

TAXONOMIC CONTRIBUTION TO THE KNOWLEDGE
OF THE ORIBATID MITE SUBGENUS
SCHELORIBATES (*PERSCHELORIBATES*)
(ACARI, ORIBATIDA, SCHELORIBATIDAE)

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A new species of *Scheloribates* (*Perscheloribates*) (Oribatida, Scheloribatidae) – *S. (P.) oromiaensis* sp. n. – is described from mosses on the swamp at the top of the mountain in Arsi Mountains National Park, Ethiopia; the new species differs from the related species *S. (P.) ethiopicus* by the larger body size, rounded rostrum and pedotectum II, the absence of prolamella, and the presence of aggenital seta. The taxonomic status of *Perscheloribates* is discussed, resulting in the supporting of it on the subgeneric level within *Scheloribates*. An identification key to known species of *Scheloribates* (*Perscheloribates*) from the Afrotropical region is provided.

Key words: oribatid mites, taxonomy, morphology, identification key, Afrotropical region.

INTRODUCTION

The oribatid mite subgenus *Scheloribates* (*Perscheloribates*) (Acari, Oribatida, Scheloribatidae) was proposed by HAMMER (1973) as the independent genus *Perscheloribates* (see Discussion section below), with *Perscheloribates clavatus* Hammer, 1973 as type species. Currently, the subgenus comprises about 50 species, distributed in the tropical and subtropical areas (SUBÍAS 2022), inhabiting various substrates but preferring the soil-litter. The subgeneric traits were given by several authors, e.g., HAMMER (1973), CORPUZ-RAROS (1980), BALOGH and BALOGH (1990, 1992). The identification keys for some species were presented by BALOGH and BALOGH (1990, 2002), ERMILOV *et al.* (2011), ERMILOV and MARTENS (2014).

The main goals of our paper are: to describe and illustrate one new species of *Scheloribates* (*Perscheloribates*) collected from Ethiopia; to discuss the taxonomic status of *Perscheloribates*; and the to update and modify (after ERMILOV *et al.* 2011) an identification key to known species of the subgenus from the Afrotropical region.

Presently, four species of *Scheloribates* (*Perscheloribates*) have been registered in Ethiopian fauna (e.g., ERMILOV *et al.* 2012, 2022a): *S. (P.) crassisetosus*

Ermilov, Rybalov et Franke, 2011; *S. (P.) ethiopicus* (Mahunka, 1986); *S. (P.) luminosus* (Hammer, 1961); and *S. (P.) minutus* (Pletzen, 1965).

METHODS

Specimens – Substrate samples (litter) containing oribatid mites were collected using a stainless-steel frame (50×50 cm) with a sieve (mesh size 2 × 2 cm). Mites were extracted into 75% ethanol using Berlese's funnels with electric lamps in laboratory conditions.

Observation and documentation – For measurement and illustration, specimens were mounted in lactic acid on temporary cavity slides. All measurements are in micrometres. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster; other structures were oriented to avoid parallax errors. Notogastral widths refer to the maximum at the level of pteromorphs and behind them in dorsal aspect. Setal lengths were measured perpendicular to their long axis, accounting for curvature. 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 DM 2500 light microscope.

Terminology – Morphological terminology used in this paper mostly follows that of Grandjean: see TRAVÉ and VACHON (1975) for references; NORTON (1977) for leg setal nomenclature; and NORTON and BEHAN-PELLETIER (2009) for overview.

Abbreviations – The following morphological abbreviations are used: Prodorsum: *lam* = lamella; *slam* = sublamella; *Al* = sublamellar porose area; *kf* = keel-shaped ridge; *ro*, *le*, *in*, *bs*, *ex* = rostral, lamellar, interlamellar, bothridial, and exobothridial seta, respectively; *Ad* = dorsosejugal porose area; *D* = dorsophragma; *P* = pleurophragma. Notogaster: *c*, *la*, *lm*, *lp*, *h*, *p* = notogastral setae; *Sa*, *S1*, *S2*, *S3* = sacculi; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. Gnathosoma: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *cm*, *acm*, *ul*, *su*, *lt*, *vt*, *inf*, *sup* = palp setae; ω = palp solenidium; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. Epimeral and lateral podosomal regions: *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c* = epimeral setae; *PdI*, *PdII* = pedotectum I and II, respectively; *z* = aperture of supracoxal gland; *Ah* = humeral porose area; *dis* = discidium; *cir* = circumpedal carina. Anogenital region: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal seta, respectively; *iad* = adanal lyrifissure; *Amar* = marginal porose area; *p.o.* = preanal organ. Legs: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = leg trochanter, femur, genu, tibia, and tarsus, respectively; *p.a.* = porose area; ω , σ , φ = solenidia; ε = famulus; *d*, *l*, *v*, *ev*, *bv*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae.

Taxonomy

Family Scheloribatidae

Genus *Schelorbates* Berlese, 1908

Subgenus *Schelorbates* (*Perschelorbates*) Hammer, 1973

Type species: *Perschelorbates clavatus* Hammer, 1973

***Schelorbates* (*Perschelorbates*) *oromiaensis* sp. n.**

(Figs 1, 2)

Diagnosis – Body length: 375–420. Rostrum rounded. Prolamella and translamella completely absent. Rostral, lamellar and interlamellar setae long,

setiform, barbed; *ro* shortest, *in* longest; bothridial seta long, clavate or fusiform, barbed. Notogastral setae short, flexible, smooth. Epimeral and anogenital setae short, setiform, roughened. Circumpedal carina long. Leg tarsus I with 19 setae (*l''* absent, *v'* present).

Description of adult – *Measurements*. Body length: 390 (holotype: male); 375–420 (56 paratypes: 28 males and 28 females); notogaster width: 270 (holotype, at level of pteromorphs), 240 (holotype, behind pteromorphs); 255–300 (paratypes, at level of pteromorphs), 225–270 (paratypes, behind pteromorphs). No difference between males and females in body size.

Integument. Body colour light brown. Cuticle smooth; lateral side of body with dense microgranulate cerotegument between bothridium and acetabula I–III.

Prodorsum. Rostrum rounded. Lamella about 1/2 length of prodorsum; prolamella absent; sublamella linear, about 2/3 length of lamella; translamella completely absent; lateral keel-shaped ridge distinct. Sublamellar porose area rounded (5–7). Rostral (56–64), lamellar (82–93) and interlamellar (112–120) setae setiform, barbed; *ro* thinner than *le* and *in*; exobothridial seta (15–19) setiform, thin, roughened; bothridial seta (71–79) with long, smooth stalk and shorter, clavate (rounded distally) or fusiform (narrowed distally), barbed head. Bothridium with lateral scale. Dorsosejugal porose area present, small, diffuse.

Notogaster. Anterior notogastral margin slightly convex medially. Ten pairs of notogastral setae (17–19) thin, flexible, smooth. Notogastral sacculi with small opening and drop-like channel. Opisthotal gland opening and all lyrifissures distinct.

Gnathosoma. Subcapitulum size: 94–101 × 75–79; subcapitular (*a*: 19–22; *m*: 15–19; *h*: 26–28) and adoral (11) setae setiform, barbed; *m* thinner than *a* and *h*. Palp length: 52–57; setation: 0-2-1-3-9(+ ω); postpalpal seta (7) spiniform, smooth. Chelicera length: 94–101; setae (*cha*: 30–34; *chb*: 19–21) setiform, barbed.

Epimeral and lateral podosomal regions. Epimeral formula: 3-1-3-3; setae (3*c*, 4*b*, 4*c*: 26–30; 1*b*, 3*b*, 4*a*: 22–26; 1*a*, 1*c*, 2*a*, 3*a*: 15–19) setiform, thin, roughened. Humeral porose area *Am* not observed, *Ah* diffuse. Pedotectum II rounded in ventral aspect. Discidium triangular. Circumpedal carina long, anteriorly reaching pedotectum II.

Anogenital region. Genital (*g*₁: 22–26; others: 15–19), aggenital (19), anal (19), and adanal (19) setae setiform, thin, roughened. Adanal lyrifissure distinct. Marginal porose area band-like, complete. Ovipositor size: 134 × 37; blade (52) shorter than length of distal section (beyond middle fold; 82); each of the three blades with four smooth setae, $\psi_1 \approx \tau_1$ (30) setiform, $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$ (15) thinly thorn-like; six coronal setae (4) spiniform.

Table 1. Leg setation and solenidia of adult *Schelorbates* (*Perschelorbates*) *oromiaensis* sp. n.

Leg	<i>Tr</i>	<i>Fe</i>	<i>Ge</i>	<i>Ti</i>	<i>Ta</i>
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>)

Note: Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus); single quotation mark (') designates setae on the anterior and double quotation mark (") setae on the posterior side of a given leg segment; parentheses refer to a pair of setae.

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 of tarsus I short, erect, slightly swollen distally, inserted posterior to solenidion ω_1 ; solenidion ω_1 on tarsus I, ω_1 and ω_2 on tarsus II and σ on genu III slightly bacilliform, other solenidia setiform.

Type material – Holotype (male) and 56 paratypes (28 males and 28 females): Ethiopia, Oromia Region, Arsi Zone, Arsi Mountains National Park, mountain near Digelu, 07°49'23.7"N, 039°23'32.9"E, 3882 m a.s.l., mosses on the swamp at the top of the mountain, 28.11.2021 (L. B. Rybalov).

Type deposition – The holotype and three paratypes are deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; 53 paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% ethanol solution with a drop of glycerol.

Etymology – The species name *oromiaensis* refers to the Oromia Region, where the new species was collected.

Remarks – In having long prodorsal setae (with *in* longest), well visible notogastral setae, and in the completely absence of translamella, *Scheloribates* (*Perscheloribates*) *oromiaensis* sp. n. is similar to *S. (P.) ethiopicus* (Mahunka, 1986). However, the new species can be distinguished from the later by the: larger body size (length: 375–420 versus 300–316); rounded (versus distinctly protruding) rostrum; absence (versus presence) of prolamella; rounded (versus slightly bifurcate) pedotectum II in ventral aspect; presence (versus absence) of aggenital seta.

DISCUSSION

The oribatid mite genus *Scheloribates* was proposed by BERLESE (1908). Later, the genus *Perscheloribates* (see HAMMER 1973) and the subgenus *Scheloribates* (*Bischeloribates*) (see MAHUNKA 1988) were described. Although the listed above taxa are morphologically similar, differing mainly only in the number of leg claws (one claw in representatives of *Perscheloribates*; two in *Scheloribates* (*Bischeloribates*); and three in *Scheloribates*), for many years, they had different taxonomic status: generic (*Scheloribates*, *Perscheloribates*) versus subgeneric (*Bischeloribates*). SUBÍAS (2004, online version 2016) proposed to consider representatives of *Perscheloribates* within *Scheloribates*, lowering the generic status of *Perscheloribates* to subgeneric status: *Scheloribates* (*Perscheloribates*). The support of subgenera within the genus based only on the number of leg claws often appears artificial and inappropriate because, for example, the number of claws may vary within individuals of the same species (e.g., WEIGMANN *et al.* 1993, ERMILOV *et al.* 2022b). However, in the case of *Scheloribates*, we previously agreed with the Subías's system of including *Bischeloribates* and *Perscheloribates* as subgenera for two reasons: firstly, cases of variation in the number of leg claws in individuals in *Scheloribates* are unknown, and,

secondly, the genus is very large (more than 270 species). Therefore, the creation of artificial subgeneric groups seems convenient for taxonomical orientation in *Scheloribates* and related taxa, but molecular and phylogenetic studies should be carried out in the future for a clearer understanding of the statuses of *Scheloribates*, *Bischeloribates* and *Perscheloribates*.

Key to Afrotropical *Scheloribates* (*Perscheloribates*) species

- | | | |
|---|--|---|
| 1 | Prolamella completely not developed | 2 |
| – | Prolamella partially or completely developed | 8 |
| 2 | Bothridial seta clavate (head distally rounded) or fusiform (head distally narrowed but without point) | 3 |
| – | Bothridial seta spindle-form (head distally with distinct protruding point) | 4 |
| 3 | Bothridial seta very short (only head visible in dorsal aspect), head nearly rounded; body length: 467–533. Distribution: Saint Helena, island in the southern Atlantic Ocean.
<i>S. (P.) abbreviatus</i> Wallwork, 1977 | |
| – | Bothridial seta comparatively long (head, stalk and opening of bothridium visible in dorsal aspect), head distinctly elongated; body length: 375–420. Distribution: Ethiopia.
<i>S. (P.) oromiaensis</i> sp. n. | |
| 4 | Translamella represented by two rudimentary parts near lamellae; only notogastral seta p_1 developed versus other setae represented by alveoli; body length: 481–531. Distribution: Ethiopia.
<i>S. (P.) paratranslamellatus</i> (Ermilov et Rybalov, 2014) | |
| – | Translamella completely not developed; all notogastral setae visible | 5 |
| 5 | Rostrum pointed; rostral region with short medial longitudinal ridge; body length: 415–482. Distribution: Afrotropical region.
<i>S. (P.) gabonensis</i> Ermilov et Frolov, 2021 | |
| – | Rostrum rounded; rostral region without longitudinal ridge | 6 |
| 6 | All notogastral setae medium-sized (distinctly longer than diameter of bothridium), flexible; body length: 350–365. Distribution: Tanzania.
<i>S. (P.) shiraensis</i> (Evans, 1953) | |
| – | All notogastral setae short (not longer than diameter of bothridium), simple | 7 |

- 7 Species large (length more 700); rostrum distinctly narrowed; body length: 715–847. Distribution: Saint Helena, island in the southern Atlantic Ocean.
S. (P.) reiteratus (Subías, 2004) (= *S. calcaratus* Wallwork, 1977)
- Species medium-sized (length less 500); rostrum broadly rounded; body length: 412–495. Distribution: Saint Helena, island in the southern Atlantic Ocean. *S. (P.) evanescens* Wallwork, 1977
- 8 Prolamella partially developed (distinctly not reaching insertion of rostral seta) 9
- Prolamella completely developed (reaching insertion of rostral seta) 10
- 9 Prolamella short (1/4 of distance *le-ro*); translamella completely not developed; all notogastral setae visible; species large (length more 600); body length: 660–715. Distribution: Saint Helena, island in the southern Atlantic Ocean *S. (P.) curvirhynchus* Wallwork, 1977
- Prolamella medium-sized (1/2 of distance *le-ro*); translamella represented by two rudimentary parts near lamellae; only notogastral seta p_1 developed versus other setae represented by alveoli; species small (length less than 300); body length: 239–281. Distribution: Senegal.
S. (P.) minimus (Mahunka, 1992)
- 10 Bothridial seta clavate (head distally rounded) or fusiform (head distally narrowed but without protruding point), or slightly unilaterally dilated 11
- Bothridial seta spindle-form (head distally with distinct point) 13
- 11 Translamella completely not developed; aggenital setae absent; rostrum slightly nasiform; species small (length less than 320); body length: 300–316. Distribution: Afrotropical region. *S. (P.) ethiopicus* (Mahunka, 1986)
- Translamella represented by two rudimentary parts near lamellae; aggenital setae present; rostrum broadly rounded; species medium-sized (length more than 400) 12
- 12 Lamellar seta thick (distinctly thicker than interlamellar seta); body length: 481–514. Distribution: Ethiopia.
S. (P.) crassisetosus (Ermilov, Rybalov et Franke, 2011)
- Lamellar seta not thick (not thicker than interlamellar seta); body length: 420. Distribution: Pantropical area. *S. (P.) luminosus* Hammer, 1961
- 13 Translamella completely not developed; body length: 330–360. Distribution: South Africa. *S. (P.) rustenburgensis* Pletzen, 1963

- Translamella represented by two rudimentary parts near lamellae 14
- 14 Bothridial seta smooth; only notogastral seta p_1 developed versus other setae represented by alveoli; body length: 405–423. Distribution: South Africa. *S. (P.) tzitzikamaensis* Pletzen, 1965
- Bothridial seta barbed; all notogastral setae visible; body length: 343–378. Distribution: South Africa. *S. (P.) minutus* Pletzen, 1965

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Acknowledgements – The work was performed within the framework of the Joint Russian-Ethiopian Biological Expedition, financially supported by the Russian Academy of Sciences. We are grateful to Dr. Gezahegn Degefe for supporting the field studies and organizing laboratory work. Collecting of materials was conducted under the current Agreement of 17.12.2020 between the Russian Academy of Sciences and the Ministry of Science and Technology (Ministry of Innovation and Technology) of the Federal Democratic Republic of Ethiopia. This research was supported by the cooperative agreement No. FEWZ-2021-0004 from the Russian Ministry of Science and Higher Education.

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Revised version submitted December 30, 2022; accepted December 31, 2022; published February 28, 2023