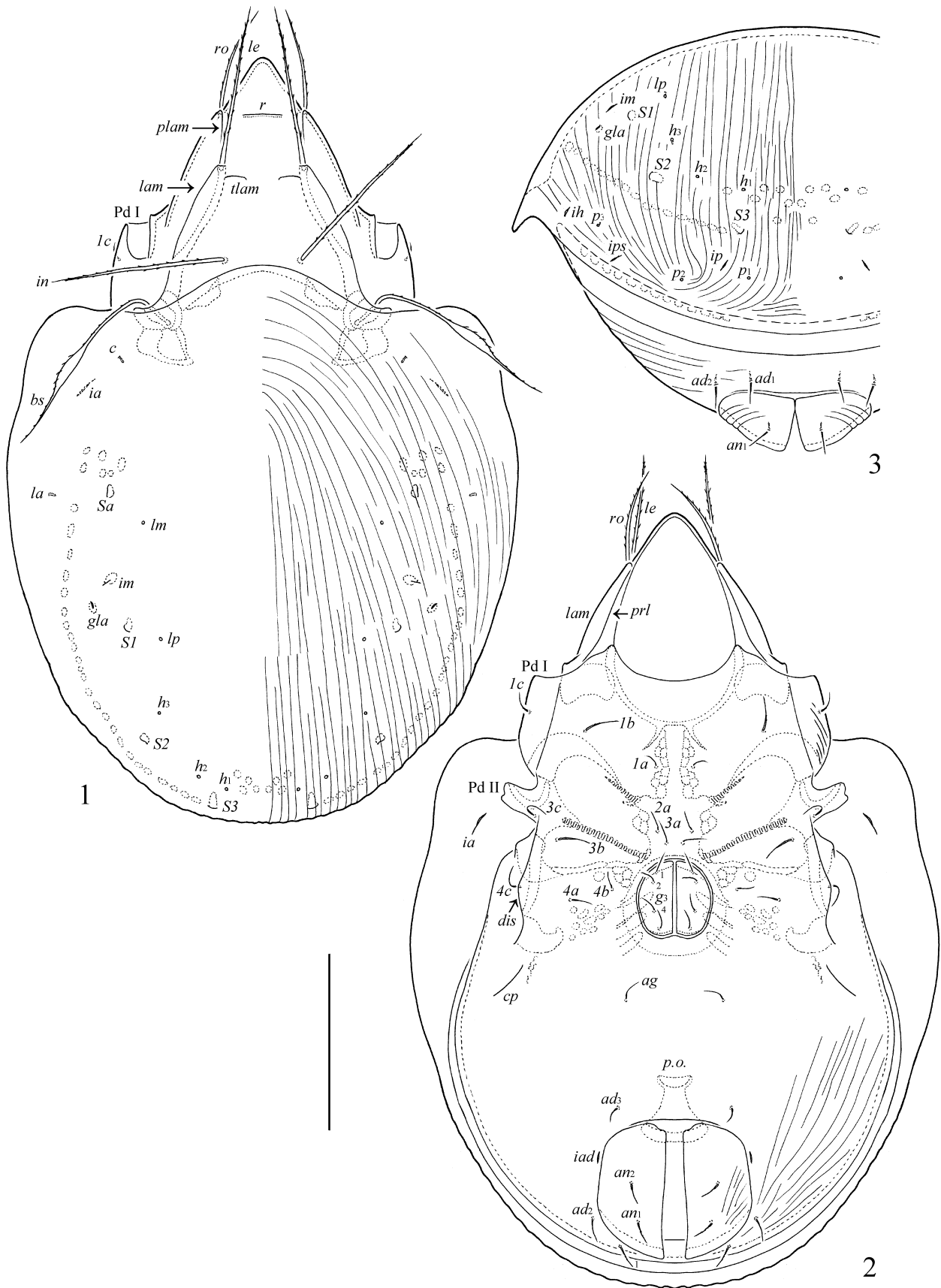
Prodorsum (Figs 1, 2, 4). Rostrum narrowly rounded. Lamellae (*lam*) located dorso-laterally, as long as half of prodorsum (measured in lateral view). Prolamellae (*plam*) complete, lineate, curving backwards distally. Sublamellae (*slam*) thin, little shorter than lamellae. Translamellar line (*tlam*) represented by two rudimentary parts (well separated medially) near lamellae. Sublamellar porose areas (*Al*) oval (8–10 × 6). Rostral (*ro*, 65–69), lamellar (*le*, 90–102) and interlamellar (*in*, 110–123) setae setiform, barbed. Bothridial setae (*bs*, 118–131) spindle-form, barbed unilaterally, stalks longest, heads shortest, well dilated, elongate oval, apex thin, setiform. Anterocentral transverse ridge (*r*), lateral keel-shaped ridges (*kf*) and lateral prodorsal ridges (*prl*) present. Exobothridial setae (*ex*, 22–24) thin, indistinctly barbed. Sejugal porose areas not visible.

Notogaster (Figs 1, 3, 4). Anterior notogastral margin convex medially. Dorsophragmata (*D*) semioval. Ten pairs of notogastral setae present, all minute (2), visible only under high magnification (× 1000). Four pairs of sacculi (*Sa*, *S1*, *S2*, *S3*) with small openings and channels, distance *S1–S1* longer than *S2–S2*. Setae *lp* inserted medially to *S1*. Lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) and opisthonotal gland openings (*gla*) clearly visible.

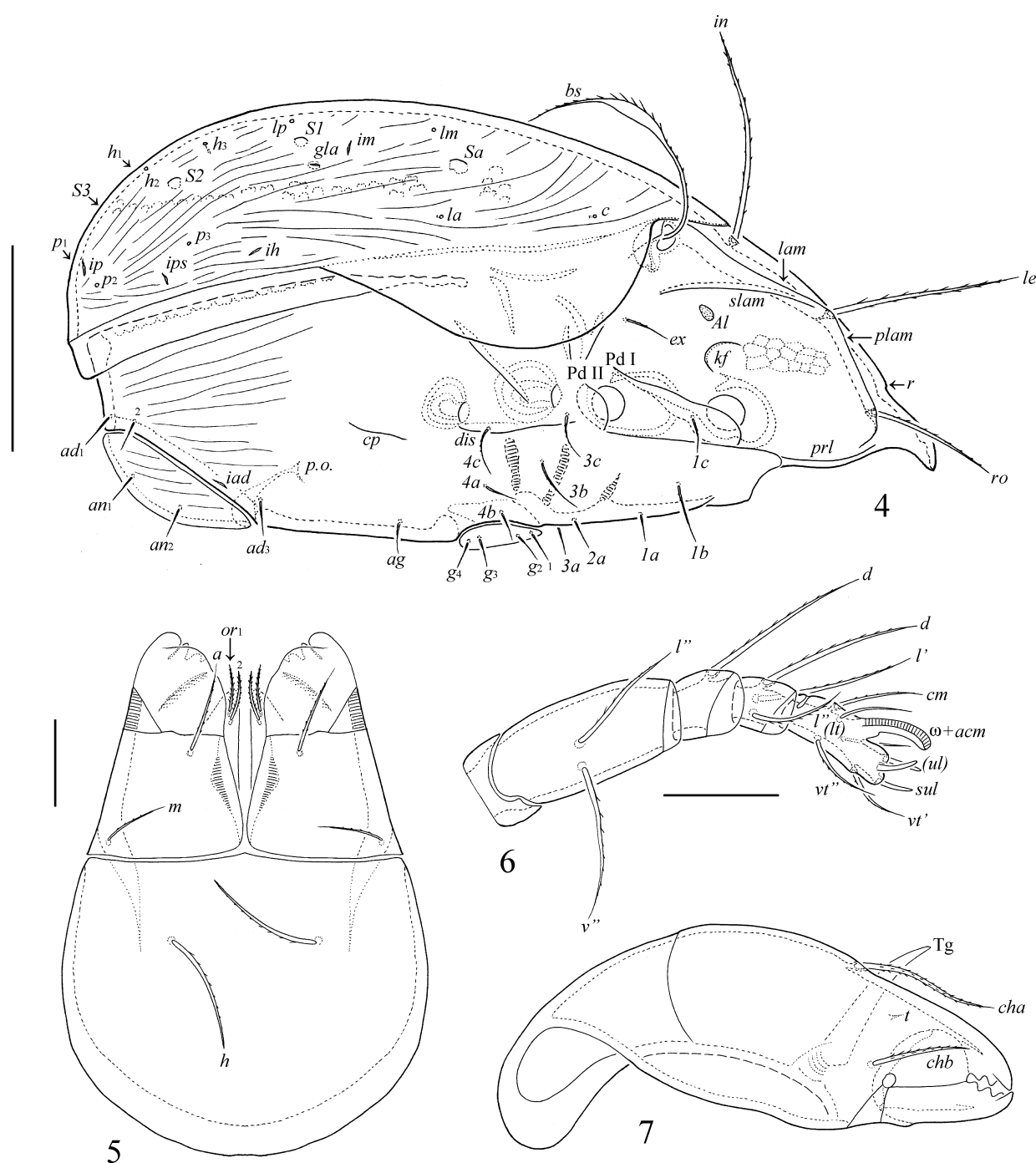
Gnathosoma (Figs 5–7). Subcapitulum longer than wide (98–123 × 73–82). Subcapitular setae setiform, barbed, *h* (30–32) longer and thicker than *a* (20–22), setae *m* shortest (14–16) and thinnest. Two pairs of adoral setae (*or*₁, *or*₂, 10–12) setiform, heavily ciliate. Palps (length 61–73) with setation 0–2–1–3–9(+∞). Solenidia slightly dilated anterodorsally. Postpalpal setae (4) spiniform, smooth. Chelicerae (length 98–123) with two barbed setae, *cha* (32–36) longer than *chb* (20–24). Trägårdh's (*Tg*) organ elongate triangular.

Epimeral and lateral podosomal regions (Figs 2, 4). Epimeral setal formula: 3–1–3–3. Setae thin, slightly barbed, *1a*, *1c*, *2a* and *3a* (12–16) shorter than other setae (24–32). Setae *1c* inserted ventrolaterally on pedotecta I. Pedotecta I (Pd I) and II (Pd II) represented by small laminae, Pd II trapezoid. Discidia (*dis*) slightly developed, elongate triangular. Circumpedial carinae (*cp*) very short.

Anogenital region (Figs 2, 4). Four pairs of genital (*g*_{1–g}₄), one pair of aggenital (*ag*), two pairs of anal (*an*₁, *an*₂) and three pairs of adanal (*ad*_{1–ad}₃) setae similar in length (12–16), setiform, slightly barbed. Adanal lyrifissures (*iad*) located close and parallel to anal plates. Preanal organ (*p.o.*) trapezoid in ventral view.

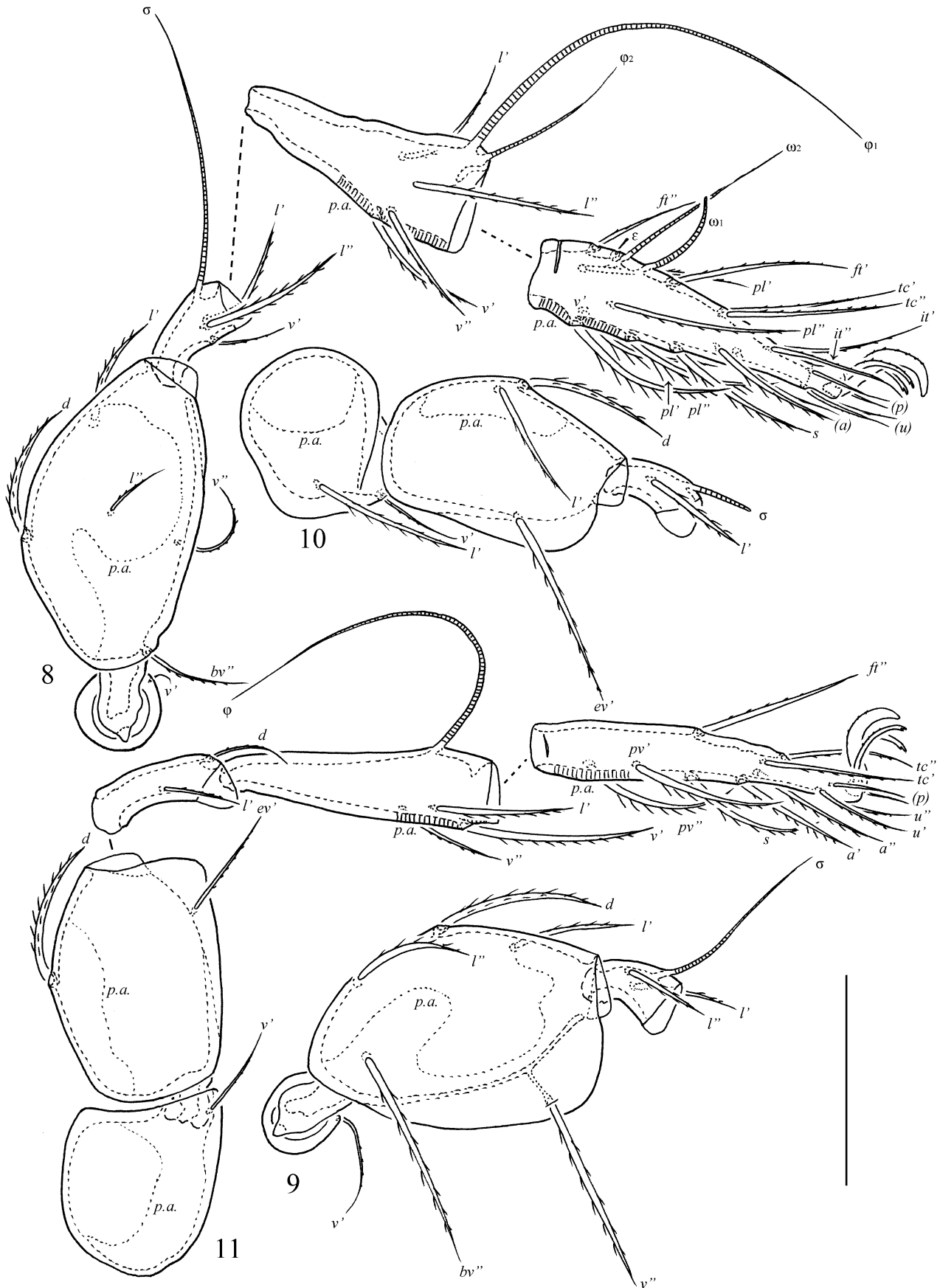


Figures 1–3. *Schelorbates (Scheloribates) daoensis* sp. nov.: 1 — dorsal view; 2 — ventral view (gnathosoma and legs not shown); 3 — posterior view (part of right half not shown); Scale bar 100 μ m.



Figures 4–7. *Scheloribates (Scheloribates) daoensis* sp. nov.: 4 — lateral view (gnathosoma and legs not shown); 5 — subcapitulum, ventral view; 6 — palp, right, antiaxial view; 7 — chelicera, right, antiaxial view. Scale bar 100 μ m (4), 20 μ m (5, 7; 6).

Legs (Figs 8–11). Median claw thicker than laterals, all serrate on dorsal side; lateral claws each with small tooth ventrodistally. Dorso-paraxial porose areas (*p.a.*) on femora I–IV and trochanters III, IV and ventral porose areas in basal parts of tarsi and distal parts of tibiae well visible. 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. Solenidia ω_1 on tarsi I, ω_1 and ω_2 on tarsi II and σ on genua III thickened, blunt-ended, other solenidia longer, setiform. Famuli short, straight, slightly dilated and truncated distally, inserted posterior to solenidia ω_2 .



Figures 8–11. *Schelorbates (Scheloribates) daoensis* sp. nov.: 8 — leg I, right, antiaxial view; 9 — trochanter, femur and genu of leg II, right, antiaxial view; 10 — trochanter, femur and genu of leg III, left, antiaxial view; 11 — leg IV, left, antiaxial view. Scale bar 50 μ m.

Type deposition. The holotype is deposited in the collection of the Senckenberg Institute, Görlitz, Germany; two paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

Etymology. The specific name *daoensis* refers to the second part of the name of the Tam Dao National Park, Northern Vietnam, where the new species was collected.

Remarks. *Scheloribates daoensis* **sp. nov.** is morphologically most similar to *S. striolatus* Balogh, 1960 from Madagascar in having striate notogaster, spindle-form bothridial setae and rudimentary parts of translamellar line. However, the new species differs from the latter by the smaller body size (465–531 × 265–348 *vs.* 700 × 498), bothridial setae with apex longer head (*vs.* apex shorter than head), very short circumpedal carinae (*vs.* long) and distance between sacculi *S1–S1* longer than *S2–S2* (*vs.* shorter).

Table 1. Leg setation and solenidia of *Scheloribates daoensis* **sp. nov.** [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. Tr – trochanter, Fe – femur, Ge – genu, Ti – Tibia, Ta – tarsus].

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>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>v'</i> , (<i>pl</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>), σ	(<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>l'</i> , σ	<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>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>)

Striolatus-group in the subgenus *Scheloribates*

Known species of *Scheloribates* with entire or partially striate (forming sometimes reticulate pattern) notogaster (lines present also on ventral side in some species) can be ascribed to *striolatus*-group (we use this group's name for the first time). At present, this group can be encompassed 10 species (including present new species) and one subspecies. Some species (e.g. *S. schauenbergi* Mahunka, 1988, *S. rugosus* Hammer, 1958) having stria only on the pteromorphs are not included in this newly proposed group.

Key to known species/subspecies of the *striolatus*-group in the subgenus *Scheloribates*

1	Only posterior part of notogaster with striate pattern; body size: 457–564 × 293–400.....	2
- <i>S. yamaeensis</i> Nakamura, Hashimoto, Nishi, Nakamura & Fujikawa, 2015. Distribution: Japan	
	Entire notogaster with striate pattern.....	2
2	Notogastral stria forming reticulate pattern.....	3
-	Notogastral stria well separated, not forming reticulate pattern.....	6
3	Eleven pairs of notogastral setae present (<i>c</i> ₃ present); body size: 574 × 331.....	
- <i>S. labyrinthicus labyrinthicus</i> Jeleva, 1962 (see Csiszár & Jeleva 1962). Distribution: Mediterranean	
	Ten pairs of notogastral setae present (<i>c</i> ₃ absent).....	4
4	Heads of bothridial setae slightly dilated, narrowly lanceolate; body size: 575–615 × 322–405.....	
- <i>S. sergienkoae</i> Subbotina, 1987. Distribution: southern Mediterranean	
	Heads of bothridial setae well dilated, fusiform to clavate.....	5
5	Bothridial setae clavate, with heads rounded distally; notogastral sacculi with long openings; body size: 460 × 300.....	
 <i>S. polygonatus</i> Balogh & Mahunka, 1974. Distribution: Cuba	

-	Bothridial setae fusiform, with heads narrowed distally; notogastral sacculi with short openings; body size: 540–576 × 370–396	<i>S. labyrinthicus oscensis</i> Pérez-Íñigo jr., Herrero & Pérez-Íñigo, 1987. Distribution: Spain
6	Heads of bothridial setae with well developed distal apex	7
-	Heads of bothridial setae without distal apex	8
7	Apex of bothridial setae longer than heads; distance between sacculi <i>S1–S1</i> longer than that of <i>S2–S2</i> ; body size: 465–531 × 265–348.....	<i>S. daoensis</i> sp. nov. Distribution: Vietnam
-	Apex of bothridial setae shorter than heads; distance between sacculi <i>S1–S1</i> shorter than that of <i>S2–S2</i> ; body size: 700 × 498	<i>S. striolatus</i> Balogh, 1960. Distribution: Madagascar
8	Translamellar line complete, with two median arch-like structures; body length: 575	<i>S. biarcualis</i> Hammer, 1973. Distribution: Polynesia
-	Translamellar line represented by two rudimentary parts near lamellae or absent	9
9	Prodorsum sparsely foveolate; interlamellar setae shorter than lamellar setae; body size: 273 × 121 ...	<i>S. multirepetitus</i> Subías, 2004 (= <i>Incabates striatus</i> Corpuz-Raros, 1980) (see Corpuz-Raros 1980). Distribution: Philippines
-	Prodorsum not foveolate; interlamellar setae longer than lamellar setae	10
10	Bothridial setae clavate, with heads rounded distally; body size: 485–545 × 324–424	<i>S. guhitanus</i> Corpuz-Raros, 1980. Distribution: Philippines
-	Bothridial setae fusiform, with heads narrowed distally; body size: 538–618 × 436–490	<i>S. viguerasis</i> Scull, Jeleva & Cruz, 1984. Distribution: Cuba

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