



New Oripodoidea (Acari, Oribatida) from New Zealand

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Abstract

Two new species of oripodoid mites (Oribatida, Oripodoidea) are described from the Kahurangi National Park in New Zealand. *Angullozetes kahurangiensis* sp. n. (Scheloribatidae) differs from *Angullozetes rostratus* Hammer, 1967 by the rounded rostrum and clavate bothridial setae with minute stalk and large, elongated head, and from *Angullozetes arilloi* Ermilov et al., Ecol Mont 18:75–81, 2018 by the presence of aggenital setae and three pairs of notogastral porose areas. *Totobates elatus* sp. n. (Haplozetidae) differs from *Totobates elegans* (Hammer, 1958) and *Totobates ovalis* Hammer, 1967 by the lanceolate bothridial setae. An identification key to known species of *Angullozetes* is presented.

Keywords Oribatid mites · Morphology · Systematics · *Angullozetes* · *Totobates* · Scheloribatidae · Haplozetidae · Australian region

Introduction

During taxonomic identification of oribatid mites from the Kahurangi National Park in New Zealand, we found two new species of the superfamily Oripodoidea, one belonging to the genus *Angullozetes* Hammer, 1967 (Scheloribatidae¹), the other to *Totobates* Hammer, 1961 (Haplozetidae²). The main goal of the paper is to describe these new species.

Angullozetes was proposed by Hammer (1967) with *Angullozetes rostratus* Hammer, 1967 as type species. The genus comprises two species, which are known only from New Zealand (Hammer 1967; Ermilov et al. 2018). The generic diagnosis was revised by Ermilov et al. (2018).

Totobates was proposed by Hammer (1961) with *Totobates discifer* Hammer, 1961 as type species. The genus comprises

16 species, which are distributed in the Australian, Antarctic and Neotropical regions (Subías 2004, updated 2018). The generic characters were summarized by Hammer (1961). An identification key to species of *Totobates* was given by Balogh and Balogh (2002).

Material and methods

Material

The detailed collection locality and habitat for each new species are given in the “Material examined” sections.

Methods

Soil cores were collected using a stainless steel corer (5 × 5 cm); the volume collected included the ground vegetation plus 5 cm of the substrate depth. Samples were kept in the refrigerator until delivered to the lab. Mites were extracted into 75% ethanol in modified Berlese extractors for a minimum of 7 days, or longer if the soil was not fully dry.

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. Notogastral width refers to the maximum width of the notogaster behind peritremes. Lengths of body setae

¹ According to Subías’s catalogue (2004, updated 2018), the genus is included in the family Liebstadiidae.

² According to Subías’s catalogue (2004, updated 2018), the genus is included in the family Protoribatidae.

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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”.

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.

The following abbreviations are used: *lam* – lamella; *plam* – prolamella; *slam* – sublamella; *Al* – sublamellar porose area; *tu* – tutorium; *ar*, *lr* – anterior and lateral ridges of prodorsum, respectively; *ro*, *le*, *in*, *bs*, *ex* – rostral, lamellar, interlamellar, bothridial and exobothridial setae, respectively; *bo* – bothridium; *D* – dorsophragma; *P* – pleurophragma; *Ad* – dorsosejugal porose area; *Am*, *Ah* – humeral porose areas; *c*, *la*, *lm*, *lp*, *h*, *p* – notogastral setae; *Aa*, *A2*, *A3* – notogastral porose areas; *ia*, *im*, *ip*, *ih*, *ips* – notogastral lyrifissures; *gla* – opisthotal gland opening; *cs* – circumgastric scissure; *csb* – circumgastric sigillar band; *a*, *m*, *h* – subcapitular setae; *or* – adoral seta, *v*, *l*, *d*, *cm*, *acm*, *ul*, *sul*, *vt*, *lt* – palp setae; ω – palp and leg solenidium; *cha*, *chb* – cheliceral setae; *Tg* – Trägårdh’s organ; *Pd I*, *Pd II* – pedotecta I, II, respectively; *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *4a*, *4b* – epimeral setae; *cus* – custodium; *dis* – discidium; *cp* – circumpedal carina; *g*, *ag*, *an*, *ad* – genital, aggenital, anal and adanal setae, respectively; *iad* – adanal lyrifissure; *p.o.* – preanal organ; *p.a.* – leg porose area; σ , φ – leg solenidia; ε – leg famulus; *v*, *ev*, *bv*, *l*, *d*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv* – leg setae.

Descriptions of new species

Family Scheloribatidae

Genus *Angullozetes* Hammer, 1967

Type species *Angullozetes rostratus* Hammer, 1967

Angullozetes kahurangiensis sp. n. (Figs. 1–12)

Diagnosis. Body size: 365–398 × 166–182. Rostrum rounded. Rostral, lamellar, interlamellar, notogastral, epimeral and anogenital setae short, setiform, smooth. Bothridial setae clavate, barbed, with very small stalk and large, elongate head. Prolamellae and posterior ridges of prodorsum absent. Tutoria with small point tip. Three pairs of rounded porose areas. Aggenital setae present.

Description. *Measurements.* Body length: 365 (holotype, male), 381, 398 (two paratypes, two males); notogaster width: 166 (holotype, male), 174, 182 (two paratypes, two males).

Integument. Body color light brown to brown. Body surface densely microfoveolate (visible under high magnification).

Prodorsum (Figs. 1, 3). Rostrum rounded. Lamellae half of prodorsum length (measured in lateral view). Prolamellae absent. Sublamellae slightly shorter than lamellae, thin. Tutoria strong, with small pointed tip. Anterior and lateral ridges on the lateral parts of prodorsum distinct, posterior ridges absent. Rostral, lamellar and interlamellar (all 8–12) setae setiform, smooth. Exobothridial setae (2) minute, thin, smooth. Bothridial setae (20; stalks in bothridia not considered) clavate, barbed, with very small stalk and large, elongate head. Dorsosejugal porose areas oval (4 × 2).

Notogaster (Figs. 1, 3–5). Anterior margin of notogaster not developed. Pteromorphs well-developed, triangular, rounded distally. Ten pairs of notogastral setae (4–6) setiform, smooth. Three pairs (*Aa*, *A2*, *A3*) of rounded porose areas (6–10) developed. Lyrifissures, opisthotal gland openings, circumgastric scissure and circumgastric sigillar band distinct.

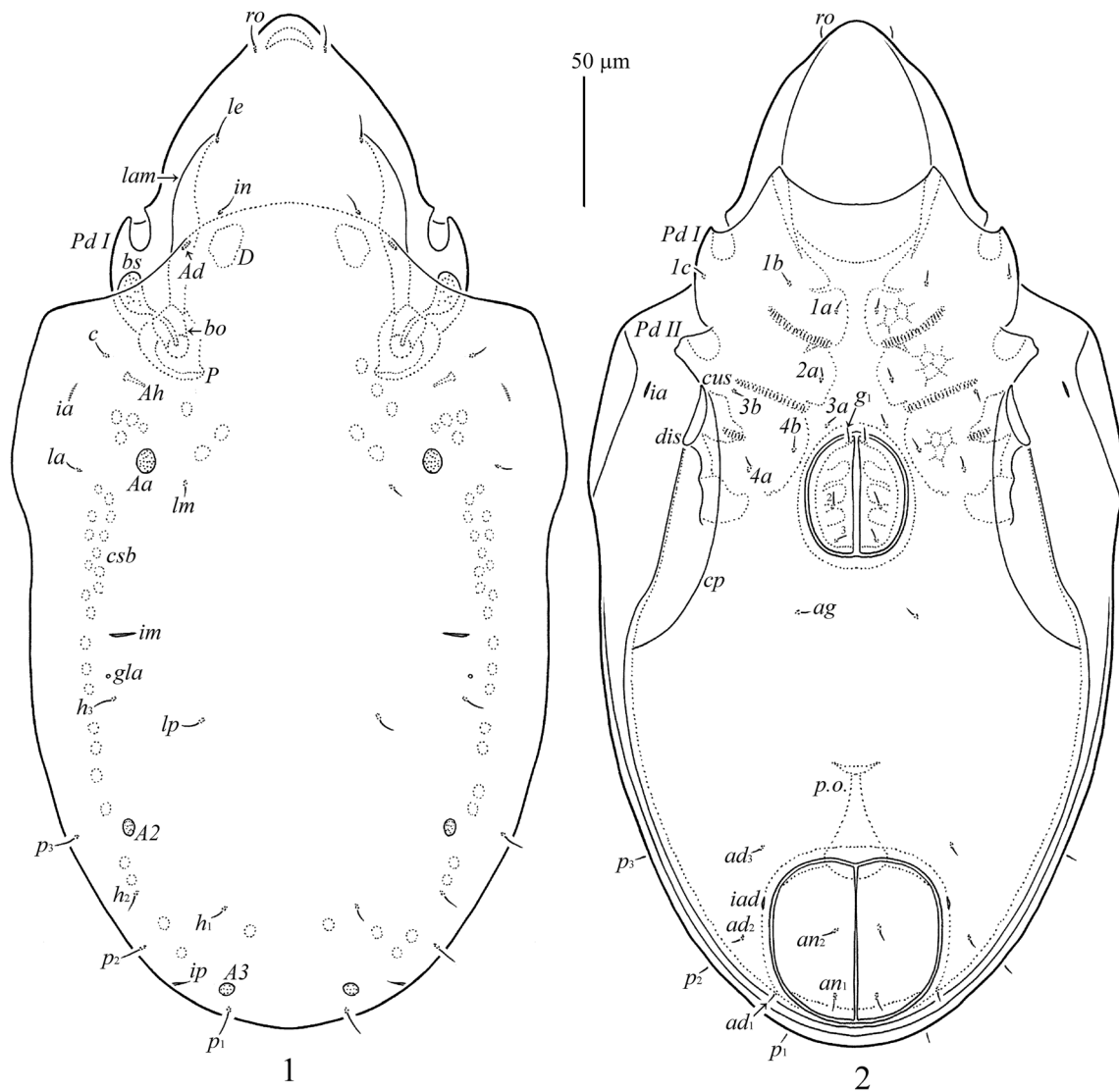
Gnathosoma (Figs. 6–8). Subcapitulum longer than wide (82–86 × 57–61). Subcapitular setae setiform, smooth, *h* (6–8) shorter and thinner than *a* and *m* (10–12). Adoral setae (6–8) setiform, barbed. Palps (length 45–49) with setation 0–2–1–3–9(+ ω). Postpalpal setae (2) spiniform, smooth. Chelicerae (length 82–86) with two setiform, barbed setae, *cha* (28–32) longer than *chb* (18–20). Trägårdh’s organ of chelicerae elongate triangular.

Epimeral and lateral podosomal regions (Figs. 2, 3). Epimeral setae (4–6) setiform, smooth. Humeral porose areas *Am* present, elongate oval, diffuse, poorly visible, *Ah* represented by saccules with small opening and conical channel. Pedotecta II trapezoid distally in ventral view. Discidia roundly triangular. Circumpedal carinae long, directed to triangular custodia.

Anogenital region (Figs. 2–5). Three pairs of genital, one pair of aggenital, two pairs of anal and three pairs of adanal setae (4–6) setiform, smooth. Adanal lyrifissures located close and parallel to anal plates. Postanal porose area long, band-like, poorly visible.

Legs (Figs. 9–12). All legs monodactylous, claw of each leg strong, smooth dorsally. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV slightly developed. Formulas of leg setation and solenidia: I (1–5–2–4–17) [1–2–2], II (1–5–2–4–15) [1–1–2], III (2–3–0–3–15) [1–1–0], IV (1–2–1–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1.

Material examined. Holotype (male) and two paratypes (two males): New Zealand, South Island, Nelson/Tasman region, Kahurangi National Park, Mount Arthur summit track, high alpine zone, 1521 m a.s.l., 41°12.601’ S, 172°42.099’ E, in soil under lichen, *Oreobolus pectinatus* (Hook. f.) and *Chionochloa australis* (Buchanan) Zotov, sample MtA-14, 23 January 2017 (collected by M. Minor).



Figs 1–2 *Angullozetes kahurangiensis* sp. n., adult. **1** Dorsal view (legs not shown). **2** Ventral view (gnathosoma and legs not shown)

Type deposition. The holotype (ethanol with a drop of glycerol) and one paratype (ethanol with a drop of glycerol) are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand. One paratype (ethanol with a drop of glycerol) is deposited in the Tyumen State University Museum of Zoology, Tyumen, Russia.

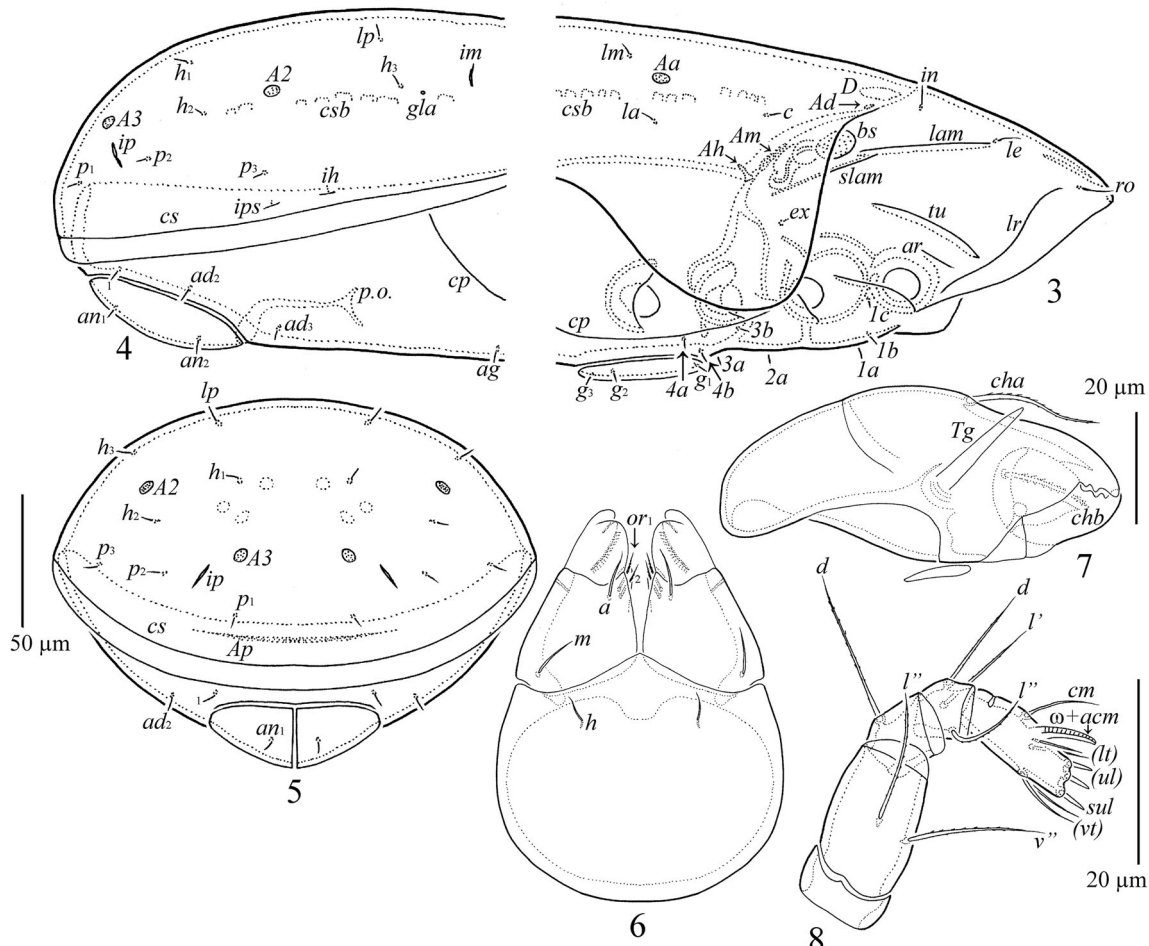
Etymology. The specific name *kahurangiensis* refers to the Kahurangi National Park where the species was collected.

Differential diagnosis. Distinctive characters of the new species versus other *Angullozetes* species can be found in the identification key below.

Table 1 Leg setation and solenidia of adult *Angullozetes kahurangiensis* sp. n. and *Totobates elatus* sp. n

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	d, (l), bv'', v''	(l), σ	(l), (v), φ ₁ , φ ₂	(ft), (tc), (it), (p), (u), (a), s, (pv), v', ε, ω ₁ , ω ₂
II	v'	d, (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'	σ	l', (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d	l', (v), φ	ft'', (tc), (p), (u), (a), s, (pv)

Roman letters refer to normal setae, Greek letters to solenidia (except ε = famulus). 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



Figs 3–8 *Angullozetes kahurangiensis* sp. n., adult. **3** Anterior part of body, lateral view (gnathosoma and legs not shown). **4** Posterior part of body, lateral view. **5** Posterior view. **6** Subcapitulum, ventral view. **7** Chelicera, left, paraxial view. **8** Palp, right, antiaxial view

Key to known species of *Angullozetes*

1. Aggenital setae absent; with four pairs of notogastral porose areas (*A1* present); body size: 225–254 × 131–147 ... *Angullozetes arilloi* Ermilov et al., 2018
 - Aggenital setae present; with three pairs of notogastral porose areas (*A1* absent) ... 2
2. Rostrum nasiform; bothridial setae with long stalk and small, globose head; body length: 360 ... *Angullozetes rostratus* Hammer, 1967
 - Rostrum not nasiform; bothridial setae with minute stalk and large, elongate head; body size: 365–398 × 166–182 ... *Angullozetes kahurangiensis* sp. n.

Family Haplozetidae

Genus *Totobates* Hammer, 1961

Type species *Totobates discifer* Hammer, 1961

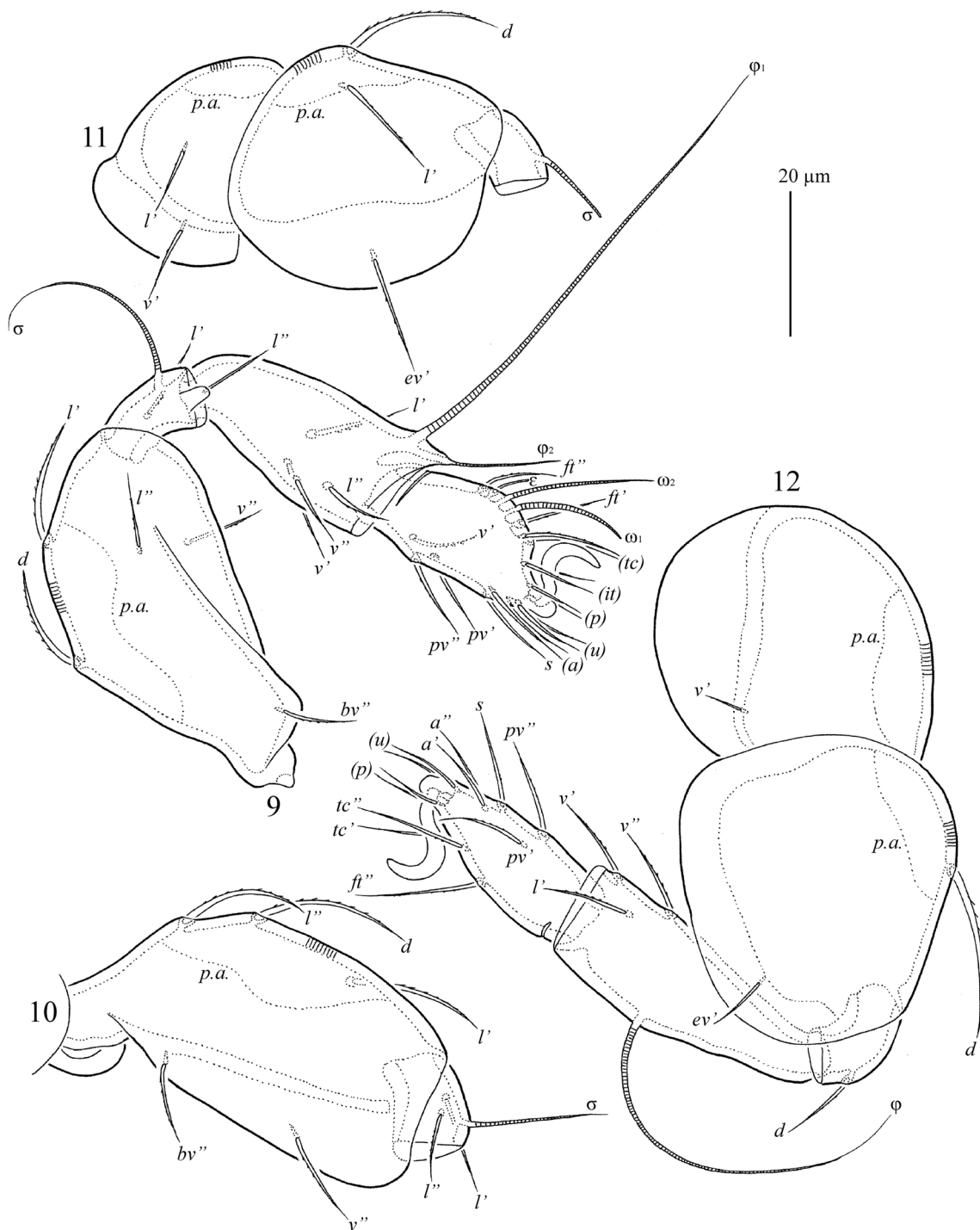
Totobates elatus sp. n. (Figs. 13–24)

Diagnosis. Body size: 315–348 × 166–190. Rostrum rounded. Rostral, lamellar and interlamellar setae long, setiform, barbed. Notogastral, anal and adanal setae short, setiform, with attenuate and flexible tip, smooth. Epimeral, genital and aggenital setae short, simple. Bothridial setae lanceolate, barbed, with long stalk and elongate head. Prolamellae present. Tutoria absent. Three pairs of rounded porose areas.

Description. Measurements. Body length: 348 (holotype, female), 315–348 (three paratypes, three females); notogaster width: 190 (holotype, female), 166–190 (three paratypes, three females).

Integument (Fig. 18). Body color light brown. Body surface densely microfoveolate (visible under high magnification). Lateral parts of subcapitular mentum slightly striate.

Prodorsum (Figs. 13, 15). Rostrum slightly protruding, rounded. Lamellae half of the prodorsum length (measured

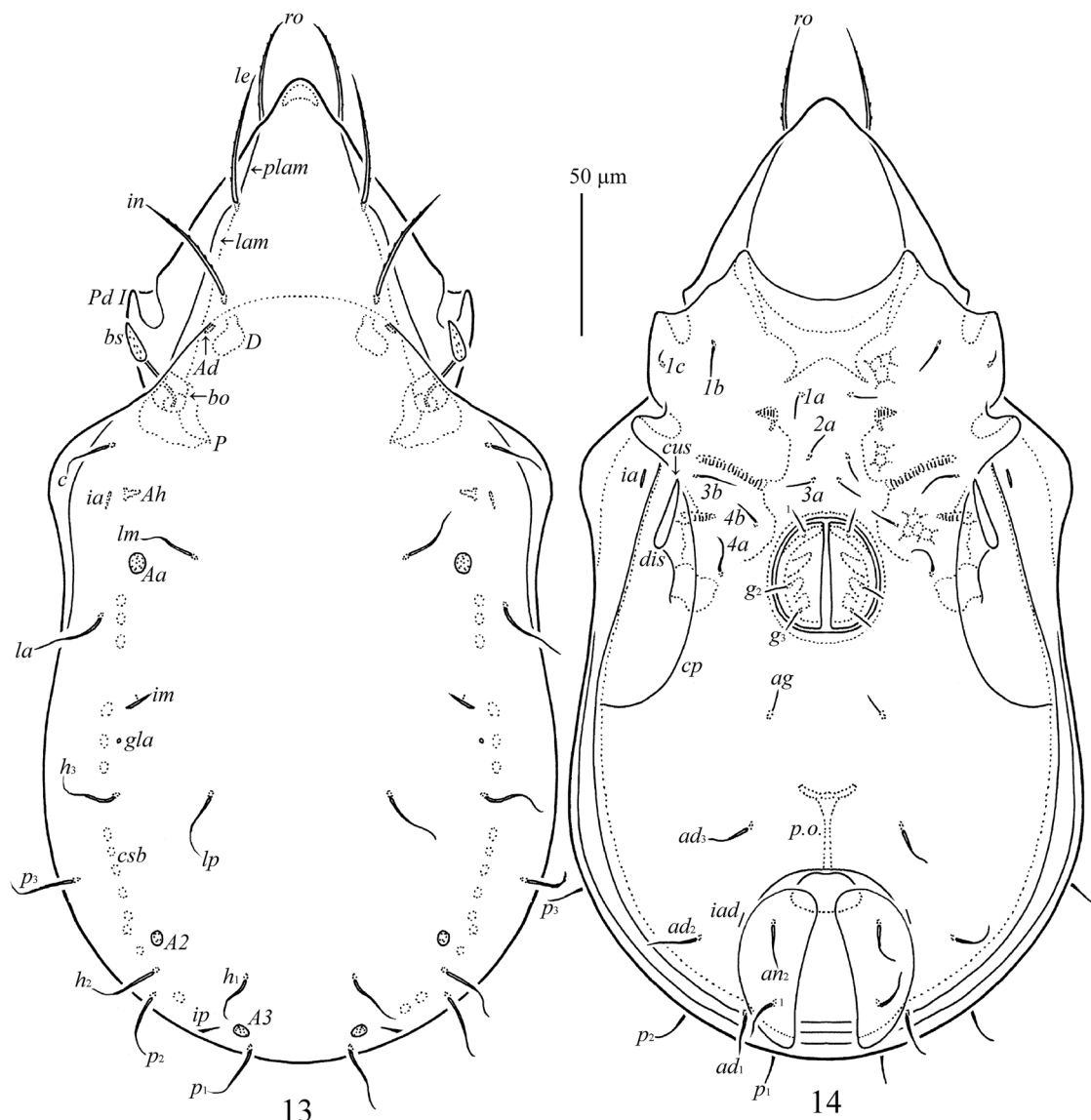


Figs. 9–12 *Angullozetes kahurangiensis* sp. n., adult. **9** Leg I, without trochanter, right, antiaxial view. **10** Trochanter, femur and genu of leg II, right, antiaxial view. **11** Trochanter, femur and genu of leg III, left, antiaxial view. **12** Leg IV, left, antiaxial view

in lateral view). Prolamellae present, reaching insertions of rostral setae. Sublamellae slightly longer than lamellae, thin. Sublamellar porose areas rounded (2). Tutoria absent. Rostral, lamellar and interlamellar (all 49–53) setae setiform, barbed. Exobothridial setae (4) minute, thin, smooth. Bothridial setae (32–36; stalks in bothridia not considered) lanceolate, barbed, with long stalk and

elongate head. Dorsosejugal porose areas oval (4 × 2). Anterior ridges on the lateral parts of prodorsum short, lateral and posterior ridges absent.

Notogaster (Figs. 13, 15–17). Anterior margin of notogaster not developed. Pteromorphs slightly developed, broadly rounded. Ten pairs of notogastral setae (20) setiform, with attenuate and flexible tip, smooth. Three pairs (*Aa*, *A2*,



Figs 13–14 *Totobates elatus* sp. n., adult. **13** Dorsal view (legs not shown). **14** Ventral view (gnathosoma and legs not shown)

A3) of rounded porose areas (6–8) developed. Lyrifissures, opisthotal gland openings, circumgastric scissure and circumgastric sigillar band distinct.

Gnathosoma (Figs. 18–20). Subcapitulum longer than wide (73–82 × 53–57). Subcapitular setae setiform, smooth, *h* (16) longer than *a* and *m* (12). Adoral setae (8) setiform, hook-like distally, smooth. Palps (length 45–49) with setation 0–2–1–3–9(+ω). Postpalpal setae (2) spiniform, smooth. Chelicerae (length 73–82) with two setiform, barbed setae, *cha* (26–28) longer than *chb* (16–18). Trägårdh's organ of chelicerae elongate triangular.

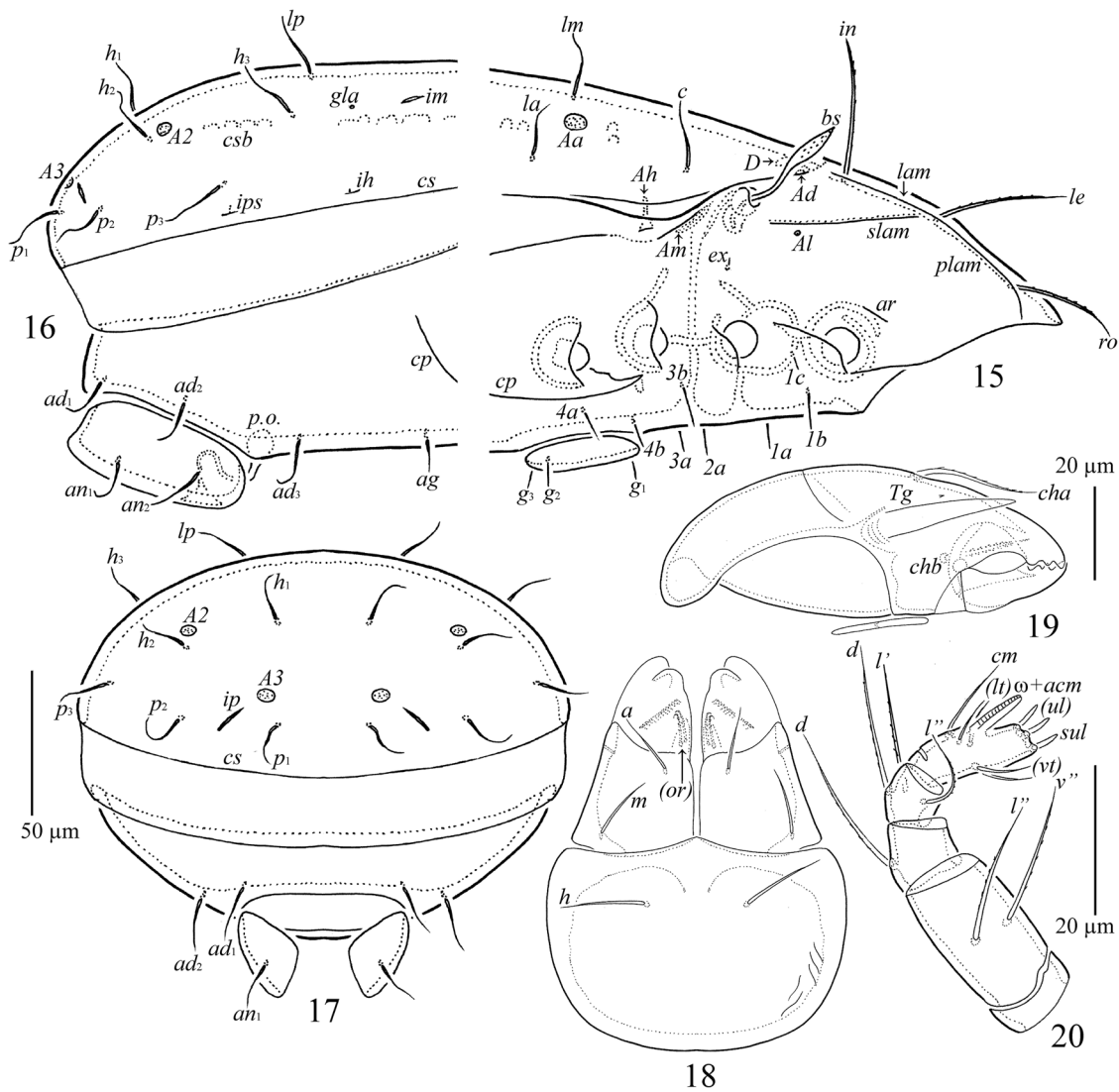
Epimeral and lateral podosomal regions (Figs. 14, 15). Epimeral setae setiform, smooth; *1c* shortest (6), *1b*, *3b* and *4a* (12) longer than others (8–10). Humeral porose areas *Am* present, elongate oval, diffuse, poorly visible, *Ah* represented by saccules with small opening and conical channel. Pedotecta II

rounded distally in ventral view. Discidia roundly triangular. Circumpedal carinae long, directed to triangular custodia.

Anogenital region (Figs. 14–17). Three pairs of genital and one pair of aggenital (8–10) setae simple. Two pairs of anal and three pairs of adanal (20) setae setiform, with attenuate and flexible tip, smooth. Adanal lyrifissures located close and parallel to anal plates. Postanal porose area not absent.

Legs (Figs. 21–24). All legs monodactylous, claw of each leg strong, smooth dorsally. Dorsoparaxial porose areas on femora I–IV and on trochanters III, IV slightly developed. Formulas of leg setation and solenidia: I (1–5–2–4–17) [1–2–2], II (1–5–2–4–15) [1–1–2], III (2–3–0–3–15) [1–1–0], IV (1–2–1–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1.

Material examined. Holotype (female) and three paratypes (three females): New Zealand, South Island,



Figs 15–20 *Totobates elatus* sp. n., adult. **15** Anterior part of body, lateral view (gnathosoma and legs not shown). **16** Posterior part of body, lateral view. **17** Posterior view. **18** Subcapitulum, ventral view. **19** Chelicera, left, paraxial view. **20** Palp, right, antiaxial view

Nelson/Tasman region, Kahurangi National Park, Mount Arthur summit track, high alpine zone, 1508 m a.s.l., 41°12.467' S, 172°42.119' E, in soil under carpet grass *Chionochloa australis*, sample MtA-1, 23 January 2017 (collected by M. Minor).

Type deposition. The holotype (ethanol with a drop of glycerol) and two paratypes (ethanol with a drop of glycerol) are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand. One paratype (ethanol with a drop of glycerol) is deposited in the Tyumen State University Museum of Zoology, Tyumen, Russia.

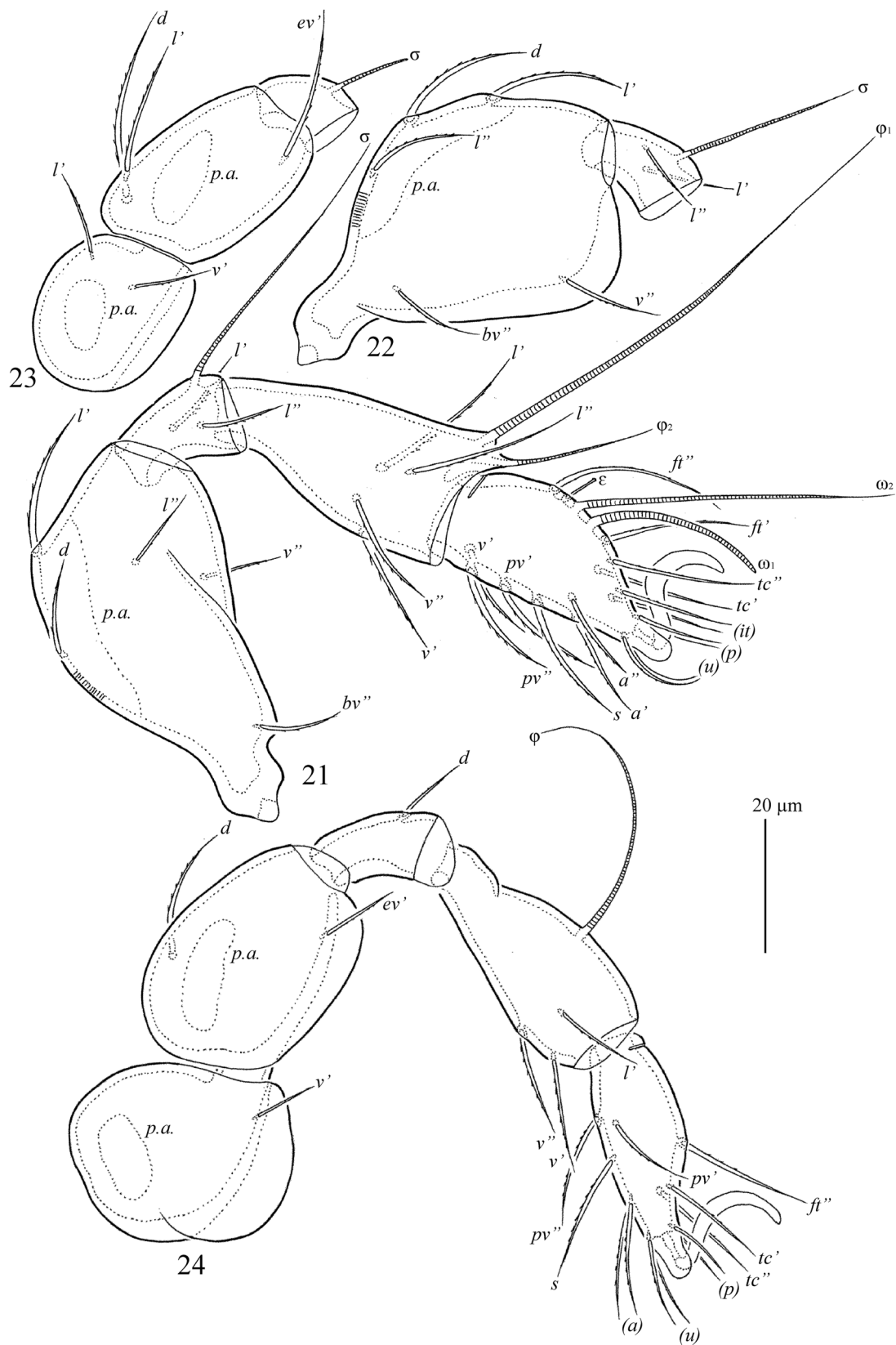
Etymology. The specific name *elatus* (from Latin: *elevatus*, *raised*) refers to the high altitude habitat of this species.

Differential diagnosis. *Totobates elatus* sp. n. is morphologically most similar to *Totobates elegans* (Hammer, 1958) from Argentina and the Antarctic region and *Totobates ovalis* Hammer, 1967 from New Zealand in having an elongate body,

long prodorsal setae and well-developed notogastral setae, but differs by the lanceolate bothridial setae (versus bothridial setae clavate to fusiform). In addition, *T. elegans* has simple prodorsal and notogastral setae (versus prodorsal setae barbed, notogastral setae with attenuate and flexible tip in *Totobates elatus* sp. n.), and *T. ovalis* has a pointed rostrum (versus rostrum rounded in *Totobates elatus* sp. n.).

Remarks

1. Ermilov et al. (2018) presented the generic diagnosis of *Angullozetes*. Some of morphological traits are: (1) prolamellae present, (2) humeral porose areas *Am* absent. However, *Angullozetes kahurangiensis* sp. n. has no prolamellae, and has humeral porose areas *Am* present.



Figs 21–24 *Totobates elatus* sp. n., adult. **21** Leg I, without trochanter, right, antiaxial view. **22** Femur and genu of leg II, right, antiaxial view. **23** Trochanter, femur and genu of leg III, left, antiaxial view. **24** Leg IV, left, antiaxial view

Hence, in the future these additions should be included in the updated generic diagnosis of *Angullozetes*.

2. The genus *Totobates* differs from the haplozetid genus *Maculobates* Hammer, 1962 by one main morphological difference: pteromorphs movable versus immovable. However, we noted that the pteromorphal hinges are often unclearly developed and sometimes represented by short dorsal ridges only, instead of true hinges, therefore, the generic identification is unclear. Thus, the systematic placement of all species belonging to *Totobates* and *Maculobates* should be revised in the future.

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Compliance with ethical standards

Conflict of interest No potential conflict of interest was reported by the authors.

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