

A NEW SPECIES OF *PERSCHELORIBATES* (ACARI, ORIBATIDA, SCHELORIBATIDAE) FROM NEPAL WITH A KEY TO ALL SPECIES OF THE GENUS FROM THE ORIENTAL REGION

S. G. Ermilov¹ and J. Martens²

¹Tyumen State University, Tyumen, Russia; e-mail: ermilovacari@yandex.ru

²Johannes Gutenberg University, Mainz, Germany; e-mail: martens@uni-mainz.de

ABSTRACT. A new species of oribatid mites, *Perscheloribates nepalensis* sp. n. (Scheloribatidae), is described from Nepal. This species is morphologically similar to *P. interlamellaris* Ermilov, Chatterjee et Marshall, 2013 from Brunei. However, it differs from the latter by the presence of only one pair of notogastral setae p_1 , rudimentary parts of translamellar line and a short basal part of prolamellar lines, absence of exobothridial setae and barbs on sensilli, and the distance between lamellar setae. An identification key to subgenera and species of *Perscheloribates* from the Oriental region is provided.

KEY WORDS: oribatid mites, *Perscheloribates*, new species, key, Nepal, Oriental region

INTRODUCTION

The oribatid mite fauna (Acari: Oribatida) of Nepal is studied insufficiently (Aoki 1965*a, b*, 1967; Sheals 1965; Piffil 1971, 1972; Travé 1977; Niedbała 1982, 1984, 2000; Nübel-Reidelbach and Woas 1992; Ermilov et al. 2013*b*). A new species of the genus *Perscheloribates* Hammer, 1973 was found in the material from Nepal. The primary purpose of this paper is to describe and illustrate a new species under the name *Perscheloribates nepalensis* sp. n.

Perscheloribates is a genus that was proposed by Hammer (1973) with *Perscheloribates clavatus* Hammer, 1973 as type species. Currently, it comprises four subgenera and more than 40 species, which are distributed in the Tropical and Subtropical regions (Subías 2004, updated 2014). The main generic characters are summarized by Ermilov et al. (2013*a*). The identification keys for the Neotropical (Balogh and Balogh 1990, 2002) and Ethiopian (Ermilov et al. 2011) species of *Perscheloribates* were presented earlier. Additionally a key to subgenera and species of this genus from the Oriental region is presented below. In total, two subgenera, 20 species, including a new species, and one subspecies are recorded (Subías 2004, updated 2013).

MATERIAL AND METHODS

Holotype (female) and four paratypes (three females, one male) were collected by J. Martens and W. Schawaller from Nepal: Gorkha District, Chuling Khola (river), Manaslu massif, 2800 m a.s.l., *Quercus semecarpifolia* forest, soil litter, 2–3 August 1983. Soil litter sifted, up to 10–15 cm depth, after hand-collecting of larger arthropods litter put into Winkler funnels for nearly two days in the open air at the camp site, no artificial heat or light source was used.

Specimens were studied in lactic acid, mounted in temporary cavity slides for the duration of the study and then stored in 70 per cent ethanol in vials. 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 in dorsal aspect. The length of body setae was measured in lateral aspect. All body measurements are presented in micrometers. Formula of leg setation is given according to the sequence trochanter – femur – genu – tibia – tarsus (famulus included). Formula of leg solenidia is given (in square brackets) according to the sequence genu – tibia – tarsus. General terminology used in this paper follows that summarized by Coetzer (1967–1968), Mahunka and Zombori (1985), and Norton and Behan-Pelletier (2009).

DESCRIPTION

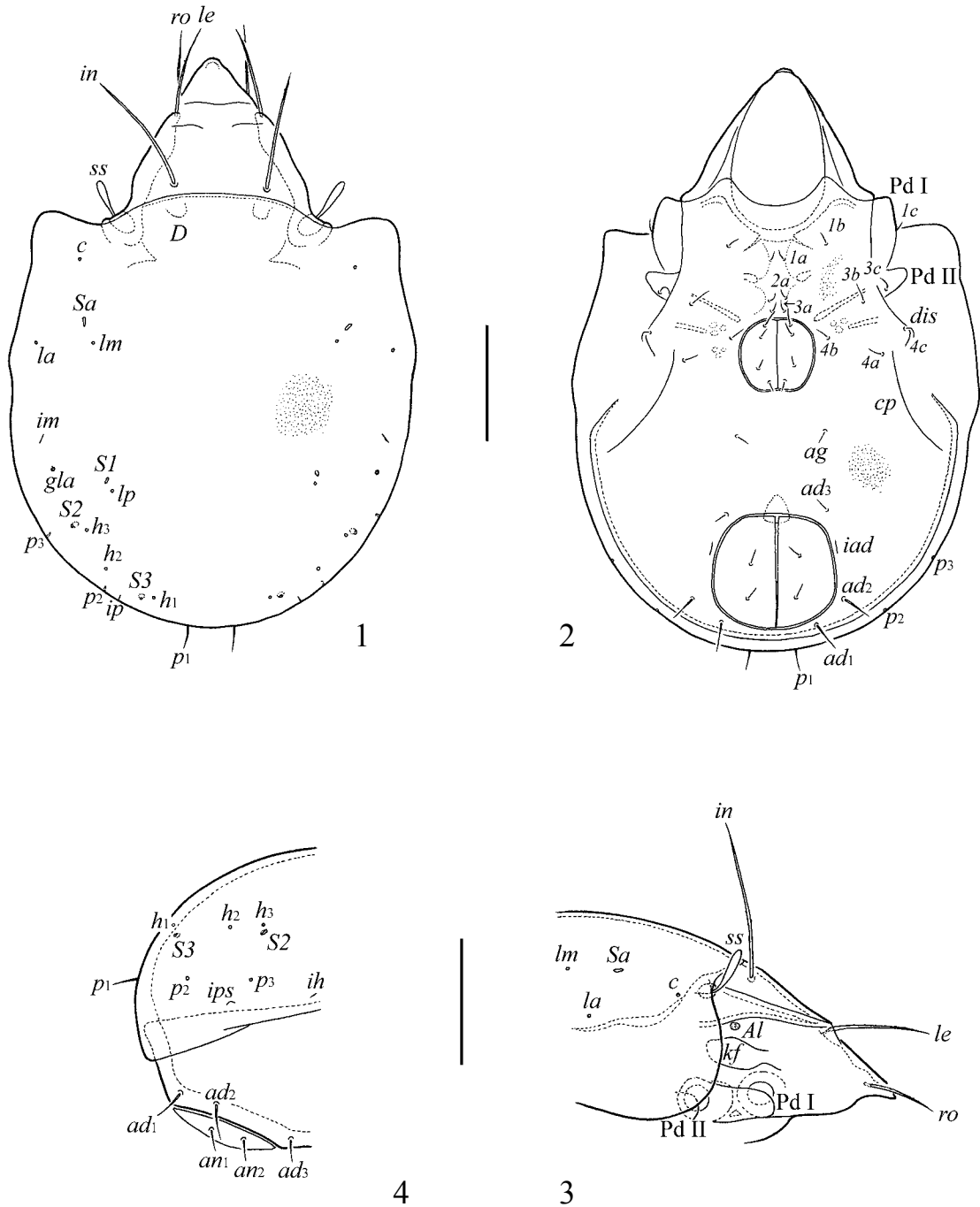
Perscheloribates nepalensis sp. n.

Figs 1–11

Diagnosis. Body size: 448–498 × 315–348. Rostrum rounded. Prodorsal setae long, setiform, slightly barbed. Sensilli of medium size, clavate, smooth, directed anteriorly or upwards. Translamellar line represented by short parts. Prolamellar lines represented by short basal part. Notogaster with nine pairs of setal alveoli and one pair (p_1) of setae. Leg claw serrate on dorsal side.

Description. *Measurements.* Body length: 448 (holotype: female), 464–498 (four paratypes: three females, one male); notogaster width (without pteromorphs): 315 (holotype), 315–348 (four paratypes).

Integument. Body color light brown. Surface of body microfoveolate (visible in dissected specimens under high magnification, ×1000). Diameter of foveolae less than 1.

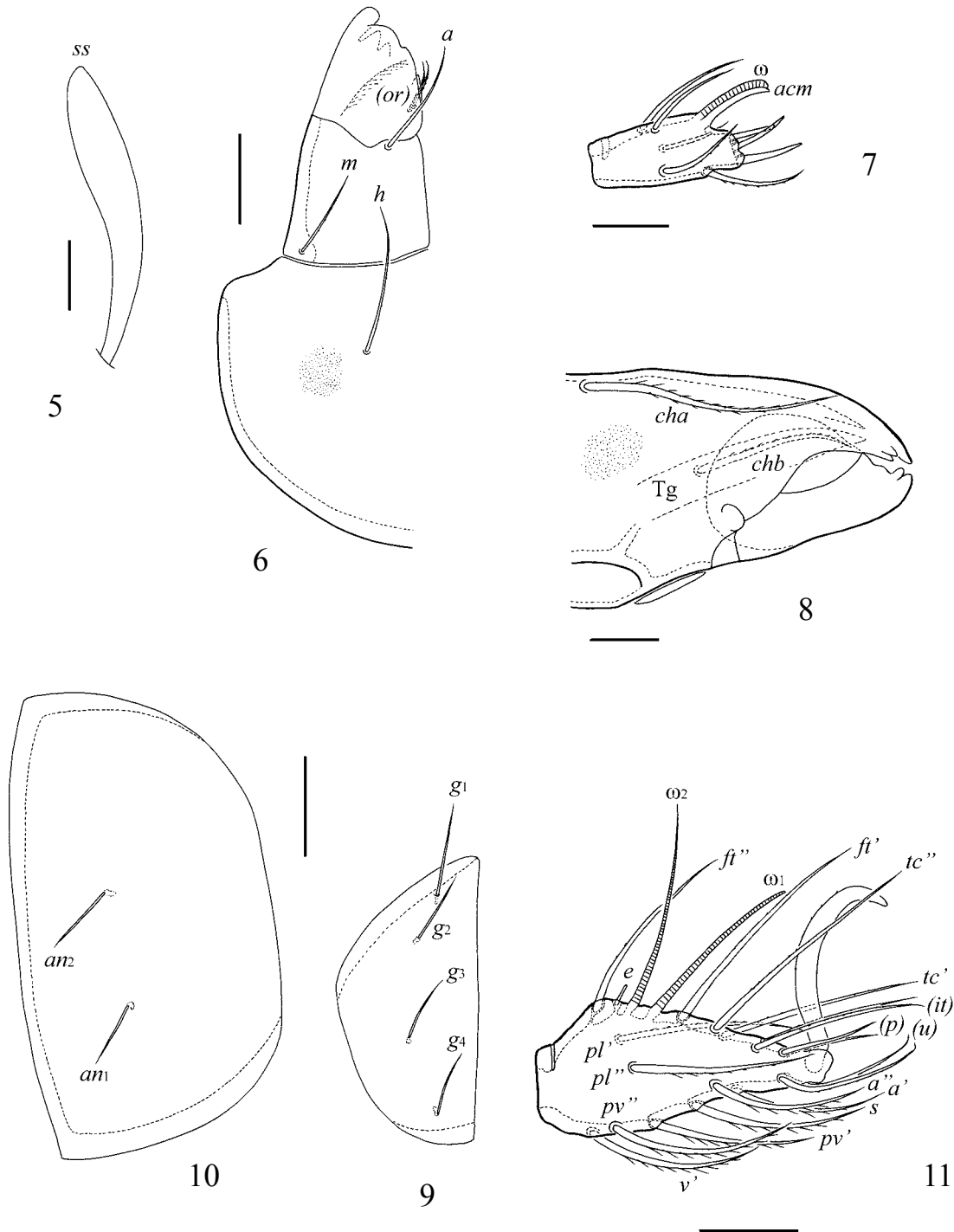


Figs 1–4. *Perscheloribates nepalensis* sp. n., adult: 1 — dorsal view; 2 — ventral view (gnathosoma and legs not illustrated); 3 — lateral view of anterior part of body (legs I, II not illustrated); 4 — lateral view of posterior part of body. Scale bar 100 μ m.

Prodorsum. Rostrum weakly protruding, rounded. Lamellae located dorso-laterally, as long as half of prodorsum (in lateral view), without cusps. Translamellar line represented by short parts near to lamellae. Sublamellar lines, rounded sublamellar porose areas (*Al*, 4–6) and lateral prodorsal carinae (*kf*) present. Rostral (*ro*, 57–65), lamellar (*le*, 73–82) and interlamellar (*in*, 123–

131) setae setiform, slightly barbed. Sensilli (*ss*) of medium size (57–65), clavate, with short stalk and longer head, which is elongate, smooth, rounded distally, directed anteriorly or upwards. Exobothridial setae and their alveoli absent.

Notogaster. Anterior notogastral margin weakly convex medially. Dorsophragmata (*D*) small, widely rounded. Nine pairs of notogastral



Figs 5–11. *Perscheloribates nepalensis* sp. n., adult: 5 — sensillus; 6 — subcapitulum, right half, ventral view; 7 — palptarsus; 8 — anterior part of chelicera; 9 — genital plate, right; 10 — anal plate, left; 11 — tarsus of leg I, right, antiaxial view. Scale bar 10 μ m (5, 7), 20 μ m (6, 8–11).

setae represented by alveoli; one pair of thin, smooth setae present (p_1 , 16). Four pairs of sacculi (Sa , $S1$, $S2$, $S3$) with small openings. Positions of lyrifissures (ia — poorly visible, im , ip , ih , ips) and opisthonotal gland openings (gla) resembled that in other *Perscheloribates* (Ermilov et al. 2011; Ermilov and Kalúz 2012).

Gnathosoma. Subcapitulum longer than wide (106–114 \times 82–86). Subcapitular setae setiform, slightly barbed; h (28–32) longer than m (20) and a (24–26). Adoral setae (or_1 , or_2 , 12) setiform, barbed. Palps (61–65) with setation 0–2–1–3–9(+ ω). Solenidion weakly dilated distally, attached with eupathidium (acm). Chelicerae (114) with

Table 1.
Leg setation and solenidia of *Perscheloribates nepalensis* sp. n.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
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), e, ω ₁ , ω ₂
II	v'	d, l', l', bv'', v''	(l), σ	(l), (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv), 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 (*e* to famulus), Greek letters to solenidia. Single prime (') marks setae on anterior and double prime (') setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

two barbed cheliceral setae; *cha* (32–36) longer, than *chb* (24). Trägårdh's organ (Tg) distinct, elongate conical.

Epimeral and lateral podosomal regions. Apodemes 1, 2, 3 and sejugal apodemes distinct. Epimeral setal formula: 3–1–3–3. Setae setiform, thin, smooth, little differs in length (16–20). Pedotecta I (Pd I) and pedotecta II (Pd II) of typical morphology for *Perscheloribates*. Discidia (*dis*) poorly developed, rounded distally. Circumpedal carinae (*cp*) poorly visible.

Anogenital region. Four pairs of genital (*g*₁, 16–18, *g*₂–*g*₄, 12–16), one pair of aggenital (*ag*, 12–16), two pairs of anal (*an*₁, *an*₂, 12–16) and three pairs of adanal (*ad*₁, *ad*₂, 20–24, *ad*₃, 12–16) setae thin, smooth. Lyrifissures *iad* distinct.

Legs. Generally, morphology typical for *Perscheloribates* (Ermilov et al. 2011; Ermilov and Kalúz 2012). Claw of each leg with several minute barbs on dorsally side. Formulae 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.

Type deposition. The holotype and one paratype are 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 new species is named after country of Nepal, where the mites were collected.

Comparison. In having the microfoveolate body surface and clavate sensilli, *Perscheloribates nepalensis* sp. n. is similar to *P. interlamellaris* Ermilov, Chatterjee et Marshall, 2013 from Brunei (Ermilov et al. 2013) However, it differs from the latter by the presence of one pair of noto-

gastral setae *p*₁ (versus all ten pairs present in *P. interlamellaris*), rudimentary parts of translamellar line (versus absent in *P. interlamellaris*) and a short basal part of prolamellar lines (versus well developed lines in *P. interlamellaris*), absence of exobothridial setae and barbs on sensilli (versus present in *P. interlamellaris*), and the distance between lamellar setae (not shorter than between rostral setae in *P. nepalensis* sp. n. versus clearly shorter in *P. interlamellaris*).

**KEY TO KNOWN SPECIES OF
PERSCHELORIBATES FROM THE ORIENTAL
REGION**

1. Rostrum tripartite, with three pointed tips and two incisions; body size: 364–424 × 242–288 subgenus *Perscheloribates* (*Makischeloribates*) Corpus-Raros, 1980; one species *P. (M.) tripartitus* Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 - Rostrum rounded or acutely pointed ... subgenus *Perscheloribates* (*Perscheloribates*) Hammer, 1973 2
 - 2. Body surface microfoveolate 3
 - Body surface smooth 4
 - 3. Prolamellar lines present; translamellar line absent; body size: 398–448 × 249–282 *P. (P.) interlamellaris* Ermilov, Chatterjee et Marshall, 2013 (see Ermilov et al. 2013a) (Distribution: Brunei)
 - Prolamellar lines represented only by basal part; translamellar line represented by short parts near to lamellae; body size: 448–498 × 315–348 *P. (P.) nepalensis* sp. n. (Distribution: Nepal)
 - 4. Sensilli clavate or capitate, with head clearly rounded distally 5
 - Sensilli spindle-form, fusiform or lanceolate, with head pointed distally 14

5. Prolamellar lines present; body length: 460
P. (P.) albialatus (Hammer, 1961) (see Hammer 1961) (Distribution: Peru, India)
 — Prolamellar lines absent or represented by basal parts 6
6. Translamellar line absent7
 — Translamellar line represented by short parts near to lamellae 11
7. Adanal setae ad_1 and ad_2 relatively long, not shorter than sensilli; interlamellar setae with small expansion distally; body size: 300–339 × 161–206
P. (P.) nodosus Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Adanal setae ad_1 and ad_2 short, clearly shorter than sensilli; interlamellar setae setiform 8
8. Rostrum acutely pointed; body size: 242–303 × 167–227
P. (P.) baluctosus Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Rostrum rounded 9
9. Sensilli with long (longer than head), strongly twisted stalk; aggenital setae absent; body size: 395–430 × 240–290
P. (P.) clavatus torquatus Aoki, 1984 (see Aoki 1984) (Distribution: Japan, Taiwan)
 — Sensilli with short (not longer than head), straight stalk; aggenital setae present 10
10. All notogastral setae developed; rostral and lamellar setae similar in length; body size: 218–273 × 130–181
P. (P.) tenius Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Notogastral setae represented by alveoli; lamellar setae longer than rostral setae; body length: 375
P. (P.) clavatus clavatus Hammer, 1973 (see Hammer 1973) (Distribution: Polynesia, Philippines)
11. Lamellar and interlamellar setae clearly thickened; body size: 327–333 × 212–227
P. (P.) crassus Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Lamellar and interlamellar setae simple, setiform 12
12. Interlamellar setae longer than lamellar setae; sensillar head clearly elongate; body size: 276–309 × 181–218
P. (P.) lumotus Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Lamellar and interlamellar setae similar in length; sensillar head oval 13
13. Rostrum acutely pointed; aggenital setae absent; body size: 309–348 × 212–227
P. (P.) agusanensis Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Rostrum narrowly pointed like a nose; aggenital setae present; body size: 303–348 × 206–236
P. (P.) luzonensis Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
14. Rostrum acutely pointed; notogastral setae represented by alveoli; body size: 318–333 × 242–258
P. (P.) surigaoensis Corpus-Raros, 1980 (see Corpus-Raros 1980) (Distribution: Philippines)
 — Rostrum rounded; all or some notogastral setae developed 15
15. Translamellar line absent 16
 — Translamellar line represented by short parts near to lamellae 17
16. Sensilli with long, thin apex, head ciliate unilaterally; lamellar and interlamellar setae similar in length; body size: 288–303 × 191–202
P. (P.) quezonensis (Corpus-Raros, 1980) (see Corpus-Raros 1980) (Distribution: Philippines)
 — Sensilli with short apex, head slightly barbed; interlamellar setae longer than lamellar setae; body length: 410
P. (P.) conjuges (Hammer, 1967) (see Hammer 1967) (Distribution: New Zealand, India)
17. Prolamellar lines absent; sensilli fusiform; body length: 420
P. (P.) luminosus (Hammer, 1961) (see Hammer 1961) (Distribution: Neotropical and Ethiopian regions, India)
 — Prolamellar lines present; sensilli spindle-form or lanceolate 18
18. All notogastral setae developed 19
 — Only notogastral setae p_1 – p_3 developed, other setae represented by alveoli 20
19. Sensilli spindle-form, ciliate unilaterally; body size: 291–348 × 197–242
P. (P.) benguetensis (Corpus-Raros, 1980) (see Corpus-Raros 1980) (Distribution: Philippines)
 — Sensilli lanceolate, ciliate bilaterally; body size: 314–350 × 197–210
P. (P.) lanceolatus (Aoki, 1984) (see Aoki 1984) (Distribution: Japan, Vietnam)
20. Sensilli with very short cilia; body size: 515 × 379
P. (P.) cavernicolus (Corpus-Raros, 1980) (see Corpus-Raros 1980) (Distribution: Philippines)
 — Sensilli with well developed cilia; body size: 343–394 × 216–303
P. (P.) minutus (Plet-

zen, 1965) (see Pletzen 1965; Corpus-Raros 1980) (Distribution: Ethiopian region, Philippines)

ACKNOWLEDGEMENTS

J. Martens thanks W. Schawaller and B. Daams for companionship during the 1983 Nepal expedition. J. Martens for many years got annual grants from the Feldbausch Foundation and the Wagner Foundation at Mainz University to carry out field work in Asia.

REFERENCES

- Aoki, J. 1965a. A preliminary revision of the family Otocephidae (Acari, Cryptostigmata). I. Subfamily Otocephinae. *Bulletin of the National Museum of Natural Science, Tokyo*, 8 (3): 259–341.
- Aoki, J. 1965b. Oribatid mites (Acarina: Oribatei) from Himalaya with descriptions of several new species. *Journal of the College of Arts and Sciences, China University*, 4 (3): 289–302.
- Aoki, J. 1967. A preliminary revision of the family Otocephidae (Acari, Cryptostigmata). II. Subfamily Tetracondylinae. *Bulletin of the National Museum of Natural Science, Tokyo*, 10 (3): 297–359.
- Aoki, J. 1984. New and unrecorded oribatid mites from Amami-Oshima island, southwest Japan. *Zoological Science*, 1: 132–147.
- Balogh, J. and Balogh, P. 1990. *Oribatid mites of the Neotropical region. II*. Budapest, Akadémiai. Kiadó press: 333 pp.
- Balogh, J. and Balogh, P. 2002. *Identification keys to the oribatid mites of the Extra-Holarctic regions. Vol. I*. Miskolc, Well-Press Publishing Limited: 453 pp.
- Coetzer, A. 1967–1968. New Oribatulidae Thor, 1929 (Oribatei, Acari) from South Africa, new combinations and a key to the genera of the family. *Memórias do Instituto de Investigação Científica de Moçambique*, 9 (A): 15–126.
- Corpus-Raros, L. 1980. Philippine Oribatei (Acarina) V. *Schelorbates* Berlese and related genera (Oribatulidae). *Kalikasan*, 9 (2–3): 169–245.
- Ermilov, S.G., Chatterjee, T. and Marshall, D.J. 2013a. Two new species of oribatid mites of Oripodoidea (Acari: Oribatida) from Brunei. *Annales Zoologici*, 63 (3): 393–400.
- Ermilov, S.G. and Kalúz, S. 2012. A new subgenus and three new species of oribatid mites of the family Schelorbatiidae (Acari: Oribatida) from Ecuador. *Annales Zoologici*, 62 (4): 773–787.
- Ermilov, S.G., Martens, J. and Tolstikov, A.V. 2013b. New species of oribatid mites of the genera *Lepidozetes* and *Scutozetes* (Acari, Oribatida, Tegoribatidae) from Nepal. *ZooKeys*, 339: 55–65.
- Ermilov, S.G., Rybalov, L.B. and Franke, K. 2011. Ethiopian oribatid mites of the family Schelorbatiidae (Acari: Oribatida). *African Invertebrates*, 52 (2): 311–322.
- Hammer, M. 1961. Investigations on the oribatid fauna of the Andes Mountains. II. Peru. *Det Kongelige Danske Videnskabernes Selskab Biologiske Skrifter*, 13 (1): 1–157.
- Hammer, M. 1967. Investigations on the oribatid fauna of New Zealand. Part II. *Det Kong. Kongelige Danske Videnskabernes Selskab Biologiske Skrifter*, 15 (4): 1–60.
- Hammer, M. 1973. Oribatids from Tongatapu and Eua, the Tonga Islands, and from Upolu, Western Samoa. *Det Kongelige Danske Videnskabernes Selskab Biologiske Skrifter*, 20 (3): 1–70.
- Mahunka, S. and Zombori, L. 1985. The variability of some morphological features in oribatid mites. *Folia Entomologica Hungarica*, 46 (1): 115–128.
- Niedbala, W. 1982. Trois Phthiracaridae (Acari, Oribatida) originaires du Nepal. *Folia Entomologica Hungarica*, 43 (1): 95–109.
- Niedbala, W. 1984. Nouveaux Phthiracaridae d'Asie (Acari: Oribatida). *Journal of Natural History*, 18: 829–842.
- Niedbala, W. 2000. The ptyctimous mites of the Oriental and Australian regions and their centers of origin (Acari: Oribatida). *Genus*, supplement: 1–493.
- Norton, R.A. and Behan-Pelletier, V.M. 2009. Oribatida. Chapter 15. In: G.W. Krantz and D.E. Walter (eds.). *A Manual of Acarology*. Texas Tech University Press, Lubbock: 430–564.
- Nübel-Reidelbach, E. and Woas, S. 1992. A few basic species of the cepheid and the pterogasterinid evolutionary line within the “Higher” oribatids (Acari, Oribatei). *Andrias*, 9: 75–119.
- Piffi, E. 1971. Neue Oribatiden (Acari) aus dem Himalaya. *Khumbu Himal*, 4 (1): 23–54.
- Piffi, E. 1972. Zur Systematik der Oribatiden (Acari) (Neue Oribatiden aus Nepal, Costa Rica und Brasilien ergeben eine neue Familie der Unduloribatidae und erweitern die Polypterozetidae um die Gattungen *Podopterotegaeus*, *Nodocepheus*, *Eremaeozetes* und *Tuberozetes*). *Khumbu Himal*, 4 (2): 269–314.
- Pletzen, R. 1965. Studies on the South African oribatei (Acari). III. Further new species of the genus *Schelorbates* Berlese, 1908. *Acarologia*, 17 (1): 113–120.
- Sheals, J.G. 1965. Primitive Cryptostigmatid mites from Rhododendron forests in the Nepal Himalaya. *Bulletin of the British Museum (Natural History), Zoology*, 13 (1): 5–35.
- Subías, L.S. 2004. Listado sistemático, sinonímico y biogeográfico de los ácaros oribátidos (Acari-formes: Oribatida) del mundo (excepto fósiles). *Graellsia*, 60 (número extraordinario): 3–305. Online version accessed in February 2014. 577 pp.; <http://www.ucm.es/info/zoo/Artrópodos/Catálogo.pdf>
- Travé, J. 1977. *Hermannia jesti* Travé, Oribate du Népal. *Acarologia*, 19 (4): 697–710.