

## A NEW SPECIES OF THE GENUS *ORTHOZETES* FROM ECUADOR (ACARI: ORIBATIDA: MICROZETIDAE)

S. G. Ermilov<sup>1</sup>, D. Sandmann<sup>2</sup> and M. Maraun<sup>2</sup>

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

<sup>2</sup>Georg-August-University Göttingen, J.F. Blumenbach Institute of Zoology and Anthropology, Göttingen, Germany; e-mail: mark.maraun@biologie.uni-goettingen.de

ABSTRACT: A new microzetid mite species of the genus *Orthozetes*, *O. bidentatus* sp. n., from the upper organic soil layer of mostly undisturbed rain forest of Ecuador is described. The new species differs from all species of the genus by the presence of interlamellar setae. The genus *Orthozetes* is recorded in Ecuador for the first time.

KEY WORDS: oribatid mites, Microzetidae, *Orthozetes*, new species, Ecuador

### INTRODUCTION

The oribatid mite genus *Orthozetes* (Acari: Oribatida: Microzetidae) was proposed by Balogh (1962a) with *Orthozetes dispar* Balogh, 1962 as the type species. Currently, this genus comprises three species, which are distributed in the tropics (Balogh 1962a, 1968): *O. depilatus* Balogh, 1968 (New Guinea), *O. dispar* Balogh, 1962 (Peru), *O. papuanus* Balogh, 1968 (New Guinea). The main diagnostic characters of the genus *Orthozetes* were summarized by Balogh (1962a, 1962b) and Balogh and Balogh (1988, 1992).

During taxonomic identification of microzetid mites from Ecuador we discovered a new species of the genus *Orthozetes*, which is described and illustrated below under the name *Orthozetes bidentatus* sp. n. This genus is recorded in Ecuador for the first time.

### MATERIAL AND METHODS

The *Orthozetes* specimens (holotype and nine paratypes, all males) were collected by D. Sandmann in Southern Ecuador: 4°70' S, 78°58' W, Bombuscaro, Podocarpus National Park, 1050 m a.s.l., upper organic soil layer in mostly undisturbed rain forest, 01.04.2008.

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. All body measurements are presented in micrometers. 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 in dorsal aspect. Lengths of body setae were measured in lateral aspect. Formulae for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulae 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 (1936a, 1936b), Engelbrecht (1972a, 1972b), and Norton and Behan-Pelletier (2009).

### Description of *Orthozetes bidentatus* sp. n.

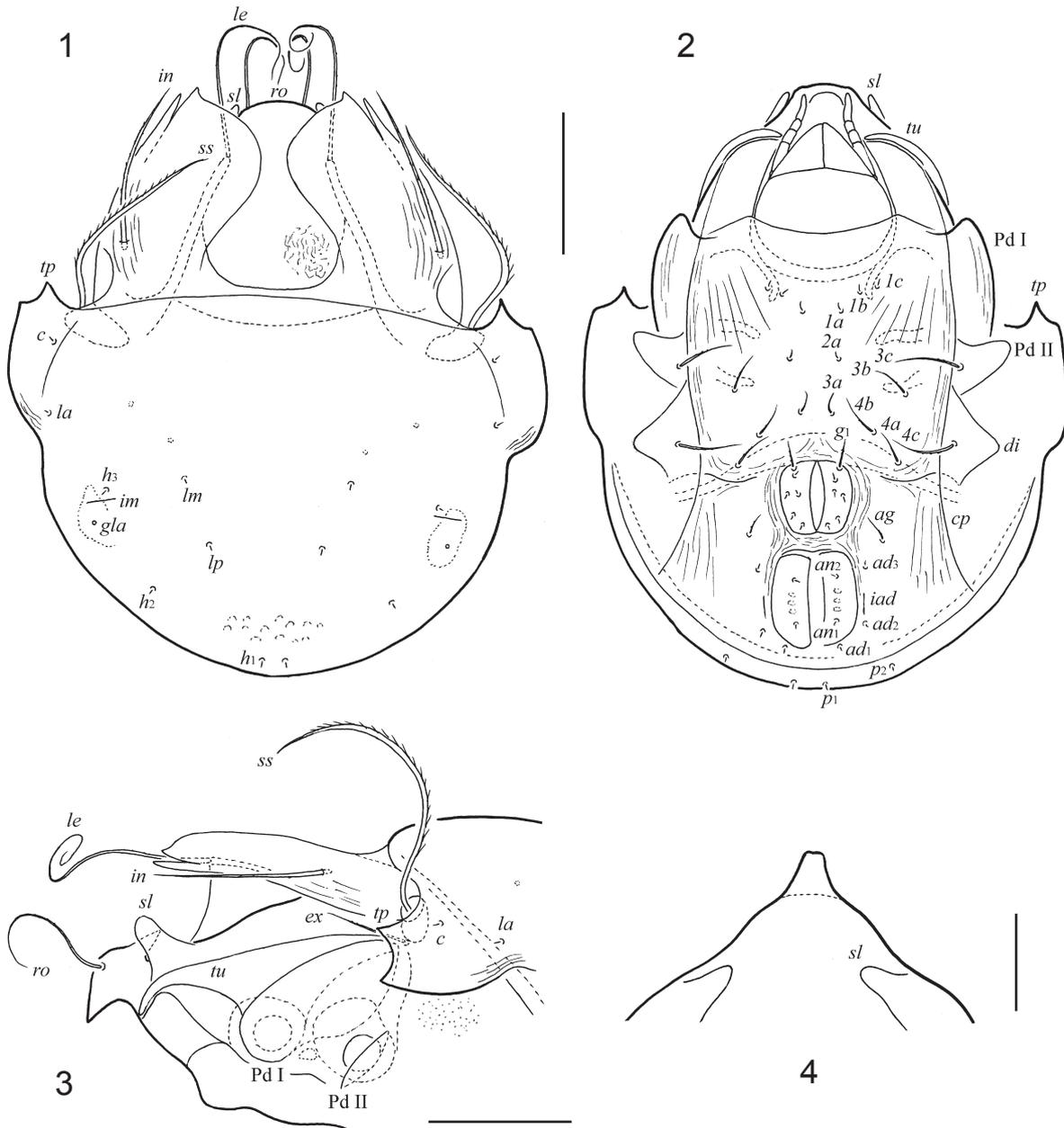
Figs 1–6

**Diagnosis.** Body size 200–221 × 151–164. Surface of prodorsum and notogaster smooth, surface of epimera I and narrow area next to the circumpedal carinae and next to the genital and anal plates striate. Rostrum protruding, truncated or with indistinct median cave. Distal-outer part of lamellae with two teeth. Rostral and lamellar setae with flagellate tip. Interlamellar setae long, setiform. Sensilli setiform, ciliate. Pteromorphs with tooth on anterior margin. Notogastral and anogenital (except longer  $g_1$  and  $ag$ ) setae short.

**Description. Measurements.** Body length 205 (holotype), 200–221 (nine paratypes); notogaster width (without pteromorphs) 159 (holotype), 151–164 (nine paratypes).

**Integument** (Figs 1–3). Body color yellow-brownish. Surface of prodorsum and notogaster smooth. Interbothridial region with filamentous cerotegument. Posterior part of pteromorphs, lateral parts of lamella, epimera I, narrow area next to the circumpedal carinae and next to the genital and anal plates striate. Lateral sides of body microgranulate up to acetabula III and IV.

**Prodorsum** (Figs 1, 3, 4). Rostrum (visible in anterior or dorso-anterior view) protruding, thin, truncated or with indistinct median cave. Two lobed structures ( $sl$ ) present in anterior part of prodorsum. These are similar morphologically, finger-like, directed upwards, located dorso-laterally. Lamellae

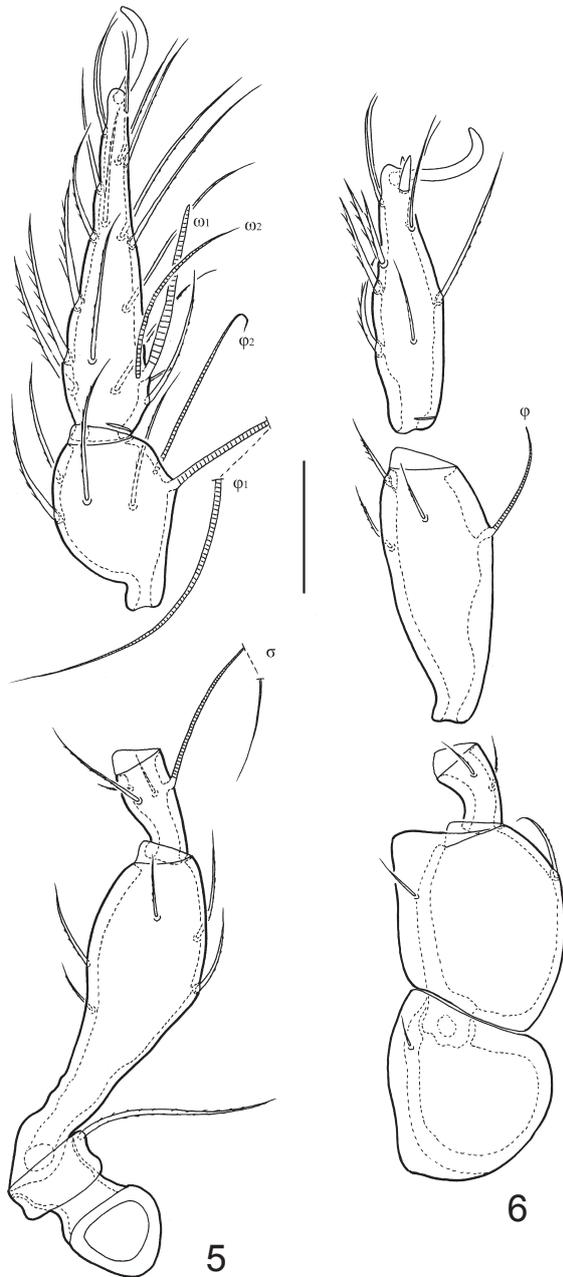


Figs 1–4. *Orthozetes bidentatus* sp. n., adult: 1 — dorsal view; 2 — ventral view (subcapitular and palpal setae, and legs not shown); 3 — prodorsum, lateral view (gnathosoma and legs not shown); 4 — rostrum, dorso-anterior view. Scale bars 50  $\mu$ m (1–3); 20  $\mu$ m (4).

wide, separated medially, but fused in basal part; their distal-outer part with one strong and one small tooth, and their distal-inner part widely rounded. Rostral setae (*ro*, 53–61) setiform, with flagellate tip, barbed, inserted dorso-laterally on prodorsum. Lamellar setae (*le*, 77–90) setiform, with flagellate tip, indistinctly barbed, inserted on ventral side of lamellae. Interlamellar setae (*in*, 61–65) present, setiform, thickened, barbed, inserted on lamellae. Sensilli (*ss*, 90–98) setiform, thickened, with cilia in dorsal side. Exobothridial setae (*ex*, 28–32) setiform, thin, slightly barbed. Tutoria (*tu*) with long cusp, which is directed ventral.

*Notogaster* (Figs 1–3). Anterior margin distinct, weakly convex. Pteromorphs pointed distally, with tooth (*tp*) on anterior margin. Nine pairs of short (4), setiform, smooth notogastral setae present. All lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) positioned in the typical arrangement for Microzetidae. Setae *h*<sub>3</sub> inserted anteriorly to lyrifissures *im*. Opisthonotal gland openings (*gla*) located posteriorly to lyrifissures *im*.

*Gnathosoma*. Typical for Microzetidae (Grandjean 1936a; Engelbrecht 1972a, 1972b; Ermilov, Anichkin 2011). Subcapitulum slightly longer than wide (53–57  $\times$  49–53). Subcapitular setae



Figs 5–6. *Orthozetes bidentatus* sp. n., adult: 5 — leg I, left, antiaxial view; 6 — leg IV, right, antiaxial view. Scale bar 20  $\mu$ m.

setiform, barbed: *h* and *m* (both 16) longer than *a* (12). Adoral setae (*or*<sub>1</sub>, *or*<sub>2</sub>) short (4–6), setiform, thin, smooth. Palps (41) with setation 0–2–1–3–9(+ $\omega$ ). Solenidion setiform, not attached with eupathidium. Chelicerae (53) with two setiform, barbed setae: *cha* (28) longer than *chb* (16). Cheliceral tubercle (8) straight, blunt-ended.

**Epimeral and lateral podosomal regions** (Figs 2, 3). Epimeral setae setiform, smooth (*1a*, *1b*, *1c*, *2a*) or barbed (all other). Lengths of setae: *1a*, *1b*, *1c*, *2a*, 4–8; *3a*, *3b*, *4a*, *4b*, 12–16; *3c*, *4c*, 24–28). Setae *3c* inserted on pedotecta II; setae *4c* inserted

on discidia. Epimeral border IV well developed. Pedotecta I (Pd I) convex, covering acetabula I. Pedotecta II (Pd II) broad, rounded distally, partly covering acetabula II. Discidia (*di*) large, triangular, blunt-ended. Circumpedal carina (*cp*) distinct.

**Anogenital region** (Fig. 2). Six pairs of genital setae setiform: *g*<sub>1</sub> longest (10–16), slightly barbed; other short (10–12), thin, smooth. One pair of aggenital setae (*ag*, 12–16) setiform, slightly barbed. Two pairs of anal (*an*<sub>1</sub>, *an*<sub>2</sub>, 4) and three pairs of adanal (*ad*<sub>1</sub>–*ad*<sub>3</sub>, 4) setae setiform, thin, smooth. Lyrifissures *iad* located in paraanal position.

**Legs** (Figs 5, 6). Typical for Microzetidae (Engelbrecht 1972b; Ermilov, Anichkin 2011). Formulae 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. Setae barbed or with ventral spines (except smooth *p*, *s* on tarsus I). Setae *p* setiform on tarsus I, thorn-like on tarsi II–IV. Famulus short, setiform, straight. Solenidia  $\omega$ <sub>1</sub> on tarsus I,  $\omega$ <sub>1</sub>,  $\omega$ <sub>2</sub> on tarsus II long, thickened, blunt-ended; other solenidia setiform, thin.

**Type deposition.** The holotype (ethanol) is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; six paratypes (ethanol) are deposited in the collection of the Siberian Zoological Museum, Novosibirsk, Russia; three paratypes (ethanol) are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

**Etymology.** The specific name “*bidentatus*” refers to two external teeth on the lamellae.

**Comparison.** The new species clearly differs from all known species of the genus *Orthozetes* by the presence of interlamellar setae (versus interlamellar setae absent in the other *Orthozetes* species) and the presence of two lateral lamellar teeth (versus with one tooth in the other *Orthozetes* species).

**Remarks.** The classification of genera in the family Microzetoidea is difficult because many characters used in diagnostics of genera are not apomorphic (for example, morphology and localization of prodorsal setae; direction and morphology of sensilli; presence or absence of some prodorsal setae; notogastral ornamentation). Due to the combination of generic characters, the new species is similar to the other species of the genus *Orthozetes*, however all *Orthozetes* species are

Table.

Leg setation and solenidia of adult *Orthozetes bidentatus* sp. n.

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ <sub>1</sub> , φ <sub>2</sub>	(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), e, ω <sub>1</sub> , ω <sub>2</sub>
II	v'	d, (l), bv'', v''	(l), v', σ	(l), (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv), ω <sub>1</sub> , ω <sub>2</sub>
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.

lacking interlamellar setae (absence of interlamellar setae is a generic character of this genus). Despite the lack interlamellar setae we tentatively include *Orthozetes bidentatus* sp. n. in *Orthozetes* because other morphological characters are similar (especially between the new species and two known species from New Guinea).

Also, due to the combination of generic characters, the new species is similar to the species of the genus *Rugozetes* Balogh, 1960 (Balogh 1960, 1962b; Balogh and Balogh 1988); however, known *Rugozetes* species possess phylliform interlamellar setae (it is a generic character of the genus).

The presence or absence of interlamellar setae as well as their morphologies are not apomorphic characters in Microzetoidea, therefore representatives of *Orthozetes* (including the new species) could possibly be included in the genus *Rugozetes*. Hence, further research on the taxonomic status of *Orthozetes* is needed.

#### ACKNOWLEDGEMENTS

We cordially thank Dr. Umukusum Ya. Shtanchaeva and Prof. Dr. Luis S. Subías (Universidad Complutense de Madrid, Madrid, Spain) for consultations. Oribatid mites were studied as part of the Research Unit “Biodiversity and Sustainable Management of a Megadiverse Mountain Ecosystem in South Ecuador”, subproject “Soil fauna: Diversity and Functioning” headed by Dr. Mark Maraun and Dr. Stefan Scheu; financial support by the German Research Foundation is gratefully acknowledged (RU 816).

#### REFERENCES

Balogh, J. 1960. Descriptions complémentaires d'Oribates (Acari) d'Angola et du Congo Belge

(1<sup>ère</sup> série). *Companhia de Diamantes de Angola, Lisboa*, 51: 89–105.

Balogh, J. 1962a. New microzetids from Eastern Peru (Acari, Oribatei). *Annales Historico-Naturales Musei Nationalis Hungarici*, 54: 405–417.

Balogh, J. 1962b. An outline of the family Microzetidae Grandjean, 1936 (Acari, Oribatei). *Opuscula Zoologica Budapest*, 4 (2–4): 35–58.

Balogh, J. 1968. New oribatids (Acari) from New Guinea. *Acta Zoologica Academiae Scientiarum Hungaricae*, 14 (3–4): 259–285.

Balogh, J. and Balogh, P. 1988. *Oribatid mites of the Neotropical region. I.* Budapest, Akadémiai Kiadó Press: 335 pp.

Balogh, J. and Balogh, P. 1992. *The oribatid mites genera of the world. Vol. 1.* Budapest, Hungarian National Museum press: 263 pp.

Engelbrecht, C.M. 1972a. Two new species of the genus *Rhopalozetes* Balogh, 1961. *Rhopalozetes georgensis* sp. n. and *Rhopalozetes witfonteinensis* sp. n. (Microzetidae: Oribatei). *Navorsinge van die Nasionale Museum, Bloemfontein*, 2 (9): 263–269.

Engelbrecht, C.M. 1972b. *Microzetes auxiliaries orkneyensis* ssp. n. (Microzetidae: Oribatei) from South Africa. *Navorsinge van die Nasionale Museum, Bloemfontein*, 2 (9): 270–281.

Ermilov, S.G. and Anichkin, A.E. 2011. A new diagnosis of *Schalleriella* (Acari: Oribatida: Microzetidae) and a new species from Vietnam. *Systematic and Applied Acarology*, 16 (2): 169–175.

Grandjean, F. 1936a. Les Microzetidae n. fam. (Oribates). *Bulletin de la Société Zoologique de France*, 61: 60–93.

Grandjean, F. 1936b. *Microzetes auxiliaris* n. sp. (Oribates). *Bulletin de Muséum*, (2), 8: 138–145.

Norton, R.A. and Behan-Pelletier, V.M. 2009. Oribatida. Chapter 15. In: G.W. Krantz & D.E. Walter (eds.). *A Manual of Acarology*. Texas Tech Univ. Press, Lubbock: 430–564.