

Two new species of oribatid mites of *Leptotocepheus* (Acari, Oribatida, Otocepheidae) from Malawi

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Abstract

Two new species of oribatid mites of the genus *Leptotocepheus* (Oribatida, Otocepheidae) are described from Malawi. *Leptotocepheus malawiensis* **sp. nov.** differs from the related species *L. macromucronatus* by the well developed, spindle-form bothridial seta with distinctly elongate, pointed tip distally (versus slightly developed, fusiform, without elongate, pointed tip distally). *Leptotocepheus zombaensis* **sp. nov.** differs from the related species *L. trimucronatus* by the comparatively short notogastral setae la , h_3 , p_1 and p_3 , longest notogastral setae h_1 and h_2 (versus all notogastral setae slightly differs in length) and long interlamellar seta (versus medium-sized).

Key words: oribatid mites, taxonomy, morphology, Afrotropical region

Introduction

The oribatid mite genus *Leptotocepheus* (Acari, Oribatida, Otocepheidae) was proposed by Balogh (1961) with *Leptotocepheus trimucronatus* Balogh, 1961 as type species. The genus comprises two subgenera (*L. (Leptotocepheus)* Balogh, 1961; *L. (Longocepheus)* Balogh & Mahunka, 1966) with seven species each, which are distributed in the Afrotropical and Oriental regions, and New Zealand (Subías 2004, updated online version 2021). The taxonomic revision, generic diagnosis and identification key to the known species of *Leptotocepheus* were presented by Ermilov & Minor (2018).

The oribatid fauna of Malawi are not known except some findings of ptyctimous mites (e.g. Niedbała 1984, 2001, 2002; Niedbała & Liu 2018). Among the oribatid mite material collected from Malawi, we found two new species of the nominate subgenus, which are the first representatives of the genus recorded in this country. The main goal of the paper is to describe these new species.

Material and methods

Specimens

All specimens of both new species were kindly provided by the Moravian Museum, Brno, Czech Republic; the collection localities are given in the *Material examined* sections. Type specimens are deposited in two institutions: the Senckenberg Museum of Natural History, Görlitz, Germany (SMNH); and the Tyumen State University Museum of Zoology, Tyumen, Russia (TSUMZ).

Observation and documentation

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster. Body width refers to the maximum width of the ventral plate in ventral view. 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. Drawings were made with a camera lucida using a Leica transmission light microscope “Leica DM 2500”.

Terminology

Morphological terminology used in this paper follows that of F. Grandjean: see Travé and Vachon (1975) for references, Norton (1977) for leg setal nomenclature, and Norton and Behan-Pelletier (2009) for overview.

Abbreviations

Prodorsum: *cos*=costula; *ro*, *le*, *in*, *bs*, *ex*=rostral, lamellar, interlamellar, bothridial and exobothridial seta, respectively; *co.pm*, *co.pl*=medial and lateral prodorsal condyles, respectively. *Notogaster*: *co.nm*, *co.nl*=medial and lateral notogastral condyles, respectively; *c*, *la*, *lm*, *lp*, *h*, *p*=setae; *ia*, *im*, *ip*, *ih*, *ips*=lyrifissures; *gla*=opisthonotal gland opening. *Gnathosoma*: *a*, *m*, *h*=subcapitular setae; *d*, *l*, *sup*, *inf*, *cm*, *ul*, *sul*, *vt*, *lt*=palp setae; ω =palp solenidium; *cha*, *chb*=cheliceral setae; *Tg*=Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a–c*, *2a*, *3a–c*, *4a–c*=epimeral setae; *PdI*, *PdII*=pedotectum I, II, respectively; *dis*=discidium. *Anogenital region*: *g*, *ag*, *an*, *ad*=genital, aggenital, anal and adanal seta, respectively; *iag*, *iad*=aggenital and adanal lyrifissure, respectively; *p.o.*=preanal organ. *Legs*: *Tr*, *Fe*, *Ge*, *Ti*, *Ta*=trochanter, femur, genu, tibia and tarsus, respectively; *p.a.*=porose area; ω , ϕ , σ =solenidia; ϵ =famulus; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*=setae.

Taxonomy

***Leptotocephus (Leptotocephus) malawiensis* sp. nov.**

(Figs 1A, B; 2A–D; 3A–D)

Diagnosis

Body length: 898–1162. Body surface densely microgranulate; notogaster and ventral side with foveolae. Interlamellar seta long, thickened, erect, barbed. Bothridial seta spindle-form, barbed, with distinctly elongate, thin tip. Medial prodorsal condyles separate. Unpaired medial notogastral condyle simple. Notogaster with 10 pairs of long, thickened, barbed setae. Epimeral and anogenital setae setiform, slightly barbed. Adanal lyrifissure oblique, removed from anal aperture. Leg tarsi I–IV with two dorsal teeth; genua III and IV with two or three small lateral teeth; femora I–IV with distoventral triangular process; seta *u* setiform on all tarsi.

Description of adult

Measurements. Large and elongate species. Body length: 996 (holotype, male), 898–1162 (seven paratypes, all males); notogaster width: 481 (holotype), 398–581 (seven paratypes). Length/width ratio of body: 2.0–2.1.

Integument. Colour yellowish brown. Cuticle densely microgranulate. Prodorsum partially with small tubercles (diameter up to 2). Notogaster and ventral side with foveolae (diameter up to 8). Lateral part of body between bothridium and acetabula I, II with dense tubercles (up to 6).

Prodorsum. Rostrum broadly rounded. Costula long, reaching bothridium basally and extending insertion of lamellar seta anteriorly. Rostral and lamellar setae (123–143) setiform, curving and directed anteromedially, barbed. Interlamellar seta (155–168) thickened, erect, barbed. Bothridial seta (length outside bothridium: 131–143) spindle-form, barbed, with distinctly elongate, thin tip (about 1/3 length of head) distally. Exobothridial seta (32–41) setiform, slightly barbed. Tutorium absent. Paired lateral prodorsal condyles and medial prodorsal condyles tubercle-like, located separately.

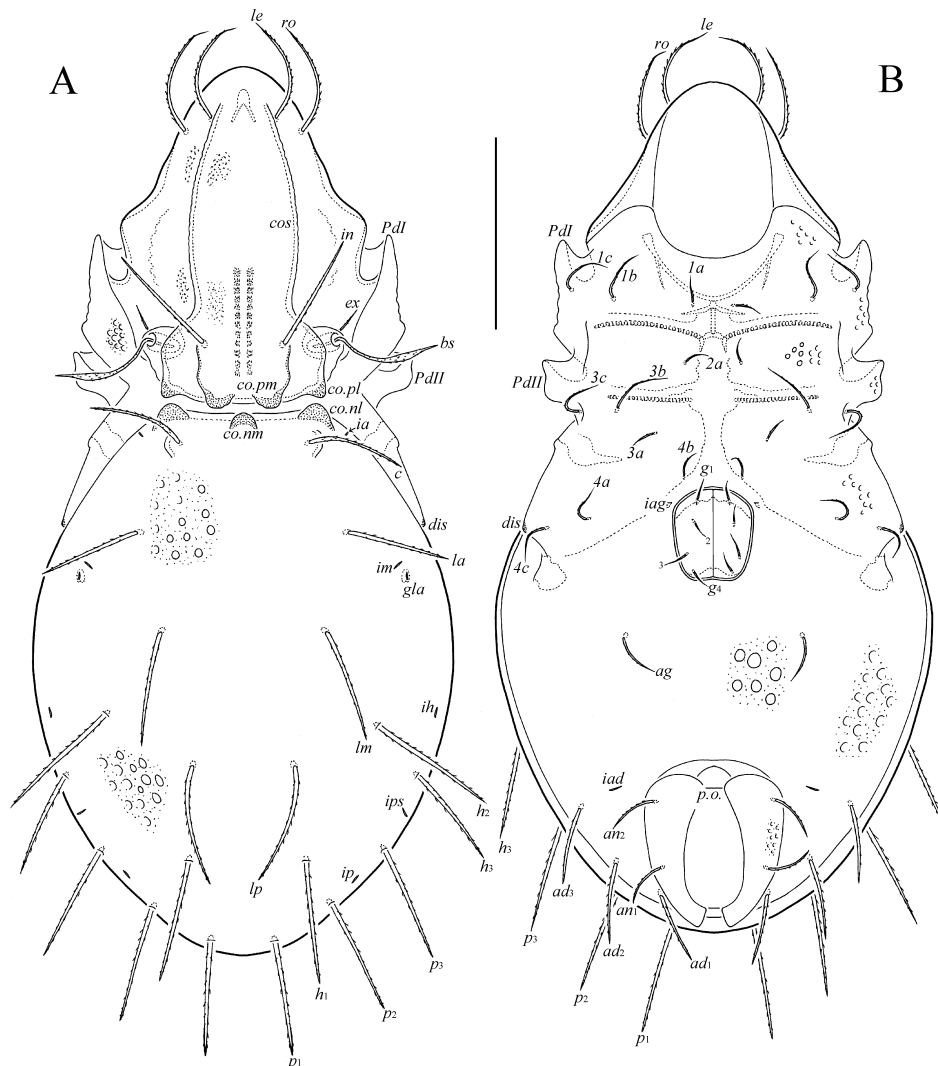


FIGURE 1. *Leptotocepheus malawiensis* sp. nov., adult: A—dorsal view (legs omitted); B—ventral view (gnathosoma and legs omitted). Scale bar 200 μ m.

Legs. Claw of each leg strong, slightly barbed on dorsal side. Tarsi I–IV with two dorsal teeth (poorly developed on tarsus IV); genua with one, genua III and IV with two or three small teeth distally; femora I–IV with distoventral triangular process. Dorsoparaxial porose area present on femora I–IV and on trochanters III, IV. Formulas of leg setation and solenidia: I (1-4-3-4-16) [1-2-2], II (1-4-3-3-15) [1-1-2], III (2-3-1-2-15) [1-1-0], IV (1-2-2-2-12) [0-1-0]; homology of setae and solenidia indicated in Table 1. Solenidion ϕ_1 on tibia I rod-like, other solenidia bacilliform. Famulus of tarsus I short, erect, distally blunt, inserted proximal to solenidion ω_1 . Seta *u* setiform on all tarsi.

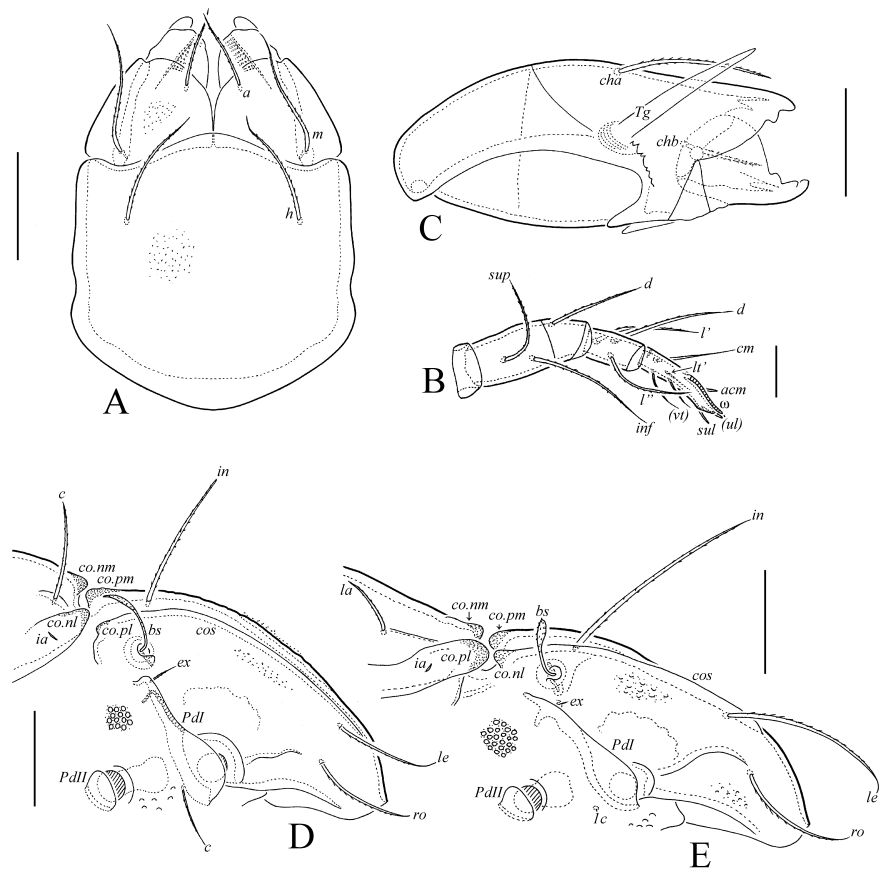


FIGURE 3. *Leptotocepheus malawiensis* sp. nov. (A–D) and *L. zombaensis* sp. nov. (E), adult: A—subcapitulum, ventral view; B—palp, left, antiaxial view; C—chelicera, left, paraxial view; D, E—anterior part of body, lateral view. Scale bars 50 μ m (A, C), 20 μ m (B), 100 μ m (D, E).

TABLE 1. Leg setation and solenidia of *Leptotocepheus malawiensis* sp. nov. and *L. zombaensis* sp. nov.

Leg	Tr	Fe	Ge	Ti	Ta
I	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</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>), ε , ω_1 , ω_2
II	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i>	(<i>l</i>), <i>v'</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>v'</i> , <i>l'</i>	<i>d</i> , <i>l'</i> , <i>ev'</i>	<i>l'</i> , σ	(<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>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.

Material examined

Holotype (male) and six paratypes (all males): sample #9, Malawi, Maloza, Mulanje Mts., Maloza stream valley, 16°01'3.9"S, 35°32'36.6"E, 972 m a.s.l., sifting litter, Winkler extraction, 24.XI.2012 (leg. P. Baňar).

Type deposition

The holotype is deposited in the collection of the SMNH; seven paratypes are deposited in the collection of the TSUMZ. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Etymology

The species name *malawiensis* refers to the country of origin, Malawi.

Remarks

In having bothridial seta with developed head and 10 pairs of medium-sized notogastral setae, *Leptotocepheus malawiensis* **sp. nov.** is morphologically similar to *Leptotocepheus macromucronatus* Mahunka, 1988 from Tanzania, but differs from the latter by the shape of bothridial seta (well developed, spindle-form, with distinctly elongate, thin, pointed tip distally versus slightly developed, fusiform, without elongate, thin, pointed tip distally).

Leptotocepheus (Leptotocepheus) zombaensis **sp. nov.**

(Figs 3E; 4A, B; 5A–D)

Diagnosis

Body length: 830–979. Body surface densely microgranulate. Interlamellar seta very long, setiform, barbed. Bothridial seta clavate, barbed. Medial prodorsal condyles connected. Unpaired medial notogastral condyle simple. Notogaster with nine pairs of thickened, barbed setae; h_1 , h_2 longest, h_3 , p_3 shortest; c absent. Epimeral and anogenital setae setiform, slightly barbed (except vestigial $1a$, $1c$, $2a$, $3a$). Adanal lyrifissure located close to anal aperture. Leg seta u setiform on all tarsi; v minute on trochanters III, IV.

Description of adult

Measurements. Large and elongate species. Body length: 830 (holotype, male), 830–979 (three paratypes, all males); notogaster width: 332 (holotype), 332–381 (three paratypes). Length/width ratio of body: 2.5.

Integument. Colour yellowish brown. Cuticle densely microgranulate. Lateral part of prodorsum, notogaster and ventral side with indistinct foveolae (diameter up to 8). Lateral part of body between bothridium and acetabula I, II with dense tubercles (up to 6).

Prodorsum. Rostrum broadly rounded. Costula long, reaching bothridium basally and extending insertion of lamellar seta anteriorly. Rostral (106–127), lamellar (131–184) and interlamellar (176–246) setae setiform (ro and le curving and directed anteromedially), barbed. Bothridial seta (length outside bothridium: 82–102) clavate, slightly barbed. Exobothridial seta (8–10) setiform, roughened. Tutorium absent. Paired lateral prodorsal condyles and medial prodorsal condyles tubercle-like, co . pm connected medially.

Notogaster. Paired lateral notogastral condyles and unpaired medial notogastral condyle tubercle-like. Notogaster with nine pairs (la : 73–94; lm : 106–151; h_1 , h_2 : 164–258; lp : as lm or as h_1 , h_2 ; h_3 , p_3 : 57–65; p_1 : 65–82; p_2 : 82–155) of thickened, barbed setae; c absent. Opisthonotal gland

Gnathosoma. Similar to that of *L. malawiensis* **sp. nov.** Subcapitulum size: 131–143×86–90. Subcapitular setae (*a*: 24–28; *m*: 41–49; *h*: 53–61) setiform, barbed. Palp (73–77) setation: 0-2-1-3-8 (+ω). Postpalpal seta (8) spiniform, smooth. Chelicera (143–151) with two (*cha*: 53–57; *chb*: 20–24) setiform, barbed setae.

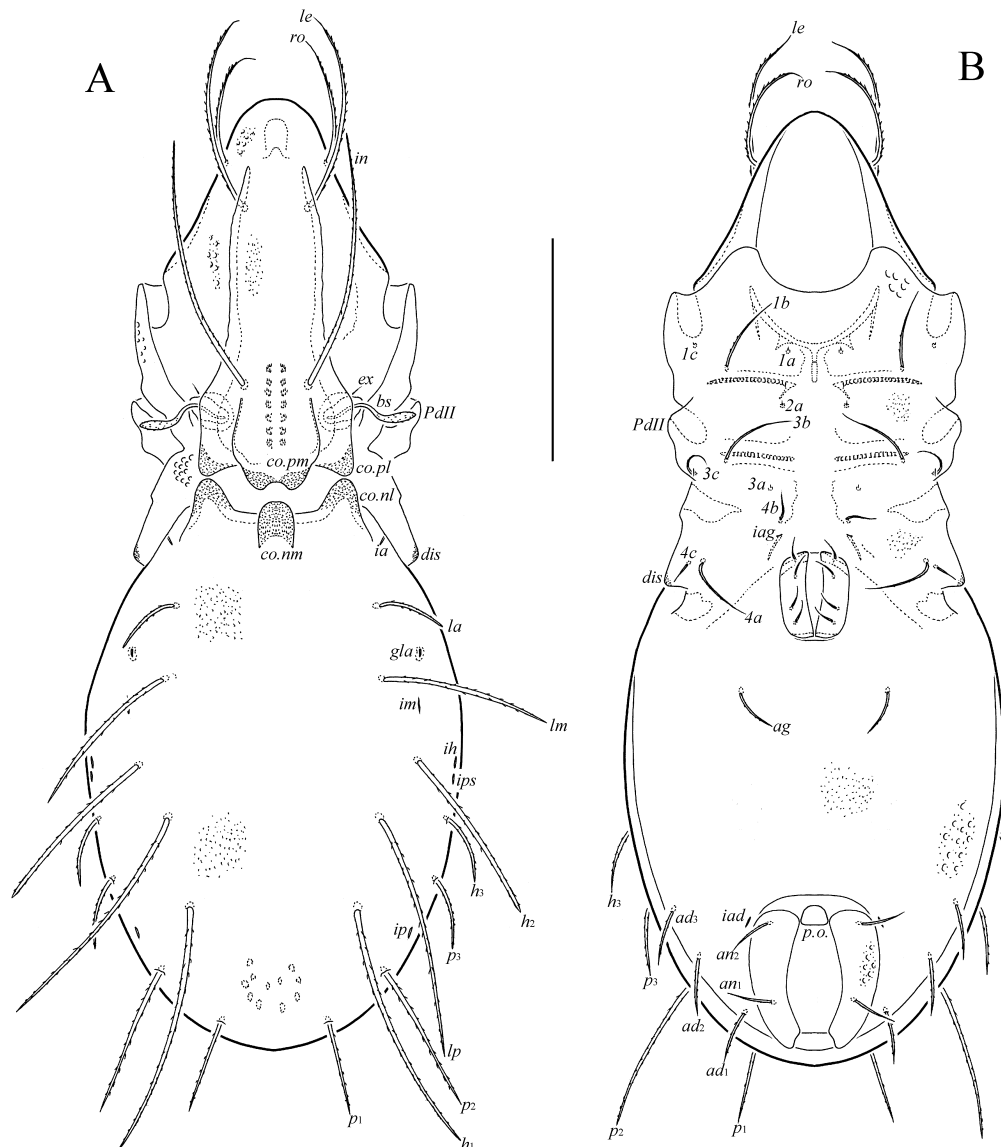


FIGURE 4. *Leptotocepheus zombaensis* sp. nov., adult: A—dorsal view (legs omitted); B—ventral view (gnathosoma and legs omitted). Scale bar 200 μ m.

of tarsus I short, erect, distally blunt, inserted proximal to solenidion ω_1 . Seta u setiform on all tarsi; v' minute on trochanters III, IV.

Material examined

Holotype (male) and two paratypes (all males): sample #12, Malawi, Zomba, Mt. Zomba, 15°20'37.2"S, 35°16'40.2"E, 1846 m a.s.l., sifting forest litter, Winkler extraction, 27.XI.2012 (leg. P. Baňář & P. Hlaváč). One paratype (male): sample #9, Malawi, Maloza, Mulanje Mts., Maloza stream valley, 16°01'3.9"S, 35°32'36.6"E, 972 m a.s.l., sifting litter, Winkler extraction, 24.XI.2012 (leg. P. Baňář).

Type deposition

The holotype is deposited in the collection of the SMNH; three paratypes are deposited in the collection of the TSUMZ. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Etymology

The species name *zombaensis* refers to the place of origin, Mt. Zomba.

Remarks

In having nine pairs of notogastral setae, *Leptotocepheus zombaensis* **sp. nov.** is morphologically most similar to the Afrotropical species, *L. trimucronatus* Balogh, 1961, but differs from the latter by the different length of notogastral setae (la , h_3 , p_1 and p_3 distinctly shorter than other notogastral setae; h_1 and h_2 longest versus all notogastral setae slightly differs in length) and interlamellar seta (about 2/3 length of prodorsum, distinctly longer than lamellar seta versus 1/2 length of prodorsum, similar to lamellar seta in length).

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