

# Three new species of flat mites (Acari: Tetranychoida: Tenuipalpidae) from alpine New Zealand

Alexander A. Khaustov <sup>a</sup>, Maria A. Minor <sup>b</sup>

<sup>a</sup> University of Tyumen, Tyumen, 6 Volodarskogo Str., 625003 Russia.

<sup>b</sup> School of Food Technology and Natural Sciences, Massey University, Palmerston North 4410, New Zealand.

## Original research

### ABSTRACT

Female, male and deutonymph of *Acaricis brevicaudus* **sp. nov.**, female and deutonymph of *Dolichotetranychus tuberculatus* **sp. nov.**, and female of *Pentamerismus corniger* **sp. nov.** are described and illustrated from alpine cushion fields in New Zealand. Both *A. brevicaudus* **sp. nov.** and *D. tuberculatus* **sp. nov.** are associated with the cushion-forming ultra-dwarf shrub *Dracophyllum muscoides* Hook. f. (Ericaceae). The host plant for *P. corniger* **sp. nov.** is currently unknown. The diagnosis of *Acaricis* Beard and Gerson is modified. Additionally, *Pentamerismus* is recorded from New Zealand for the first time.

**Keywords** Prostigmata; *Acaricis*; *Dolichotetranychus*; *Pentamerismus*; systematics; morphology; phytophagy

**Zoobank** <http://zoobank.org/5057ACDE-FA5C-4D58-A5D3-411BBBE5E373>

## Introduction

Tenuipalpidae is the second largest family of tetranychoid mites (after Tetranychidae) presently comprising 41 genera and 1105 described species (Castro *et al.* 2024) distributed worldwide. All flat mites are obligate phytophages of various plants (Mesa *et al.* 2009; Beard *et al.* 2012; Castro *et al.* 2024). The fauna of flat mites of New Zealand currently includes 34 described species of seven genera (Xu and Zhang 2013, 2018; Castro *et al.* 2024).

The genus *Acaricis* Beard and Gerson, 2009 presently comprises five described species, two described from Australia (Beard and Gerson 2009) and three from New Zealand (Castro *et al.* 2018).

The genus *Dolichotetranychus* Sayed, 1938 comprises 26 species distributed worldwide (Mahdavi *et al.* 2022). Two species have been recorded from New Zealand (Zhang and Fan 2004),

The genus *Pentamerismus* McGregor, 1949 comprises 24 described species distributed worldwide (Khanjani and Gotoh 2008; Castro *et al.* 2024). *Pentamerismus* species have never been recorded in New Zealand.

Here we describe and illustrate one new species of flat mites from each of those genera, collected from soil samples in alpine New Zealand.

## Material and methods


Mites were obtained from soil cores collected in February 2014 in the high alpine zone (1600–1900 m a.s.l.) of three mountain ranges in the South Island of New Zealand (Central Otago): Old Man's Range, Pisa Range and The Remarkables. In each area, alpine cushion fields,

Received 09 December 2024

Accepted 22 January 2025

Published 27 January 2025

Corresponding author

Alexander A. Khaustov   
alex1973khaustov@gmail.com

Academic editor

Auger, Philippe

<https://doi.org/10.24349/5ues-p6s3>

ISSN 0044-586X (print)

ISSN 2107-7207 (electronic)



Khaustov A. A. and Minor M. A.

Licensed under

Creative Commons CC-BY 4.0



**How to cite this article** Khaustov A. A. and Minor M. A. (2025), Three new species of flat mites (Acari: Tetranychoida: Tenuipalpidae) from alpine New Zealand. *Acarologia* 65(1): 91-115. <https://doi.org/10.24349/5ues-p6s3>

vegetated snowbanks and alpine bogs were sampled. The species described in this paper have been found only in alpine cushion fields.

The cushion fields are periglacial patterned ground landforms which occupy extensive areas at high altitudes (above 1600 m a.s.l.) in the Central Otago mountains (Mark and Bliss, 1970; Mark, 1994). These fields have a microtopography of low (15–30 cm in height) hummocks with furrows in between. The crests of hummocks are occupied by ultra-dwarf cushion-forming shrubs *Dracophyllum muscoides* Hook. f. (Ericaceae) and *Raoulia* sp. (Asteraceae; most likely *Raoulia hectori* Hook.f.); the furrows between hummocks contain bare soil as well as some herb and lichen species. The soil is a shallow fine-textured loess underlain by schist fragments (Mark, 1994). Rain and snow (mean annual precipitation is about 1600 mm) keep soil moisture close to field capacity during the growing season (December to March) (Mark and Bliss 1970). This is a harsh tundra-like environment, with mean annual temperatures ca. 2 °C and frequent freeze-thaw cycles; freezing occurs every month of the year and for about five months of the year the crests with cushion plants remain continuously frozen from the surface to at least 20 cm depth (Mark, 1994; Scott *et al.*, 2008).

Samples were collected using a 5 × 5 cm stainless steel corer, samples from cushion plants included the entire vegetation layer (~2 cm) plus the soil to a depth of 5 cm, samples of bare soil between cushions were 5 cm deep. Microarthropods were extracted into 75% ethanol in modified Tullgren-Berlese extractors for a week. Most of collected mite specimens were cleared in lactic acid and mounted in Hoyer's medium.

The terminology of mite structures follows that of Lindquist (1985). All measurements are given in micrometers (µm) for holotype and range of measurements for the paratypes (in parentheses). For leg chaetotaxy, the number of solenidia is given in parentheses. Mite morphology was studied using a Carl Zeiss AxioImager A2 (Carl Zeiss, Germany) compound microscope with phase contrast and differential interference contrast (DIC) optical systems. Photomicrographs were taken with an Axio Cam ICc5 (Carl Zeiss, Germany) digital camera. Figures herein contain images assembled from multiple focal planes using Helicon Focus 7.7.5 software, using algorithms A and mostly B with subsequent manual addition of significant details from the individual focal planes.

## Systematics

### Family Tenuipalpidae Berlese, 1913

#### Genus *Acaricis* Beard and Gerson, 2009

Type species: *Acaricis plana* Beard and Gerson, 2009, by original designation.

#### Diagnosis

The latest diagnosis was provided by Castro *et al.* (2018). In our publication we follow that diagnosis with the following modification: setae *h2* elongate, filiform or foliate.

#### *Acaricis brevicaudus* sp. nov.

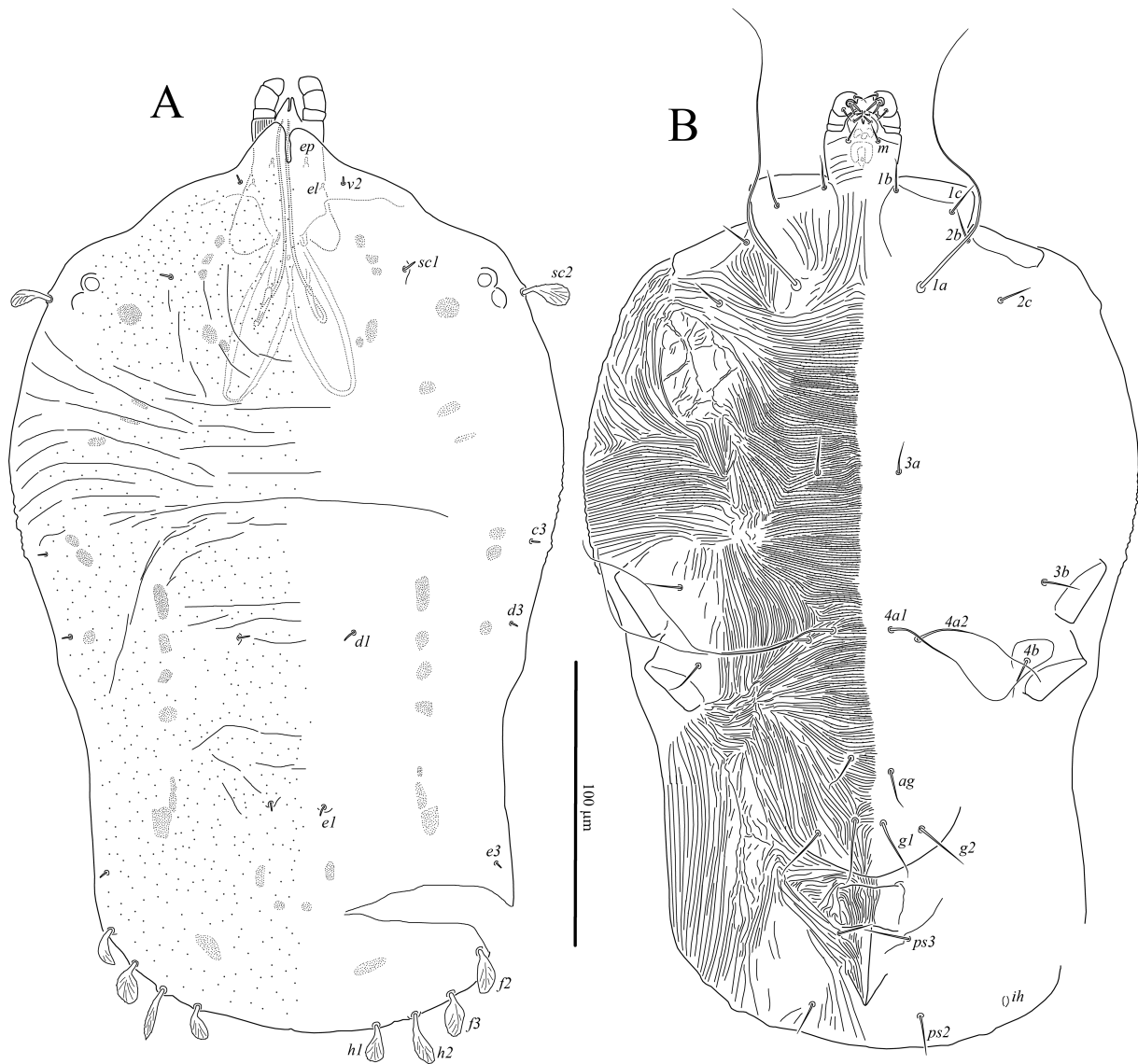
Zoobank: [6580B859-00C4-4A2C-9FAB-302C1ECCECD7](https://doi.org/10.24349/5ues-p6s3)

(Figs 1–9)

#### Description

**Female** — (Figs 1, 2A, B, 3A, 4–6; 5 measured). Body pear-shaped. Length of idiosoma 330 (307–335), maximum width 195 (195–207).

**Gnathosoma** – (Figs 2A, B, 6B). Palps four-segmented; setal formula 0-0-2(*d*, *l*"')-2(*ul*'ζ, *ul*"ζ); tibia with two subequal smooth and pointed setae; tarsus with two subequal eupathidia (Fig. 2A); palpal supracoxal setae (*ep*) short, peg-like, slightly widened distally and covered by

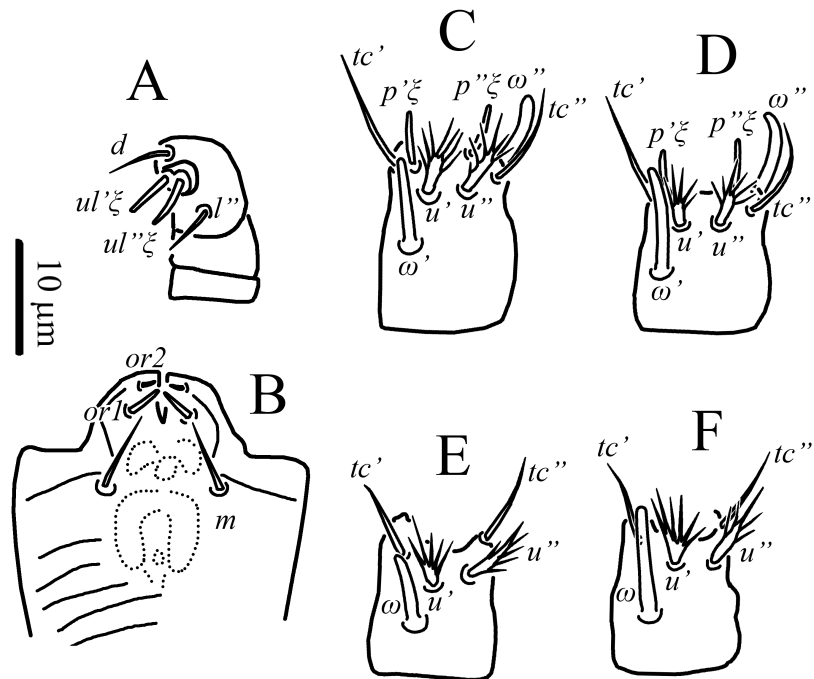


**Figure 1.** *Acaricis brevicaudus* n. sp., female: A – dorsum of body, B – venter of body.

anterior part of prodorsal shield (Fig. 6B). Subcapitulum with one pair of smooth and pointed subcapitular setae (*m*) and two pairs of smooth and blunt-tipped adoral setae (*or1*, *or2*); setae *or1* about three times longer than *or2* (Fig. 2B).

*Idiosomal dorsum* – (Figs 1A, 5A, 6A, C). All dorsal face with tiny sparsely distributed puncta; anterior margin of prodorsal shield with a pair of rounded distally projections separated by narrow notch (Fig. 6A); hysterosoma anteriorly with broken transverse striae. Setae *v2*, *scl1*, *c3*, *dl1*, *d3*, *e1*, and *e3* minute, smooth and blunt-tipped; setae *sc2*, *f2*, *f3*, *h1*, and *h2* foliate and weakly barbed; setae *h2* usually slightly longer and narrower than *h1* and *f3*. Length of dorsal setae: *v2* 4 (4–5), *scl1* 5 (5–6), *sc2* 18 (17–20), *c3* 4 (4), *dl1* 5 (5–6), *d3* 4 (3–5), *e1* 4 (4–5), *e3* 4 (4–5), *f2* 16 (14–15), *f3* 17 (16), *h1* 13 (14–16), *h2* 19 (15–19). Distances between setae: *v2*–*v2* 37 (33–38), *scl1*–*scl1* 84 (83–93), *sc2*–*sc2* 168 (165–175), *c3*–*c3* 172 (177–181), *dl1*–*dl1* 41 (42–47), *d3*–*d3* 156 (155–163), *e1*–*e1* 19 (19–22), *e3*–*e3* 138 (133–139), *f2*–*f2* 131 (130–137), *f3*–*f3* 111 (109–115), *h1*–*h1* 63 (58–65), *h2*–*h2* 89 (85–91).

*Idiosomal venter* – (Figs 1B, 3A, 5B, 6D–F). Ventral idiosoma mostly with delicate transverse striae; striae in central part with tiny microtubercles (Fig. 6E). All ventral setae



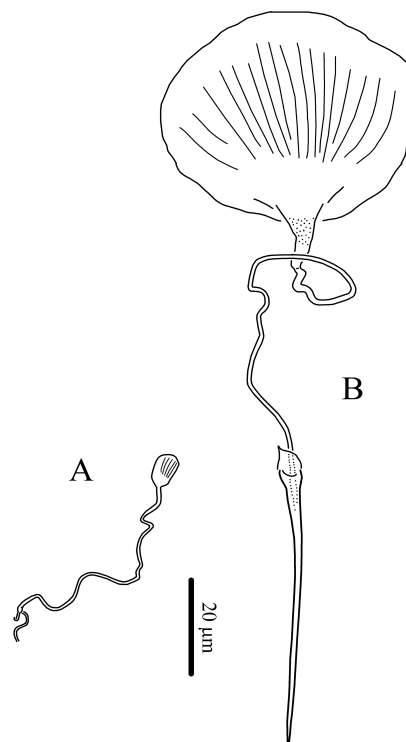
**Figure 2** . *Acaricis brevicaudus* n. sp., female (A, B) and male (C–F): A – right palp, ventral aspect; B – subcapitulum; C–F – right tarsi I–IV, ventral aspect.

smooth and pointed; setae *1a*, *4a1*, and *4a2* long, whip-like. Genital plate weakly defined. Cupules *ih* hardly visible and located laterad setae *ps2*. Length of ventral setae: *1a* 135 (132), *1b* 13 (13), *1c* 11 (13), *2b* 13 (13–14), *2c* 12 (13), *3a* 12 (12–13), *3b* 14 (14–15), *4a1* 100 (97–100), *4a2* 100 (98–105), *4b* 15 (13–16), *ag* 15 (14–20), *g1* 24 (19–21), *g2* 21 (20–22), *ps2* 14 (11–14), *ps3* 15 (15–17).

*Spermathecal apparatus* – (Fig. 3A). Spermatheca represented by oval and weakly longitudinally striated vesicle connected with long and narrow duct.

*Legs* – (Fig. 4). Leg I (Fig. 4A). Setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *v'*, *bv''*), Ge 2 (*d*, *l''*), Ti 5 (*d*, *l'*, *l''*, *v'*, *v''*), Ta 7(1) (*p'ζ*, *p''ζ*, *tc'*, *tc''*, *ft''*, *u'*, *u''*, *ω''*). Solenidion *ω''* 5 (5–7) digitiform; setae (*p*) of tarsus smooth, blunt-tipped, eupathid-like; setae *d*, *l'* of femur, *d*, *l''* of genu, and *l''* of tibia foliate and barbed; seta *d* of tibia lanceolate and barbed; setae (*u*) flattened and widened, with long distal projections; other setae smooth and pointed; seta *ft''* located on distinct tubercle. Leg supracoxal seta (*el*) of same shape as palpal supracoxal setae and located under anterior part of prodorsal shield (Fig. 6B). Leg II (Fig. 4B). Setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *v'*, *bv''*), Ge 2 (*d*, *l''*), Ti 5 (*d*, *l'*, *l''*, *v'*, *v''*), Ta 7(1) (*p'ζ*, *p''ζ*, *tc'*, *tc''*, *ft''*, *u'*, *u''*, *ω''*). Solenidion *ω''* 5 (5–7) digitiform; setae (*p*) of tarsus smooth, blunt-tipped, eupathid-like; setae *d*, *l'*, *bv''* of femur, *d*, *l''* of genu, *d* and *l''* of tibia foliate and barbed; seta *d* of tibia lanceolate and barbed; setae (*u*) flattened and widened, with long distal projections; other setae smooth and pointed; seta *ft''* located on distinct tubercle. Leg III (Fig. 4C). Setation: Tr 2 (*l'*, *v'*), Fe 2 (*d*, *ev'*), Ge 1 (*d*), Ti 3 (*d*, *v'*, *v''*), Ta 5 (*ft'*, *tc'*, *tc''*, *u'*, *u''*). Setae *l'* of trochanter, *d* of femur, genu and tibia foliate and barbed; setae (*tc*) slightly widened and weakly barbed; setae (*u*) flattened and widened, with long distal projections; other setae smooth and pointed. Leg IV (Fig. 4D). Setation: Tr 1 (*v'*), Fe 2 (*d*, *ev'*), Ge 0, Ti 3 (*d*, *v'*, *v''*), Ta 5 (*ft'*, *tc'*, *tc''*, *u'*, *u''*). Setae *l'* of trochanter, *d* of femur and tibia foliate and barbed; seta *tc'* and (*u*) as on tarsus III; other setae smooth and pointed.

**Male** — (Figs 2C–F, 3B, 7, 9A–C; 2 measured). Body is narrower than that of female.



**Figure 3** . *Acaricis brevicaudus* n. sp., female (A) and male (B): A – spermatheca; B – genitalia.

Length of idiosoma 255–260, maximum width 147–157.

*Gnathosoma* – Similar to that of female.

*Idiosomal dorsum* – (Figs 7A, 9A). Idiosomal dorsum similar to that of female. Length of dorsal setae: *v2* 5, *sc1* 5–6, *sc2* 14–15, *c3* 4–5, *d1* 5, *d3* 4, *e1* 4–5, *e3* 4–5, *f2* 13–15, *f3* 13–14, *h1* 12–13, *h2* 17–18. Distances between setae: *v2–v2* 32–33, *sc1–sc1* 72–73, *sc2–sc2* 135–140, *c3–c3* 123–130, *d1–d1* 30–36, *d3–d3* 100–105, *e1–e1* 14–17, *e3–e3* 82–84, *f2–f2* 87–88, *f3–f3* 76–78, *h1–h1* 45, *h2–h2* 55–62.

*Idiosomal venter* (Figs 3B, 7B, 9B, C). In general similar to that of female; all ventral striae smooth. All ventral setae smooth (Fig. 9B); seta *ps3* blunt-tipped and located under anal lateral flaps; other setae pointed. Length of ventral setae: *1a* 112, *1b* 11–12, *1c* 11–12, *2b* 12–13, *2c* 12–13, *3a* 10–12, *3b* 13–14, *4a1* 78, *4a2* 80, *4b* 14–15, *ag* 12–14, *g1* 18–19, *g2* 18–20, *ps2* 11–12, *ps3* 7–8.

*Aedeagus* – (Fig. 3B). Aedeagus well-sclerotized, long and narrow, connected with narrow and weakly sclerotized duct ending in large and hardly visible spherical vesicle.

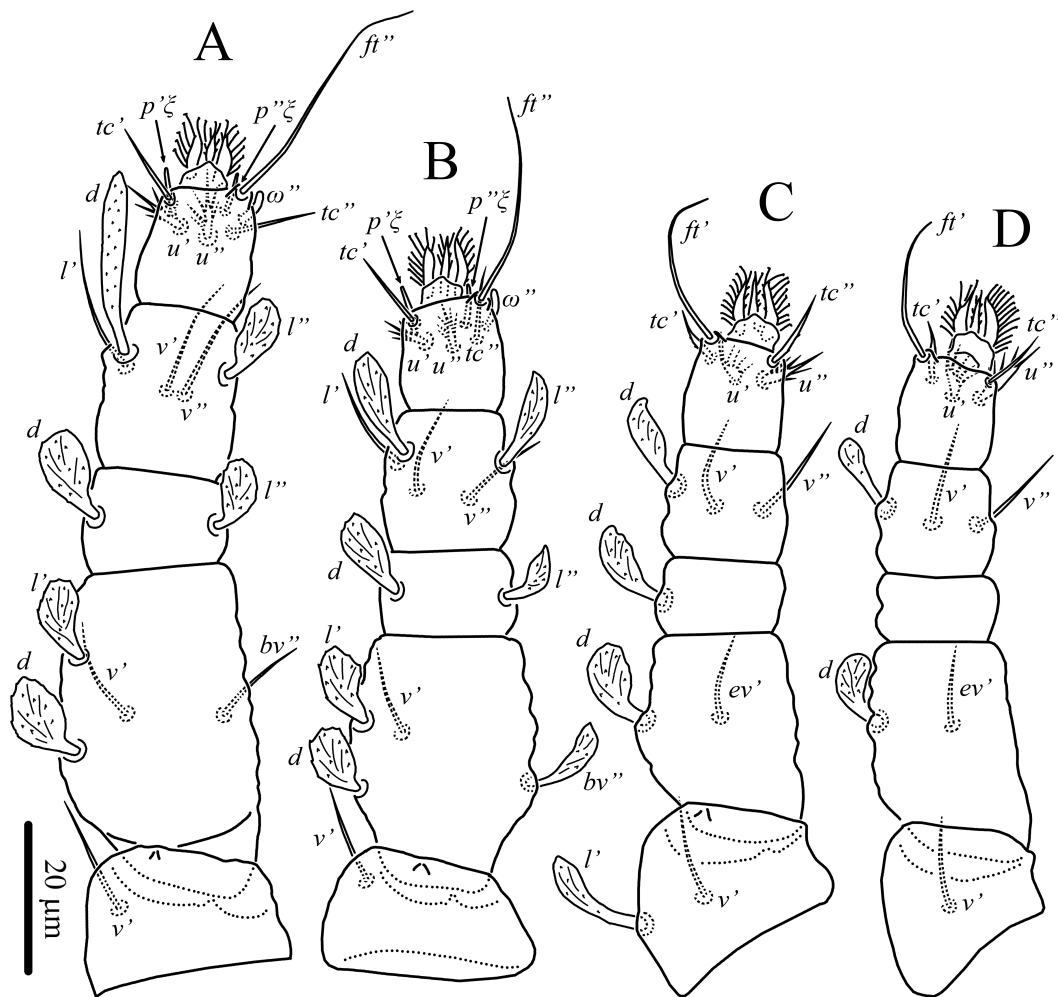
*Legs* – (Figs 2C–F). Setation of legs as in female, except presence of two solenidia ( $\omega'$ ,  $\omega''$ ) on tarsi I and II, and solenidium  $\omega$  on tarsi III and IV. Lengths of solenidia:  $\omega'$ I 8–10,  $\omega''$ I 810,  $\omega'$ II 9–10,  $\omega''$ II 9,  $\omega$ III 6–10,  $\omega$ IV 9–10.

**Deutonymph** — (Figs 8, 9D–F; 1 measured). Body pear-shaped. Length of idiosoma 290, maximum width 180.

*Gnathosoma* – similar to that of female.

*Idiosomal dorsum* – (Figs 8A, 9D). Metapodosoma distinctly transversely striated; shape of dorsal setae as in female, except narrowly lanceolate *sc2*. Length of dorsal setae: *v2* 4, *sc1* 4, *sc2* 18, *c3* 4, *d1* 4, *d3* 4, *e1* 4, *e3* 4, *f2* 14, *f3* 15, *h1* 10, *h2* 18. Distances between setae: *v2–v2* 31, *sc1–sc1* 70, *sc2–sc2* 143, *c3–c3* 155, *d1–d1* 36, *d3–d3* 130, *e1–e1* 16, *e3–e3* 107, *f2–f2* 104, *f3–f3* 87, *h1–h1* 50, *h2–h2* 70.

*Idiosomal venter* – (Figs 8B, 9E, F). In general similar to that of female except the following:



**Figure 4 .** *Acaricis brevicaudus* n. sp., female: A–D – right legs I–IV, respectively, dorsal aspect.

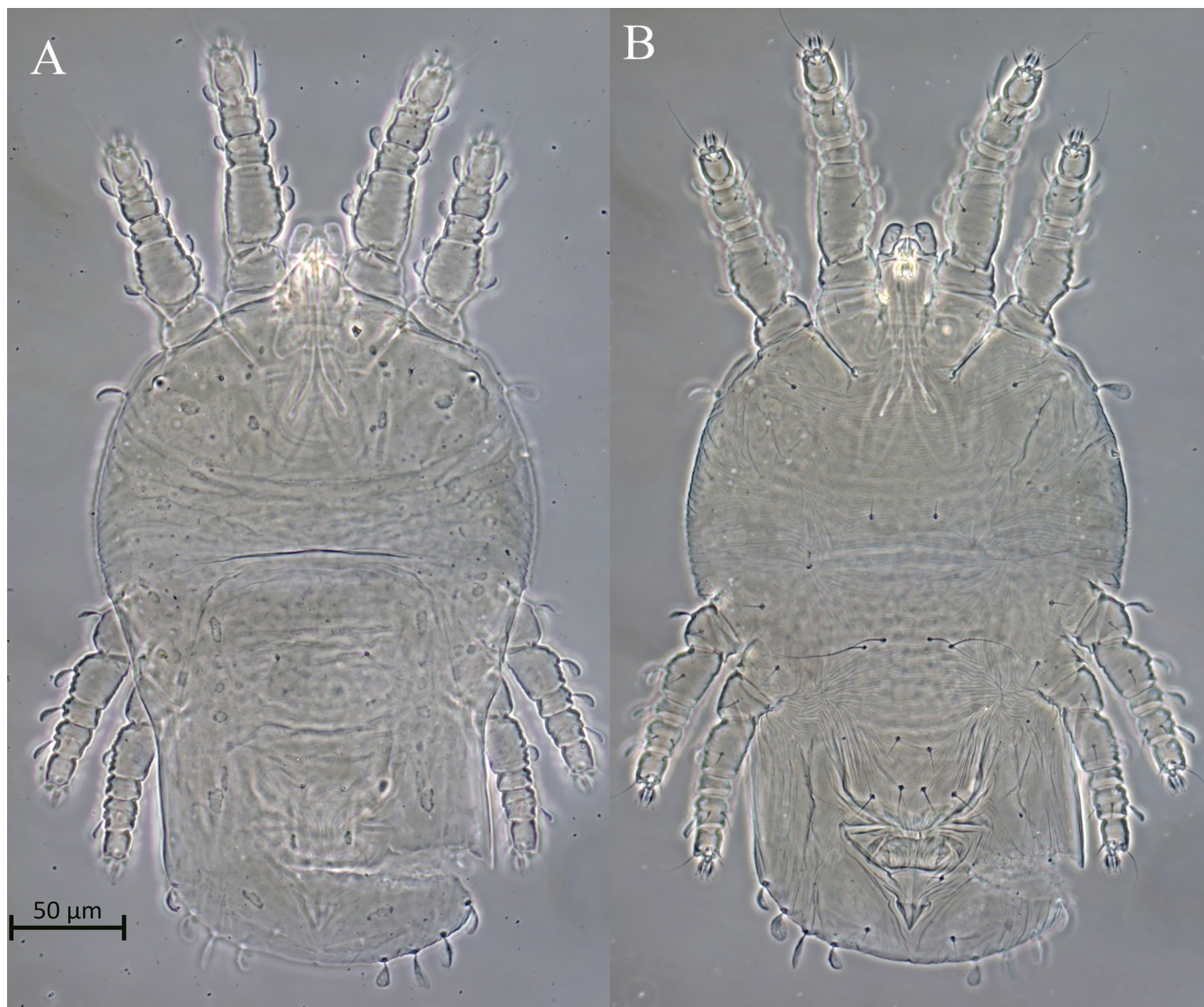
all ventral striae smooth; only one pair of setae *4a* (*4a2* absent); only one pair of genital setae (*g2* absent); genital plate not developed. Length of ventral setae: *1a* 110, *1b* 10, *1c* 10, *2b* 10, *2c* 12, *3a* 11, *3b* 12, *4a* 76, *4b* 12, *ag* 10, *g* 16, *ps2* 11, *ps3* 9.

*Legs* – As in female, except trochanter IV without seta. Lengths of solenidia:  $\omega'$ I 5,  $\omega''$ II 5.

**Protonymph and larva** — unknown.

**Type material**

Holotype female, New Zealand, South Island, Central Otago, Old Man’s Range, 45°18’58.45”S, 169°11’45.21”E, 1646 m a.s.l., sample from *Dracophyllum muscoides* Hook. f. (Ericaceae) cushion plant, 17 February 2014, sample code (OmC2D2 in); paratypes: 1 female, same data; 1DN, 2 males, 5 females, same locality, from *D. muscoides* cushion, 17 February 2014, sample code (OmC2D1 in); 1 male, New Zealand, South Island, Central Otago, Pisa Range, 44°52’11.1”S, 169°10’9.2”E, 1797 m a.s.l., from *D. muscoides* cushion, 18 February 2014, sample code (PiC2D3 in); 2 females, same locality, from *D. muscoides* cushion, 18 February 2014, sample code (PiC2D1 in); 1 female, New Zealand, South Island, Central Otago, Pisa Range, 44°52’18.79”S, 169°10’30.39”E, 1880 m a.s.l., from *D. muscoides* cushion, 18 February



**Figure 5 .** Phase contrast micrographs of *Acaricis brevicaudus* n. sp., female: A – general dorsal view; B – general ventral view.

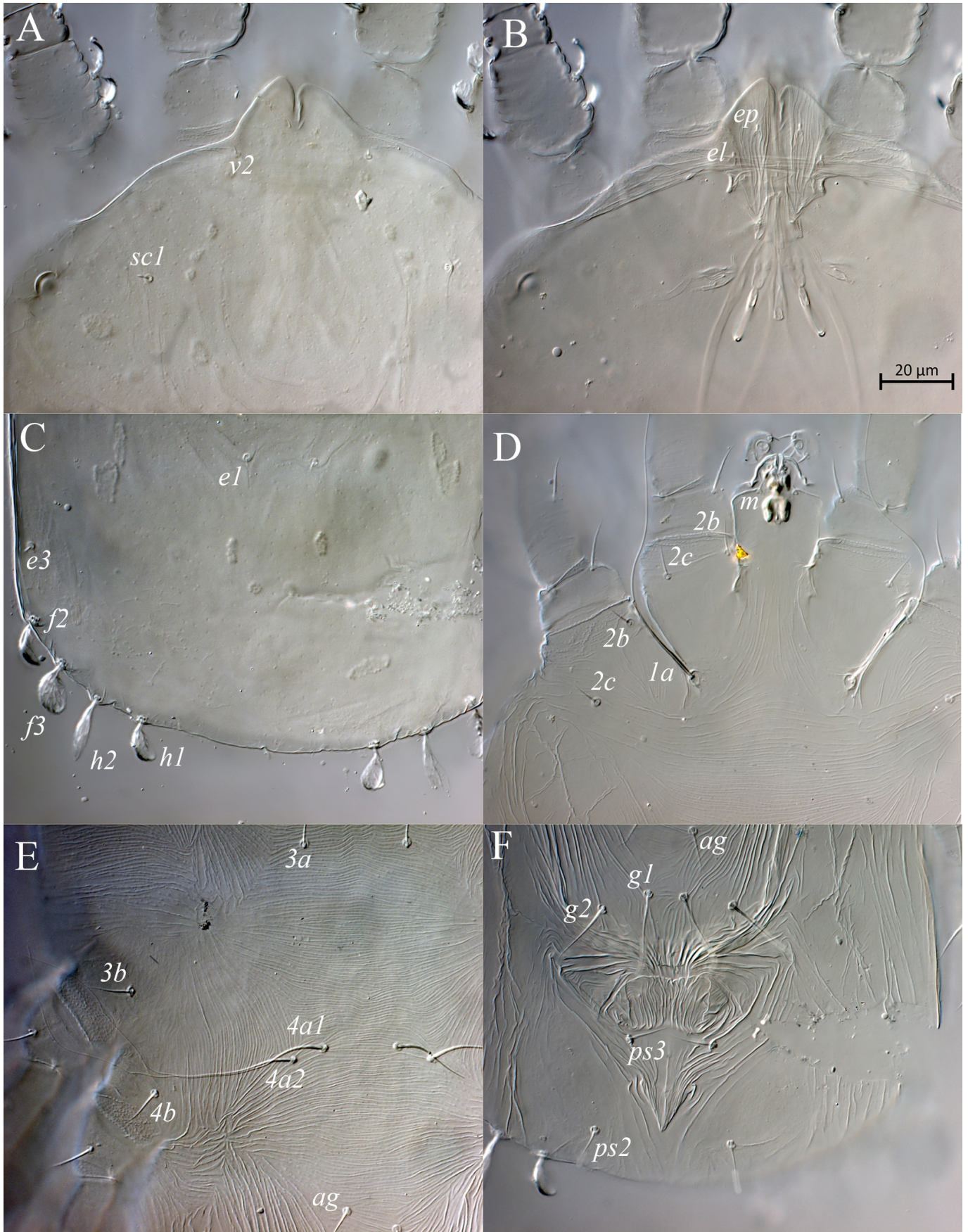
2014, sample code (PiC1D2 in); 1 female, New Zealand, South Island, Central Otago, The Remarkables, 45°03' 38.19"S, 168°48'49.51"E, 1839 m a.s.l., from *D. muscoides* cushion, 19 February 2014, sample code (RemC3D2 in). All specimens collected by M. Minor.

#### **Type deposition**

The holotype and one paratype females are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand; other paratypes are deposited in the mite collection of the University of Tyumen Museum of Zoology, Tyumen, Russia.

#### **Differential diagnosis**

Female of the new species differs significantly from other species of *Acaricis* in having seta *h2* foliate, similar in shape to *h1* and *f3* (vs. seta *h2* long, whip-like in other species). Among New Zealand species of *Acaricis*, female of the new species is most similar to *A. montanus* (Collyer, 1973). It can be distinguished from *A. montanus* in having wider foliate and distally



**Figure 6** . DIC micrograph of *Acaricis brevicaudus* n. sp., female: A – prodorsum; B – supracoxal setae *ep* and *el*; C – opisthosoma, dorsal aspect; D – proterosoma, ventral aspect; E – metapodosoma, ventral aspect; F – opisthosoma, ventral aspect.

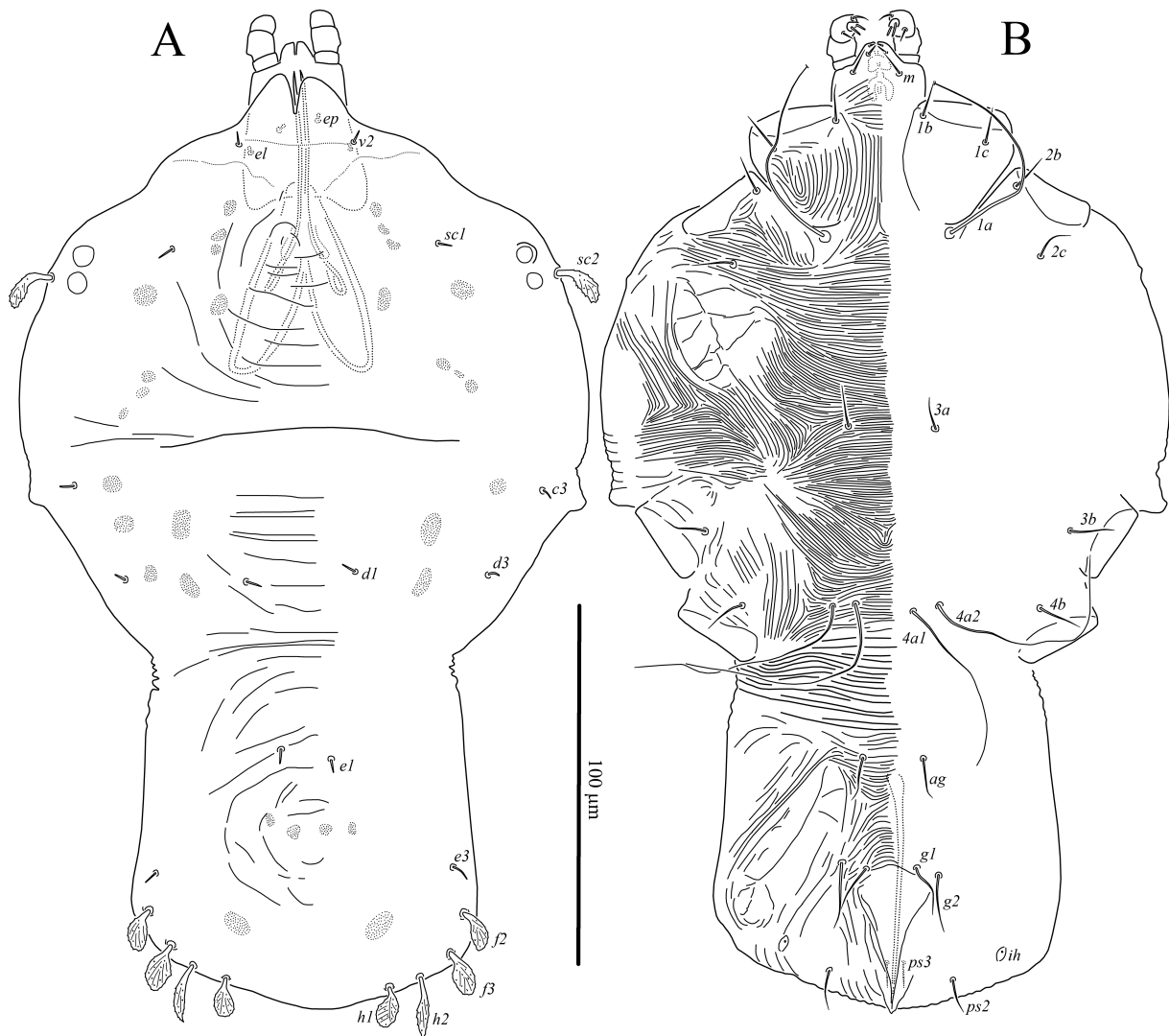


Figure 7. *Acaricis brevicaudus* n. sp., male: A – dorsum of body, B – venter of body.

rounded setae *sc2*, *f2*, *f3*, and *h1* (vs. setae *sc2*, *f2*, *f3*, and *h1* narrower and broadly lanceolate in *A. montanus*).

#### Etymology

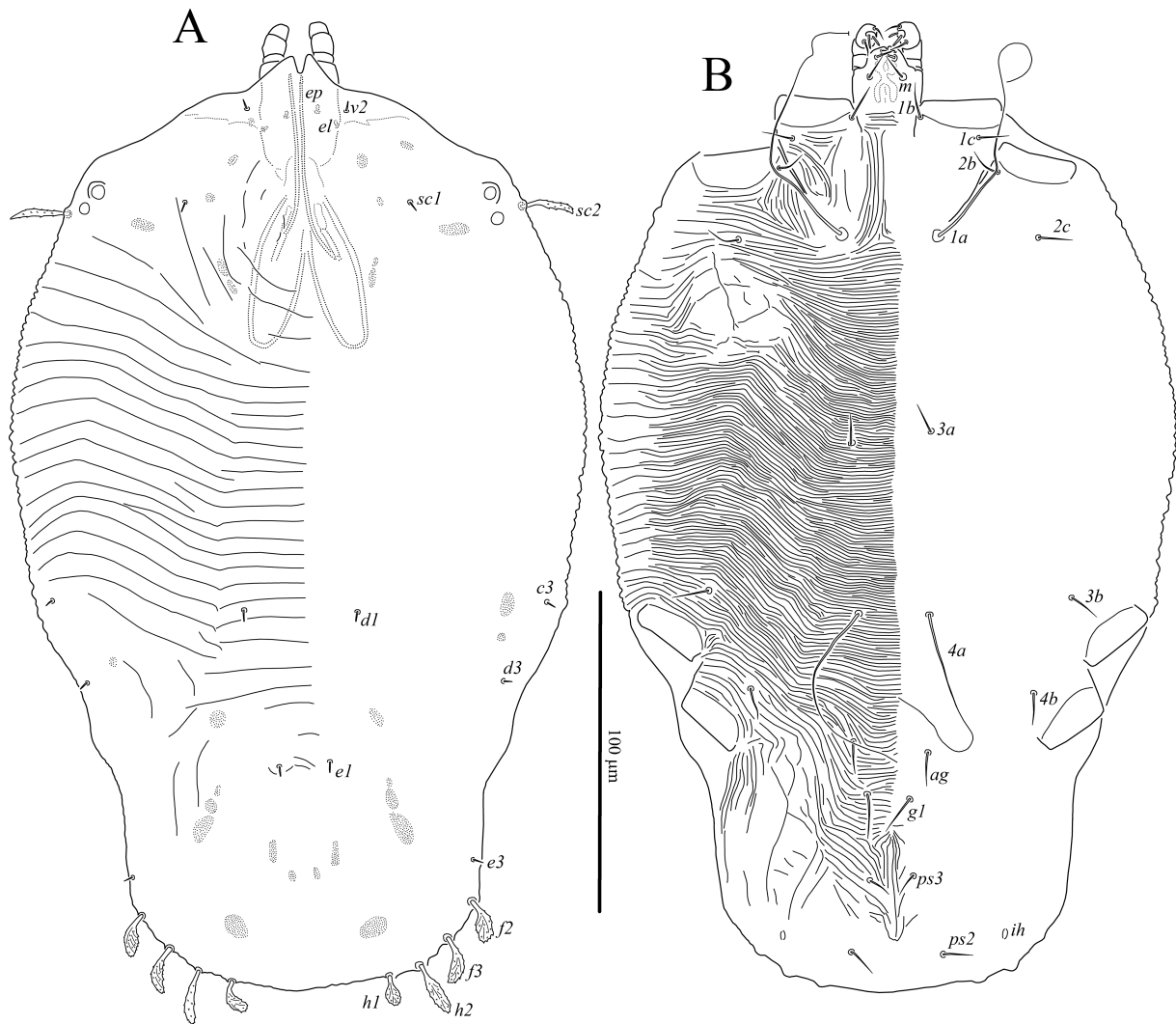
The name of the new species is a combination of two Latin words: *brevis* meaning *short*, and *caudus* meaning *tail*, and refers to unusually short “caudal” seta *h2*.

#### Genus *Dolichotetranychus* Sayed, 1938

Type species: *Stigmaeus floridanus* Banks, 1900, by monotypy.

#### Diagnosis

In this publication we follow the diagnosis of *Dolichotetranychus* proposed by Seeman *et al.* (2015).



**Figure 8 .** *Acaricis brevicaudus* n. sp., deutonymph: A – dorsum of body, B – venter of body.

***Dolichotetranychus tuberculatus* sp. nov.**

Zoobank: 54489401-E984-43C9-AE72-156F09519A3C

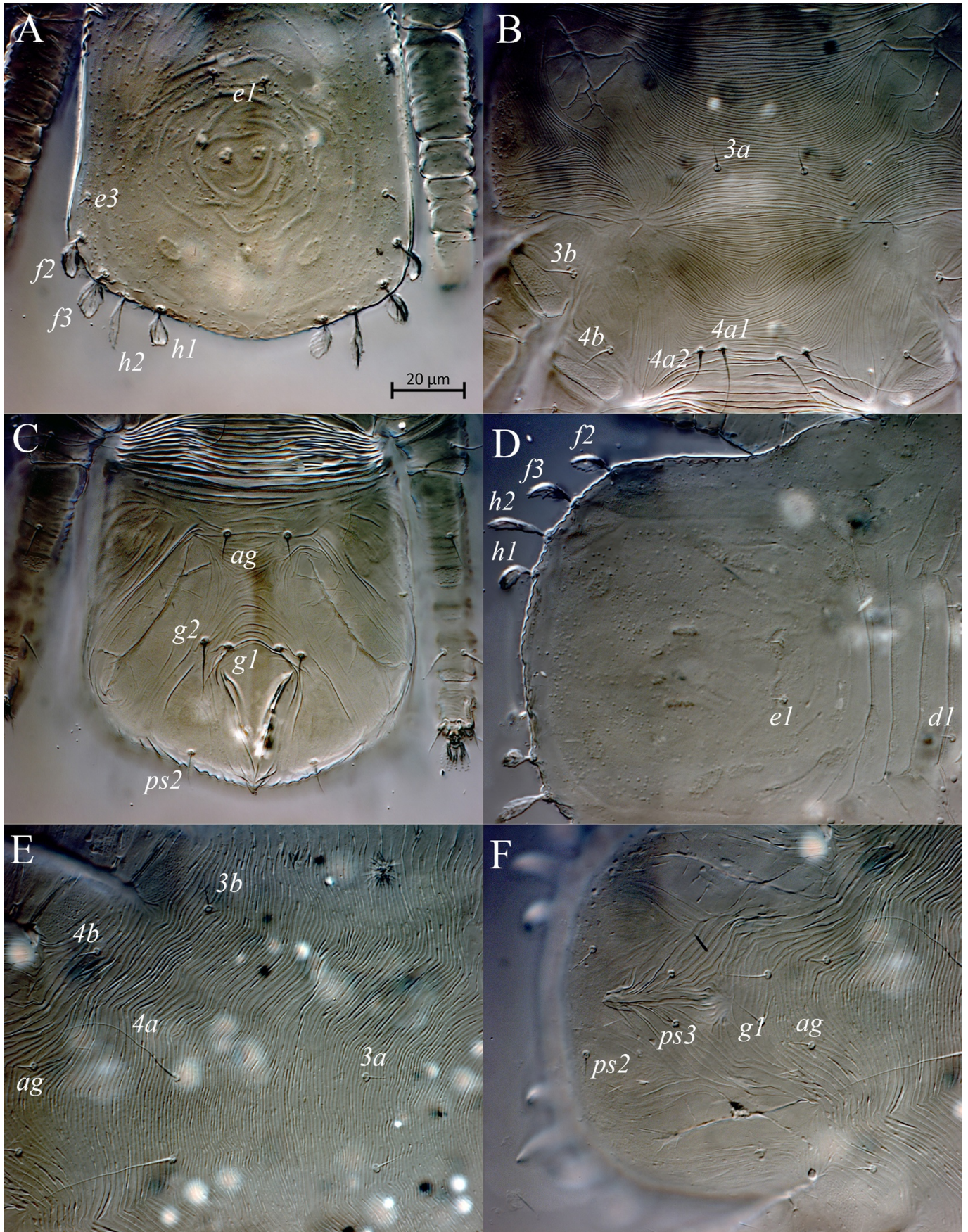
(Figs 10–16)

**Description**

**Female** — (Figs 10–14; 5 measured). Body elongated. Length of idiosoma 238 (235–280), maximum width 145 (145–160).

**Gnathosoma** – (Figs 11B, C). Palps three-segmented; setal formula 0-1(*d*)-2(1)(*d*, *ul'*ζ, ω); Femorogenu with one smooth and pointed dorsal seta *d*; tibiotarsus with one smooth and pointed dorsal seta *d*, tiny eupathidium *ul'*ζ and baculiform solenidion ω (Fig. 11C); in some specimens (including holotype) tiny eupathidium *ul'*ζ not visible; palpal supracoxal setae (*ep*) short, peg-like, slightly widened distally. Subcapitulum with one pair of smooth and pointed subcapitular setae (*m*) and two pairs of smooth and blunt-tipped adoral setae (*or1*, *or2*); seta *or1* about three times longer than *or2* (Fig. 11B).

**Idiosomal dorsum** – (Figs 10A, 13A, 14A, C, E). All dorsal striae with large oval tubercles



**Figure 9** . DIC micrograph of *Acaricis brevicaudus* n. sp., male (A–C) and deutonymph (D–F): A – opisthosoma, dorsal aspect; B – metapodosoma, ventral aspect; C – opisthosoma, ventral aspect; D – opisthosoma, dorsal aspect; E – metapodosoma, ventral aspect; F – opisthosoma, ventral aspect.

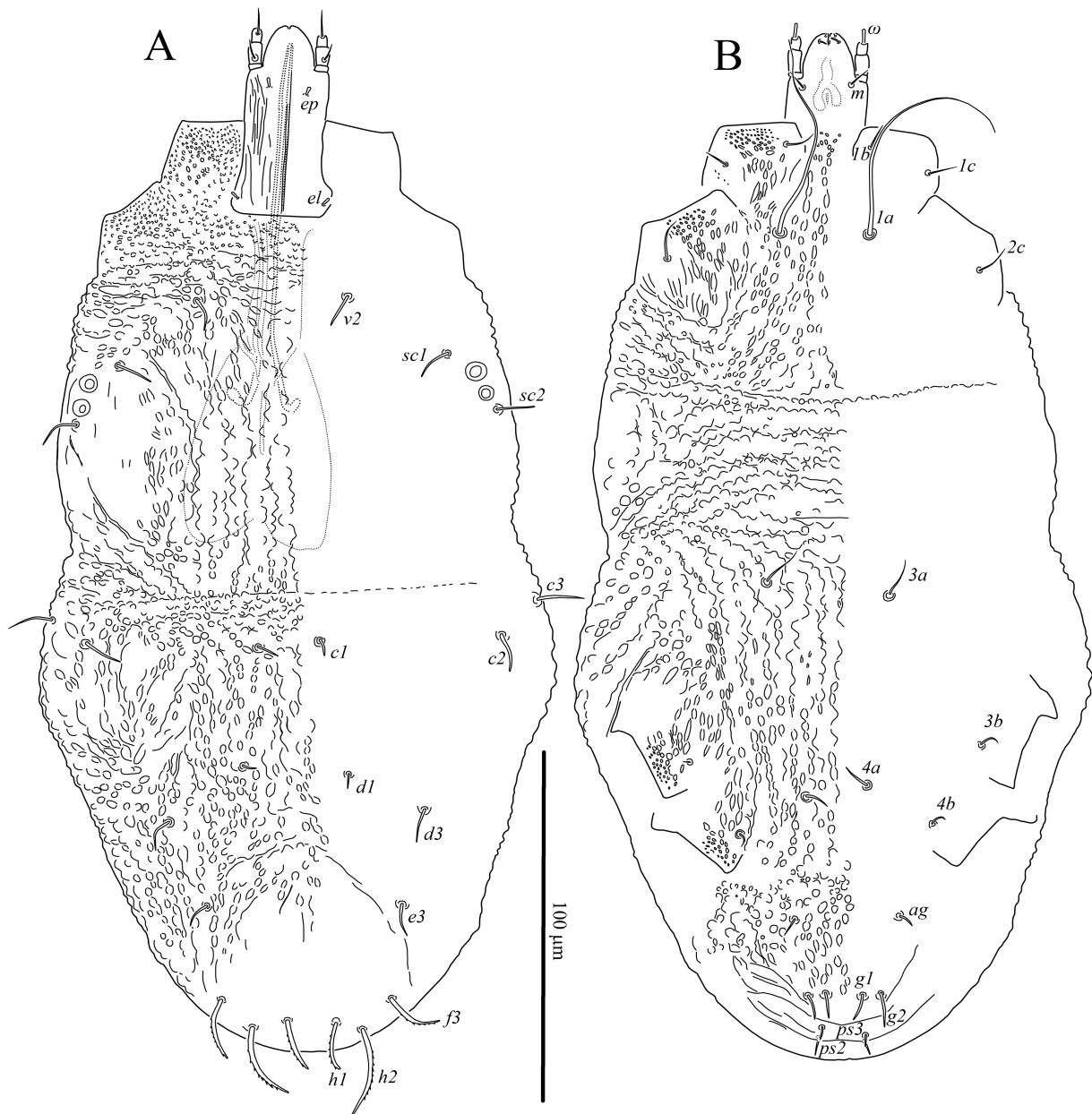
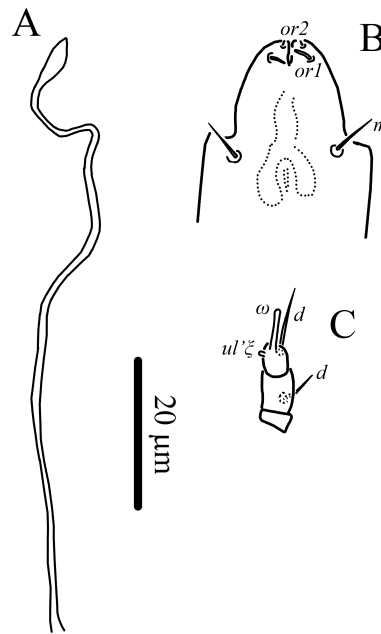


Figure 10 . *Dolichotetranychus tuberculatus* n. sp., female: A – dorsum of body, B – venter of body.

(Fig. 13A); prodorsum with narrow band of transverse striae anterior setae *v2* and longitudinal posterior *v2*; with smooth area posterior ocelli (Fig. 14A); hysterosoma with narrow band of transverse striae anterior setae of C-series and mostly longitudinal posterior setae of C-series (Fig. 14C); with smooth area posterior setae *e3* (Fig. 14E). Setae *f3*, *h1*, and *h2* thicker than others, distinctly barbed and blunt-tipped; other dorsal setae smooth and weakly blunt-tipped. Length of dorsal setae: *v2* 10 (9–10), *scl* 11 (10–12), *sc2* 13 (12–14), *c1* 6 (5–7), *c2* 11 (10–11), *c3* 15 (11–13), *d1* 5 (4–5), *d3* 11 (8–10), *e3* 8 (8–9) *f3* 20 (16–24), *h1* 18 (18–22), *h2* 29 (29–31). Distances between setae: *v2*–*v2* 42 (42–54), *scl*–*scl* 92 (92–110), *sc2*–*sc2* 118 (118–138), *c1*–*c1* 17 (12–29), *c2*–*c2* 115 (112–123), *c3*–*c3* 135 (132–148), *d1*–*d1* 30 (25–32), *d3*–*d3* 71 (71–78), *e3*–*e3* 54 (54–64), *f3*–*f3* 47 (47–56), *h1*–*h1* 14 (13–19), *h2*–*h2* 30 (30–37).



**Figure 11** . *Dolichotetranychus tuberculatus* n. sp., female: A – spermatheca, B – subcapitulum; C – right palp, ventral aspect.

*Idiosomal venter* – (Figs 10B, 11A, 13B, 14B, D, F). All ventral striae with large oval tubercles (Fig. 13B); genital plate with tubercles (Fig. 14F). All ventral setae smooth; two pairs of genital and of pseudanal setae; seta *2b* absent; setae *3a* and *4a* short; seta *1a* long, whip-like; setae *g1*, *g2*, *ps2*, *ps3*, and *ag* weakly blunt-tipped, other ventral setae pointed. Length of ventral setae: *1a* 70 (52–73), *1b* 10 (9–12), *1c* 8 (6–8), *2c* 12 (12–13), *3a* 12 (12–17), *3b* 7 (6–7), *4a* 8 (7–13), *4b* 6 (6–7), *ag* 5 (3–5), *g1* 8 (8–12), *g2* 10 (8–10), *ps2* 6 (5–6), *ps3* 4 (4–5).

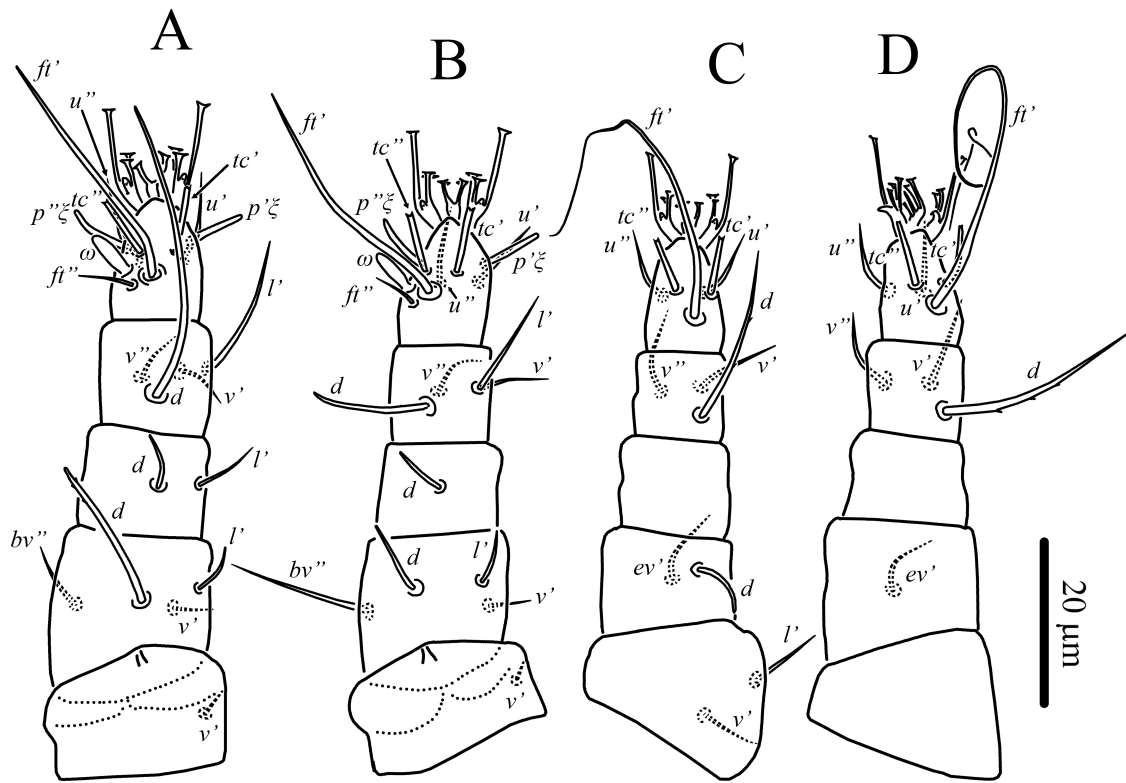
*Spermathecal apparatus* – (Fig. 11A). Spermatheca represented by oval vesicle connected with long and narrow duct.

*Legs* – (Fig. 12). Claws on tarsi I–IV slightly hooked distally, with outer tenent hairs distinctly longer than inner. Leg I (Fig. 12A). Setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *v'*, *bv''*), Ge 2 (*d*, *l'*), Ti 4 (*d*, *l'*, *v'*, *v''*), Ta 8(1) (*p'ζ*, *p''ζ*, *tc'*, *tc''*, *ft'*, *ft''*, *u'*, *u''*, *ω''*). Solenidion *ω''* 6 (5–6) digitiform; setae (*p*) of tarsus smooth, blunt-tipped, eupathid-like; setae (*tc*) characteristically blunt-tipped and with few apical barbs; seta *d* of femur weakly barbed, other setae smooth; setae *d* of femur, genu and tibia, and *l'* of femur weakly blunt-tipped, other setae pointed. Leg supracoxal seta (*el*) of same shape as palpal supracoxal setae and located near anterior margin of prodorsum. Leg II (Fig. 12B). Setation: Tr 1 (*v'*), Fe 4 (*d*, *l'*, *v'*, *bv''*), Ge 1 (*d'*), Ti 4 (*d*, *l'*, *v'*, *v''*), Ta 8(1) (*p'ζ*, *p''ζ*, *tc'*, *tc''*, *ft'*, *ft''*, *u'*, *u''*, *ω''*). Solenidion *ω''* 5 (5–6) digitiform; setae (*p*) and (*tc*) as on tarsus I; other setae smooth; setae *d* of femur, genu and tibia, and *l'* of femur weakly blunt-tipped, other setae pointed. Leg III (Fig. 12C). Setation: Tr 2 (*l'*, *v'*), Fe 2 (*d*, *ev'*), Ge 0, Ti 3 (*d*, *v'*, *v''*), Ta 5 (*tc'*, *tc''*, *ft'*, *u'*, *u''*). Setae (*tc*) as on tarsus II; seta *d* of tibia weakly barbed; other setae smooth; seta *d* of femur weakly blunt-tipped, other setae pointed. Leg IV (Fig. 12D). Setation: Tr 0, Fe 1 (*ev'*), Ge 0, Ti 3 (*d*, *v'*, *v''*), Ta 5 (*tc'*, *tc''*, *ft'*, *u'*, *u''*). Setae (*tc*) as on tarsus III; seta *d* of tibia weakly barbed and pointed; other setae smooth and pointed.

**Deutonymph** — (Figs 15, 16; 1 measured). Length of idiosoma 215, maximum width 120.

*Gnathosoma* – Similar to that of female.

*Idiosomal dorsum* – (Fig. 15A, 16A, C). Striation pattern similar to that of female, except absence of smooth area posteriad ocelli (Fig. 16A). Shape of dorsal setae as in female. Length of dorsal setae: *v2* 8, *sc1* 9, *sc2* 11, *c1* 5, *c2* 8, *c3* 10, *d1* 5, *d3* 6, *e3* 7, *f3* 17, *h1* 18, *h2* 26.



**Figure 12.** *Dolichotetranychus tuberculatus* n. sp., female: A–D – left legs I–IV, respectively, dorsal aspect.

Distances between setae:  $v_2-v_2$  46,  $sc_1-sc_1$  87,  $sc_2-sc_2$  105,  $c_1-c_1$  14,  $c_2-c_2$  97,  $c_3-c_3$  110,  $d_1-d_1$  23,  $d_3-d_3$  60,  $f_3-f_3$  38,  $h_1-h_1$  11,  $h_2-h_2$  26. In available specimen right seta  $e_3$  absent (Fig. 16C).

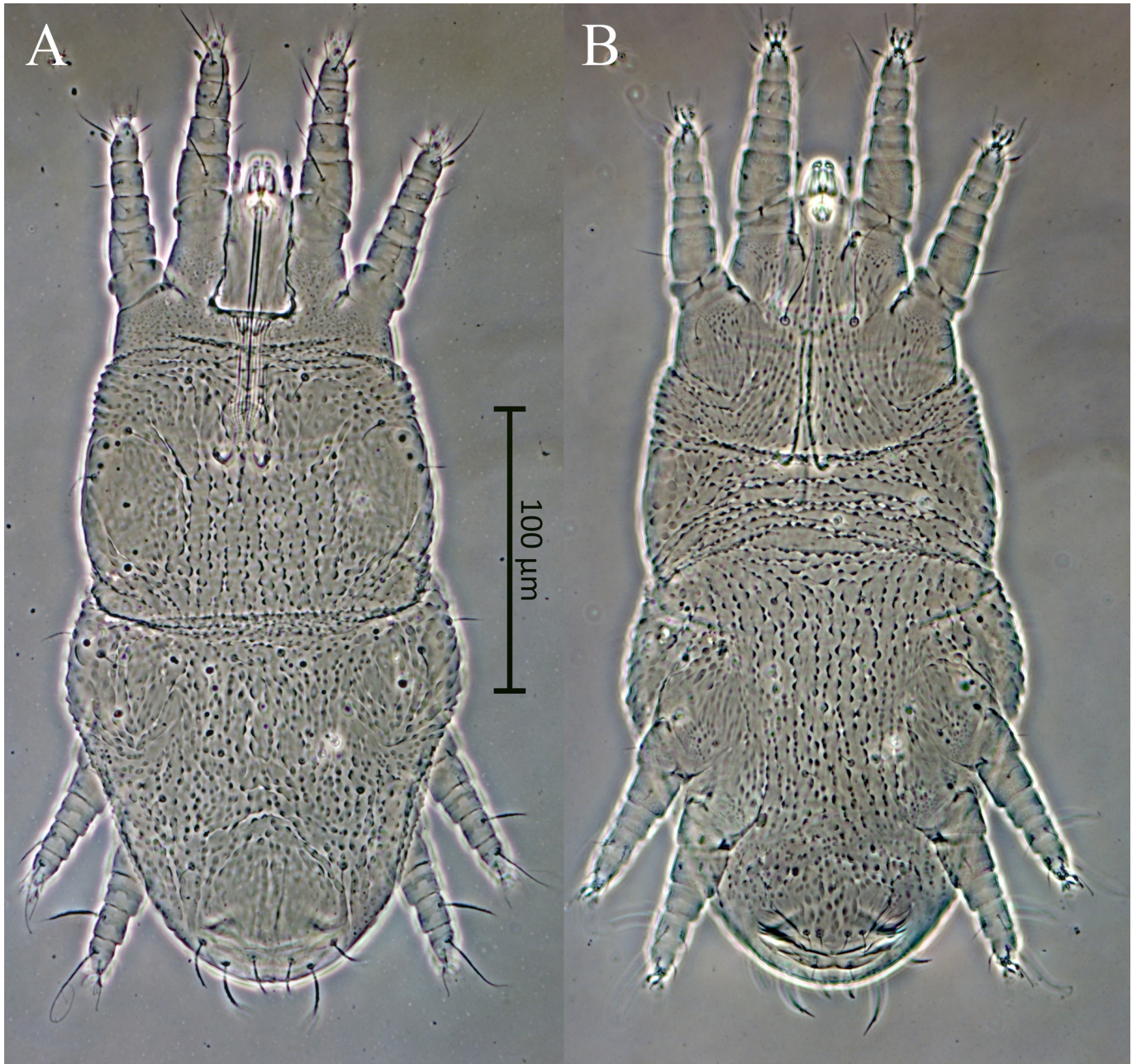
*Idiosomal venter* – (Figs 15B, 16B, D). In general similar to that of female except the following: only one pair of genital setae ( $g_2$  absent); genital plate not developed (Fig. 16D). Length of ventral setae:  $1c$  6,  $2c$  7,  $3a$  11,  $3b$  5,  $4a$  7,  $4b$  5,  $ag$  3,  $g$  5,  $ps_2$  4,  $ps_3$  4. In available specimen left seta  $4a$  absent; setae  $1a$  and  $1b$  broken.

*Legs* – As in female, except femora I and II without seta  $l'$ , genua I and II without seta  $d$ , trochanter III without seta  $v'$ . Lengths of solenidia:  $\omega^I$  5,  $\omega^{II}$  5. In available specimen right legs III and IV abnormal (Fig. 15B).

**Male, protonymph and larva** — unknown.

#### Type material

Holotype female, New Zealand, South Island, Central Otago, The Remarkables, 45°03'37.89"S, 169°11'45.21"E, 1867 m a.s.l., from *Dracophyllum muscoides* Hook. f. (Ericaceae) cushion plant, 19 February 2014, sample code (RemC2D2 in); paratypes: 6 females, 1 DN, same data; 1 female, New Zealand, South Island, Central Otago, The Remarkables, 45°03' 38.19"S, 168°48'49.51"E, 1839 m a.s.l., from *D. muscoides* cushion, 19 February 2014, sample code (RemC3D3in); 2 females, New Zealand, South Island, Central Otago, Old Man's Range, 45°20'3.78"S, 169°12'25.26"E, 1649 m a.s.l., from *D. muscoides* cushion, 17 February 2014, sample code (OmC3D2in); 1 female, New Zealand, South Island, Central Otago, Pisa Range,

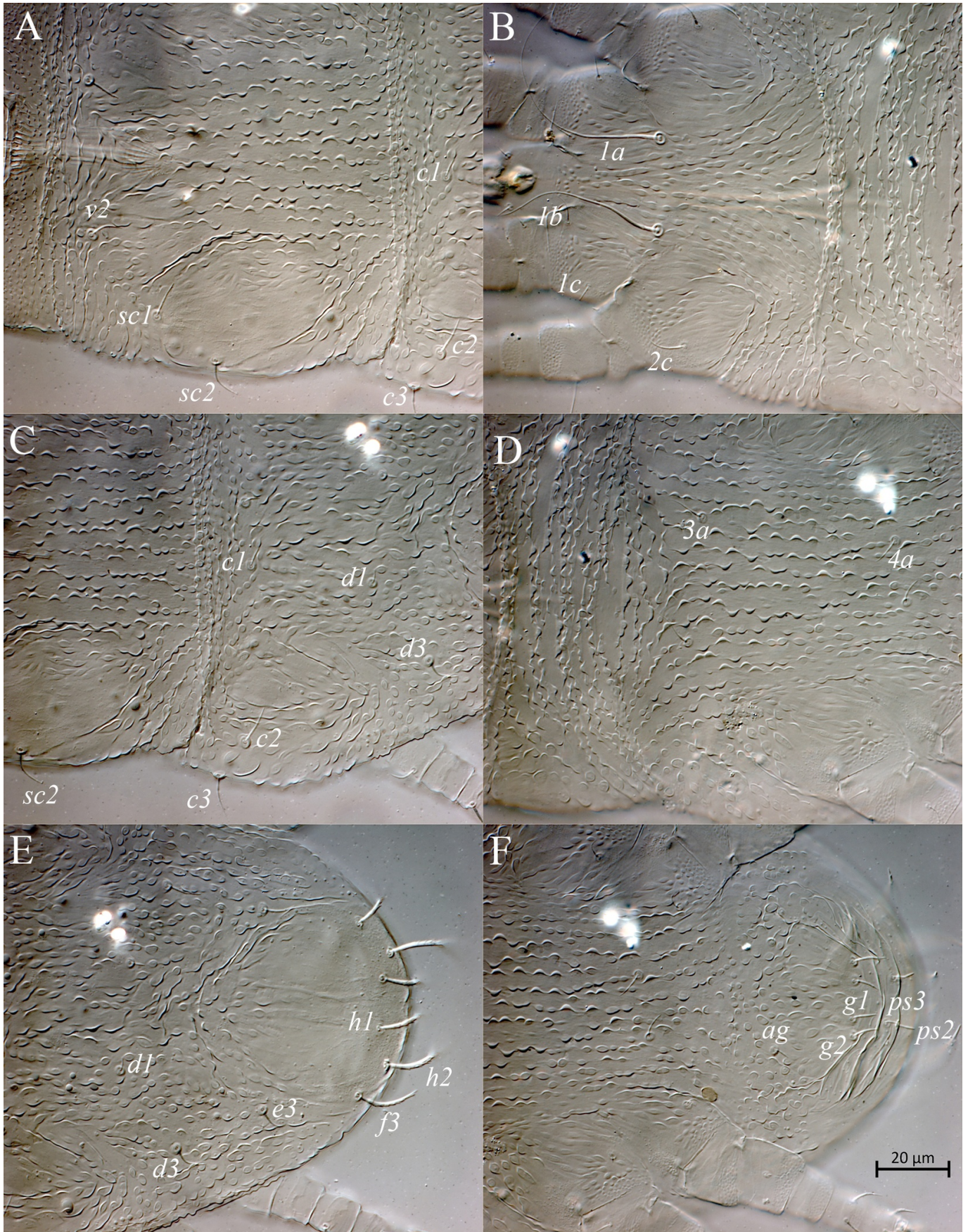


**Figure 13** . Phase contrast micrographs of *Dolichotetranychus tuberculatus* n. sp., female: A – general dorsal view; B – general ventral view.

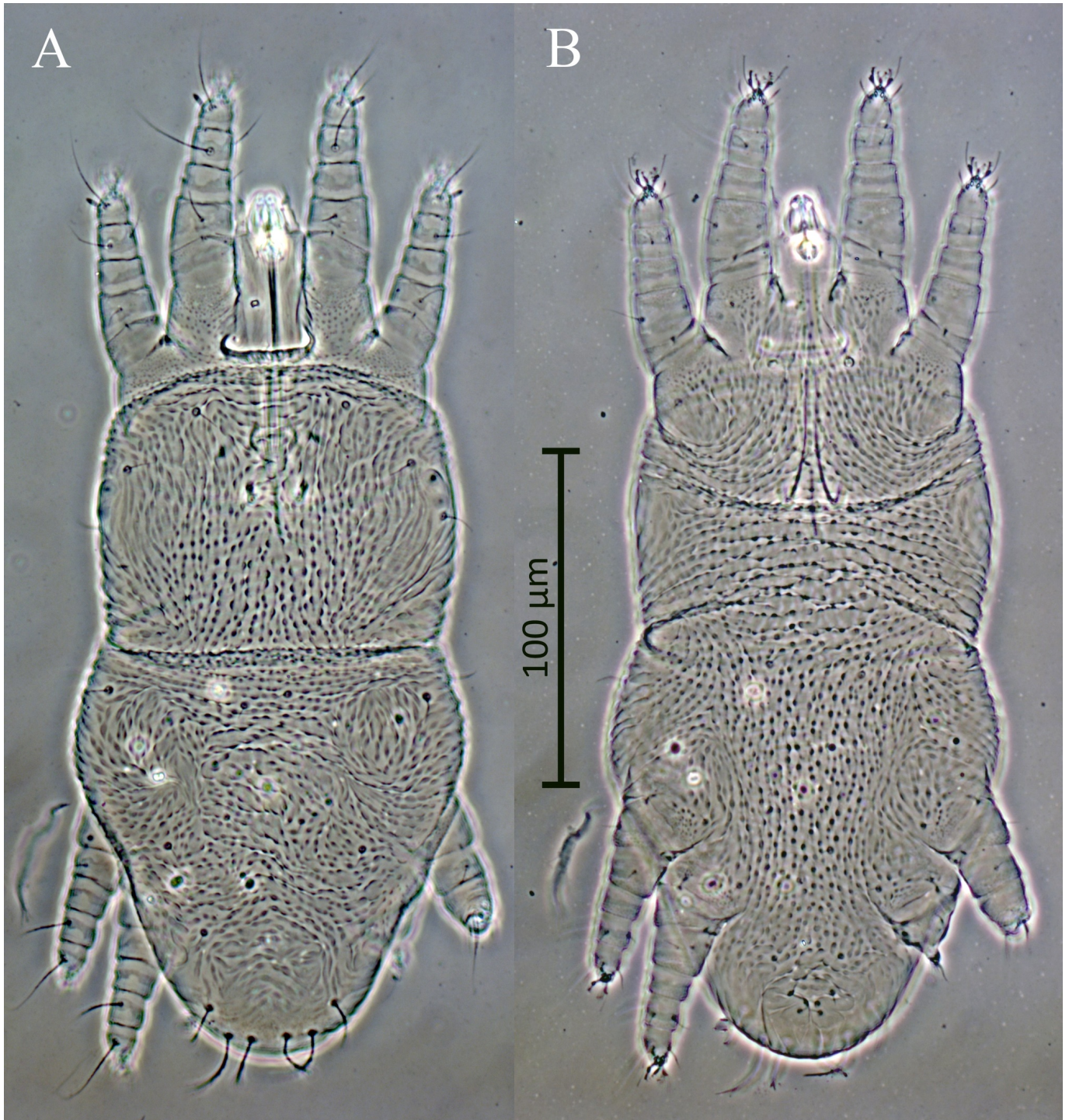
44°52'2.99"S, 169°09'33.21"E, 1700 m a.s.l., in the bare soil near *Raoulia* sp. cushion plant, 18 February 2014, sample code (PiC3R2out). All specimens collected by M. Minor.

**Type deposition**

The holotype and one paratype females are deposited in the New Zealand National Arthropod Collection, Auckland, New Zealand; other paratypes are deposited in the mite collection of the University of Tyumen Museum of Zoology, Tyumen, Russia.



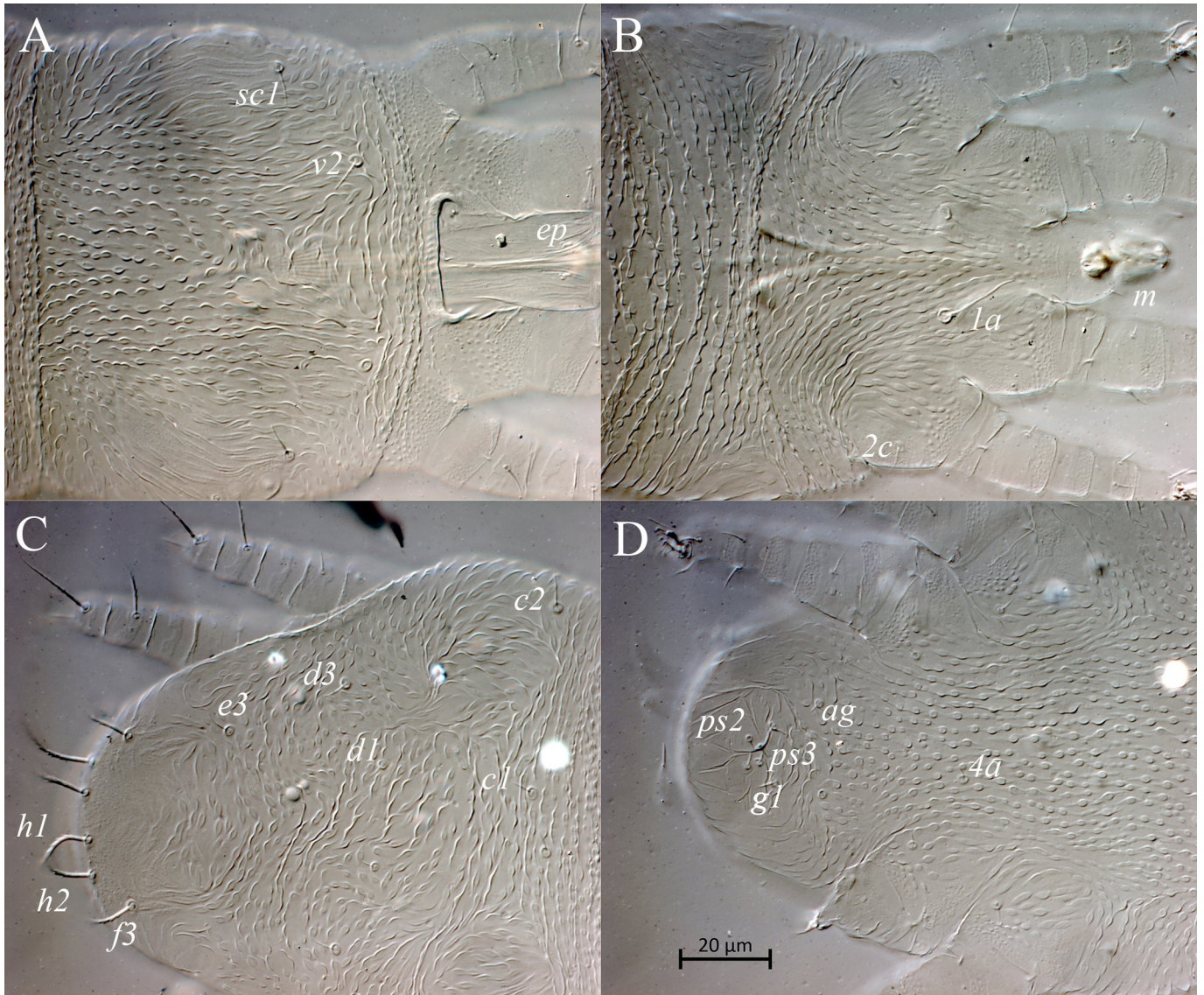
**Figure 14** . DIC micrograph of *Dolichotetranychus tuberculatus* n. sp., female: A – prodorsum; B – propodosoma, ventral aspect; C – metapodosoma, dorsal aspect; D – metapodosoma, ventral aspect; E – opisthosoma, dorsal aspect; F – opisthosoma, ventral aspect.



**Figure 15** . Phase contrast micrographs of *Dolichotetranychus tuberculatus* n. sp., deutonymph: A – general dorsal view; B – general ventral view.

#### Differential diagnosis

The new species belongs to the *floridanus* species-group by having two pairs of pseudanal setae and two pairs of genital setae. Female of the new species is most similar to *D. salinas* Pritchard and Baker, 1952 and *D. zoysiae* Ehara, 2004 lacking seta *2b*. The new species differs



**Figure 16** . DIC micrograph of *Dolichotetranychus tuberculatus* n. sp., deutonymph: A – prodorsum; B – proterosoma, ventral aspect; C – hysterosoma, dorsal aspect; D – hysterosoma, ventral aspect.

from *D. salinas* in having short ventral idiosomal setae *3a* and *4a* (vs. long and whip-like in *D. salinas*) and genital setae *g1* and *g2* situated almost in a transverse row (vs. setae *g1* situated far posteriad *g2* in *D. salinas*). Female of the new species is most similar to *D. zoysiae*, but differs in having strongly tuberculate dorsal and ventral idiosomal striae (vs. only some striae microtuberculate in *D. zoysiae*) and in having distinctly barbed and blunt-tipped setae *f3*, *h1* and *h2* (vs. setae *f3*, *h1* and *h2* smooth and pointed in *D. zoysiae*). Among the New Zealand species of *Dolichotetranychus*, female of the new species is most similar to *D. alpinus* (Collyer, 1973). It can be distinguished from *D. alpinus* in having two pairs of pseudanal setae (vs. one pair in *D. alpinus*), dorsal idiosomal striae strongly tuberculate (vs. dorsal idiosomal striae tuberculate in *D. alpinus*), and propodosoma ventrally with strongly tuberculate striae (vs. propodosoma ventrally with smooth striae in *D. alpinus*).

### Etymology

The name of the new species is derived from Latin *tuberculatus* meaning *tuberculate* and refers to unusually strongly tuberculate idiosomal striae of the new species.

### Genus *Pentamerismus* McGregor, 1949

Type species: *Tenuipalpus erythreus* Ewing, 1917, by original designation.

### Diagnosis

In this publication we follow the diagnosis of *Pentamerismus* proposed by Beard *et al.* (2014).

### *Pentamerismus corniger* sp. nov.

Zoobank: [8EA43071-FF19-41CE-BC7B-D0897DDF8BCC](https://doi.org/10.24349/5ues-p6s3)

(Figs 17–20)

### Description

**Female** — (2 measured). Body oval. Length of idiosoma 260 (283), maximum width 150 (175).

*Gnathosoma* – Palps five-segmented; setal formula 0-0-0-2(*d*, *l*'')-2(1)(*ul*'ζ, *ul*''ζ, ω); tibia with pointed and weakly barbed dorsal seta *d* and pointed and smooth lateral seta *l*''; tarsus with two subequal eupathidia (*ul*'ζ) and baculiform solenidion ω; palpal supracoxal setae (*ep*) short, peg-like, slightly widened distally and covered by anterior part of prodorsal shield. Subcapitulum with one pair of barbed and pointed subcapitular setae (*m*), and two pairs of smooth and blunt-tipped adoral setae (*or1*, *or2*); seta *or1* about two times longer than *or2*.

*Idiosomal dorsum* – (Figs 17A, 19A, 20A, C, E). All dorsal face with tiny sparsely distributed puncta; anterior margin of prodorsal shield with a pair of horn-like projections separated by deep notch (Fig. 20A); dorsal shields with irregular striae not forming close cells. All dorsal setae similar in shape, smooth, flattened, foliate and oval in outline, sometimes with several small distal projections. Hysterosomal shield with eight pairs of dorsolateral setae (*c3*, *d3*, *e2*, *e3*, *f3*, *f3*, *h1*, *h2*). Cupules *ia*, *im* and *ih* present; *ip* not evident; *ia* located posteriad setae *d2*, *im* between setae *e2* and *e3* (Fig. 20C), and *ih* laterad of imaginary line connecting bases of setae *f3* and *h2*. Length of dorsal setae: *v2* 17 (16), *sc1* 15 (17), *sc2* 18 (20), *c1* 16 (16), *c2* 16 (16), *c3* 13 (15), *d1* 11 (14), *d2* 12 (16), *d3* 14 (15), *e1* 11 (13), *e2* 14 (14), *e3* 14 (15), *f2* 14 (15), *f3* 14 (15), *h1* 15 (16), *h2* 15 (15). Distances between setae: *v2*–*v2* 43 (39), *sc1*–*sc1* 94 (93), *sc2*–*sc2* 113 (113), *c1*–*c1* 43 (44), *c2*–*c2* 115 (120), *c3*–*c3* 146 (168), *d1*–*d1* 29 (29), *d2*–*d2* 95 (99), *d3*–*d3* 130 (135), *e1*–*e1* 19 (15), *e2*–*e2* 120 (130), *e3*–*e3* 105 (112), *f2*–*f2* 90 (96), *f3*–*f3* 75 (80), *h1*–*h1* 21 (23), *h2*–*h2* 49 (53).

*Idiosomal venter* – (Figs 17B, 18E, 19B, 20B, D, F). Ventral plates mostly smooth; with transverse striae anteriad *3a* and posteriad *4a*, and longitudinal striae laterad aggenital and genital plates. Seta *1a* smooth, other ventral setae barbed; setae *1a*, *1b*, *1c*, *2b*, *3a*, *3b*, *4a*, and *4b* pointed; other ventral setae blunt-tipped. Length of ventral setae: *1a* 57 (broken), *1b* 22 (24), *1c* 18 (19), *2b* 19 (20), *2c* 24 (23), *3a* 15 (15), *3b* 13 (15), *4a* 14 (17), *4b* 16 (16), *ag* 15 (15), *g1* 12 (12), *g2* 10 (10), *ps1* 11 (13), *ps2* 10 (11), *ps3* 7 (7).

*Spermathecal apparatus* – (Fig. 18E). Spermatheca represented by narrow membranous tube widened into oval vesicle.

*Legs* – (Figs 18A–D). Claws on tarsi I–IV well-developed and hooked distally, with outer tenent hairs slightly longer than inner. Leg I (Fig. 18A). Setation: Tr 1 (*v*''), Fe 4 (*d*, *l*'', *v*'', *bv*''), Ge 3 (*d*, *l*'', *l*''), Ti 4 (*d*, *l*'', *v*'', *v*''), Ta 8(1) (*p*'ζ, *p*''ζ, *tc*'', *tc*'', *ft*'', *ft*'', *u*'', *u*'', ω''). Solenidion ω'' 9 (9) digitiform; setae (*p*) of tarsus smooth, blunt-tipped, eupathid-like; setae *d* of femur and genu similar in shape to dorsal idiosomal setae; setae *l*' of femur and *d* of tibia weakly blunt-tipped; other setae pointed; setae (*u*) with long projections; setae (*tc*) barbed, with long blunt-tipped subapical projection; setae (*ft*) smooth; other setae barbed. Leg supracoxal seta (*el*) of same

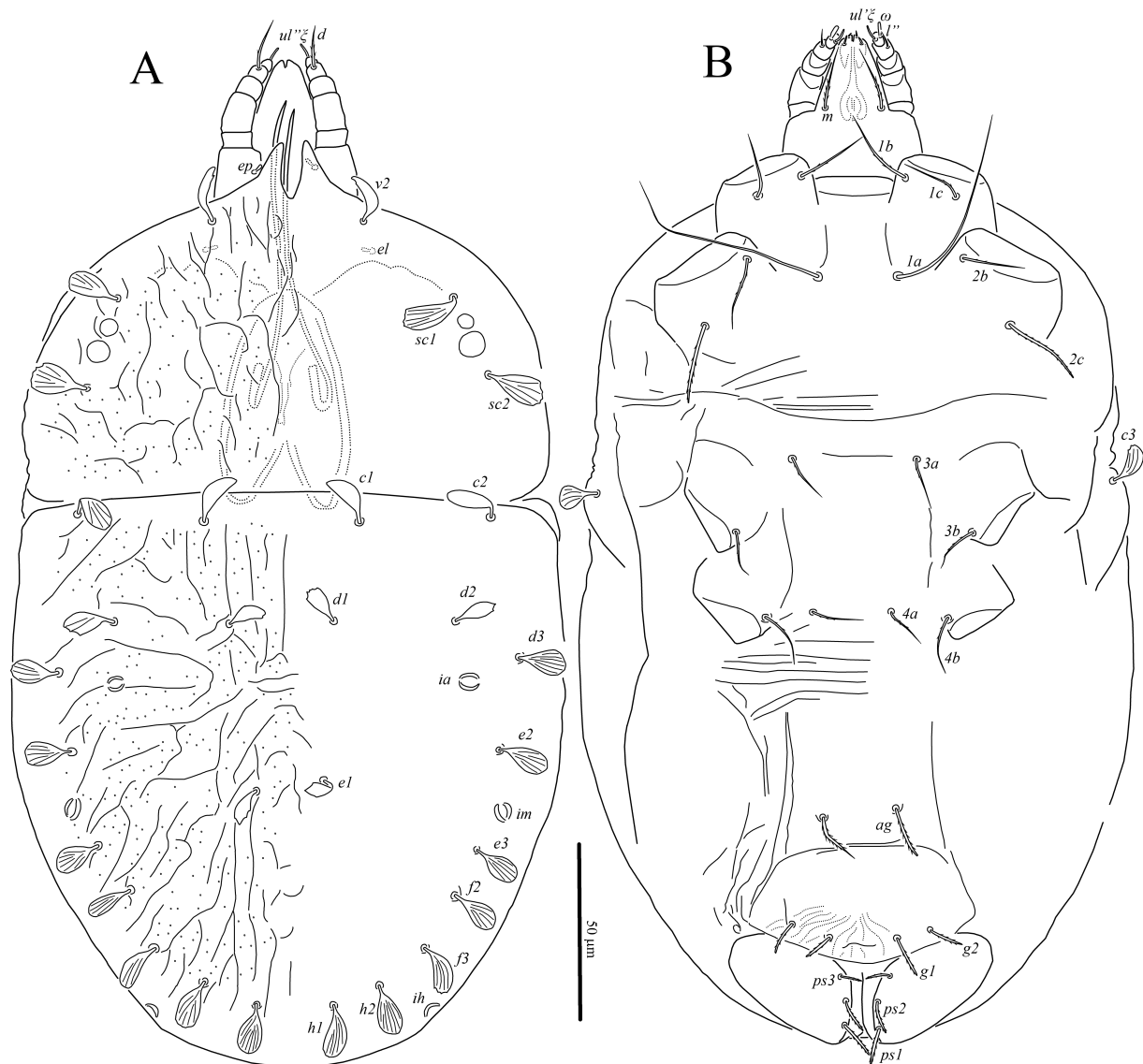
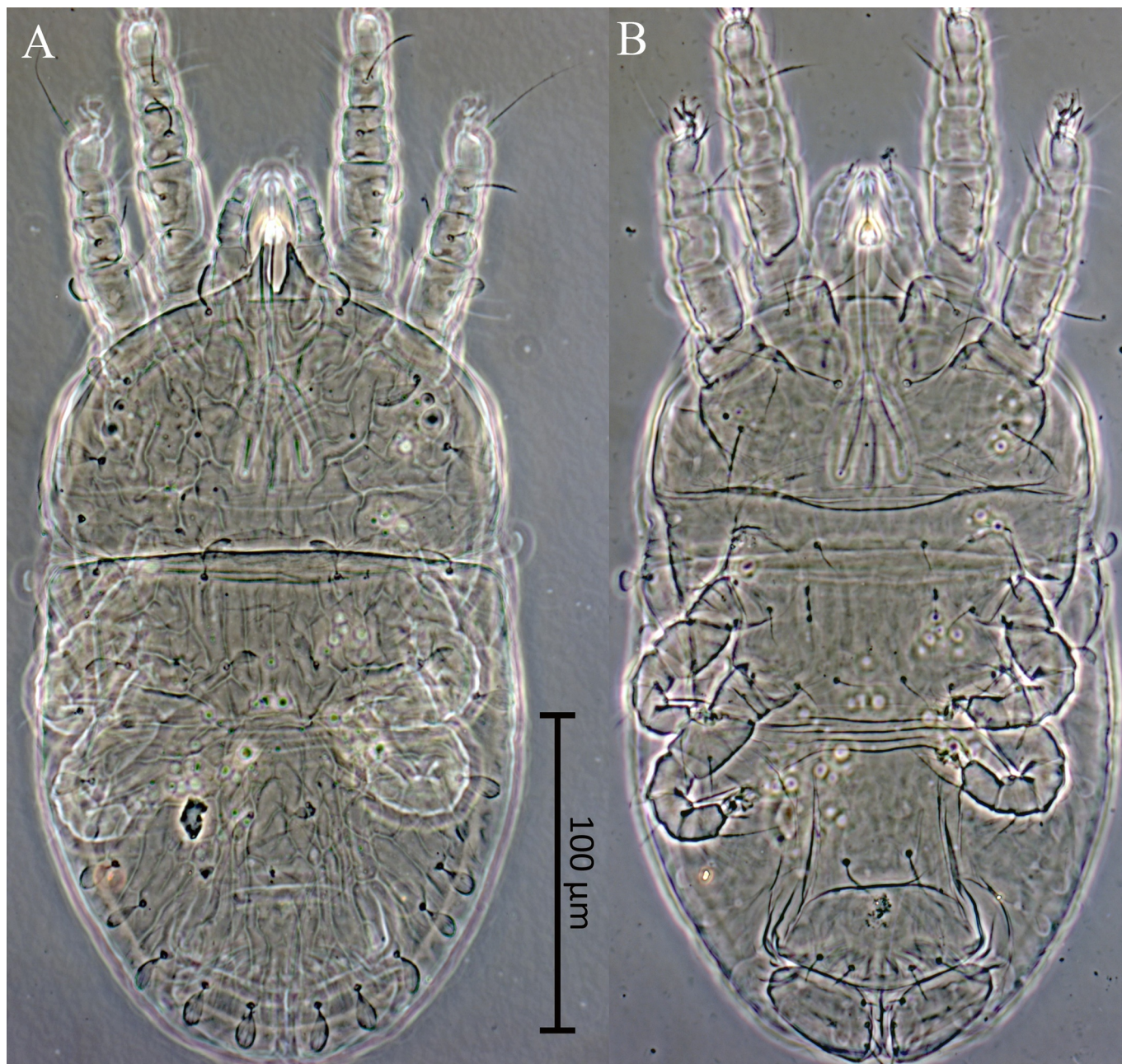


Figure 17 . *Pentamerismus corniger* n. sp., female: A – dorsum of body, B – venter of body.

shape as palpal supracoxal setae and located under anterior part of prodorsum. Leg II (Fig. 18B). Setation: Tr 1 ( $v'$ ), Fe 4 ( $d, l', v', bv''$ ), Ge 3 ( $d, l', l''$ ), Ti 4 ( $d, l', v', v''$ ), Ta 8(1) ( $p''\zeta, p''\zeta, tc'', ft'', ft'', u', u'', \omega''$ ). Solenidion  $\omega''$  7 (7) digitiform; other setae as on leg I. Leg III (Fig. 18C). Setation: Tr 1 ( $v'$ ), Fe 2 ( $d, ev'$ ), Ge 1 ( $l'$ ), Ti 3 ( $d, v', v''$ ), Ta 5 ( $tc', tc'', ft', u', u''$ ). Seta  $d$  of femur similar in shape to dorsal idiosomal setae; setae  $v'$  of trochanter,  $ev'$  of femur,  $l'$  of genu, and  $d$  of tibia blunt-tipped; over setae pointed; setae ( $tc$ ) barbed, with long blunt-tipped subapical projection; setae ( $u$ ) of tarsus and ( $v$ ) of tibia strongly barbed; other setae weakly barbed. Leg IV (Fig. 18D). Setation: Tr 1 ( $v'$ ), Fe 1 ( $ev'$ ), Ge 0, Ti 3 ( $d, v', v''$ ), Ta 5 ( $tc', tc'', ft', u', u''$ ). Setae  $v'$  of trochanter,  $ev'$  of femur, and  $d$  of tibia weakly blunt-tipped; other setae pointed; setae ( $tc$ ) barbed, with long blunt-tipped subapical projection; setae ( $u$ ) of tarsus and ( $v$ ) of tibia strongly barbed; other setae weakly barbed.

**Male, deutonymph, protonymph and larva** — unknown.

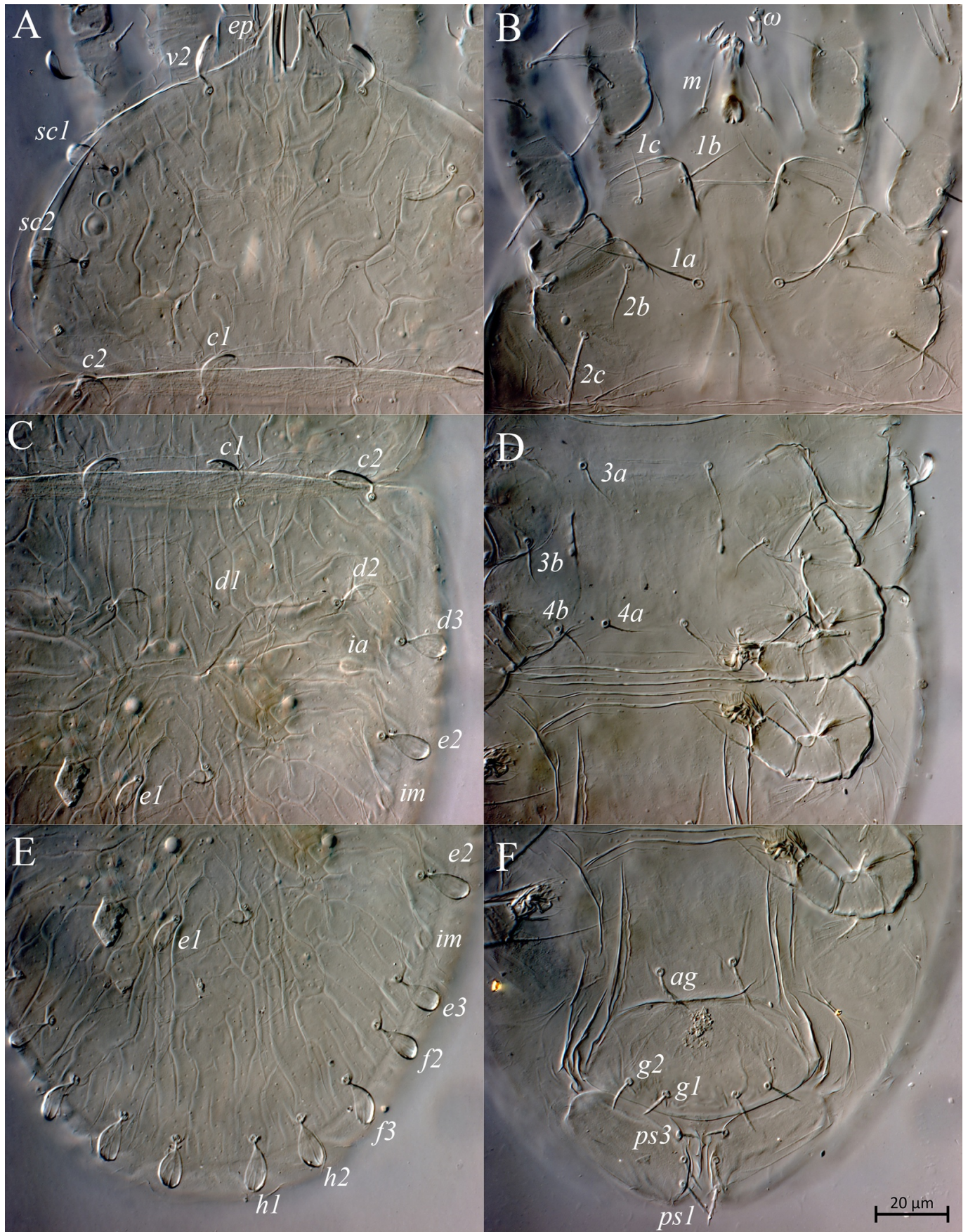




**Figure 19** . Phase contrast micrographs of *Pentamerismus corniger* n. sp., female: A – general dorsal view; B – general ventral view.

#### Differential diagnosis

The new species belongs to *erythreus* species-group by having eighty pairs of dorsolateral setae. Female of the new species is most similar to *P. sititoris* Beard and Seeman, 2014, *P. wardo* Seeman and Beard, 2014, and *P. hicklingorum* Seeman and Beard, 2014 in having all dorsal idiosomal setae similar in shape and foliate. Female of the new species differs from *P. sititoris*, *P. wardo* and *P. hicklingorum* in having four setae on each of femora I and II (vs. three setae on each of femora I and II in *P. sititoris*, *P. wardo* and *P. hicklingorum*), and in having only one seta on trochanter III (vs. two setae on trochanter III in *P. sititoris*, *P. wardo* and *P. hicklingorum*).



**Figure 20** . DIC micrograph of *Pentamerismus corniger* n. sp., female: A – prodorsum; B – proterosoma, ventral aspect; C – metapodosoma, dorsal aspect; D – metapodosoma, ventral aspect; E – opisthosoma, dorsal aspect; F – opisthosoma, ventral aspect.

## Etymology

The name of the new species is derived from Latin *corniger* meaning *horned* and refers to long horn-like projections of anterior margin of the prodorsum in the new species.

## Remark

A representative of the genus *Pentamerismus* is recorded in New Zealand for the first time.

## Discussion

The shape of the opisthosomal seta *h2* in females is an important character state for the separation of tenuipalpid genera. In some genera, such as *Tenuipalpus*, *Acaricis*, *Prolixus*, *Lisaepalpus* and *Tenuilichus*, it is characteristically long and whip-like (Mesa *et al.* 2009). The discovery of *Acaricis brevicaudus* **sp. nov.**, corresponds to all characters of the genus, except shape of seta *h2*. In *A. brevicaudus* **sp. nov.** it is foliate and similar in shape to setae *h1* and *f3*; however, in some specimens, it is slightly longer and narrower than setae *h1* and *h3*. Also *A. brevicaudus* **sp. nov.** is undoubtedly very similar to another New Zealand species, *A. montanus*. Thus, the shape of the seta *h2* can vary within the genus and this feature requires more thorough research in other genera of Tenuipalpidae.

For many New Zealand species, the mite-plant associations are limited to a single host plant species or few closely related hosts, while some (e.g., *Tenuipalpus antipodus* Collyer, 1964) appear to have a broad range of phylogenetically diverse hosts (Collyer 1973; Xu and Zhang 2018; Castro *et al.* 2024). For the new species presented here, the collection data suggest that both *A. brevicaudus* **sp. nov.** and *D. tuberculatus* **sp. nov.** are associated with the ultra-dwarf shrub *Dracophyllum muscoides* Hook. f. (Ericaceae); the true host association(s) for *P. corniger* **sp. nov.** remains unknown.

## Acknowledgements

We thank Dr. Alastair Robertson (School of Food Technology and Natural Sciences, Massey University, NZ) for the help with fieldwork, the staff of the Snow Farm (Cardrona, NZ) for facilitating access to Pisa Range sites, and the New Zealand Department of Conservation for sampling permit (national authorization # 38116-GEO). The project was supported by the Massey University Research Fund to Maria Minor.

## ORCID

Alexander A. Khaustov  <https://orcid.org/0000-0002-0306-112X>

Maria A. Minor  <https://orcid.org/0000-0003-2095-5456>

## References

- Beard, J.J., Gerson, U. 2009. A new flat mite genus, *Acaricis* (Prostigmata: Tenuipalpidae), from Australian sedges (Cyperaceae). *Zootaxa*, 2073: 31-44. <https://doi.org/10.11646/zootaxa.2073.1.3>
- Beard, J.J., Ochoa, R., Baughan, G.R., Trice, M.D., Redford, A.J., Walters, T.W., Mitter, C. 2012. Flat Mites of the World. Edition 2. Fort Collins, Colorado, Identification Technology Program, CPHST, PPQ, APHIS, USDA Available from: <https://idtools.org/tools/1074/index.cfm> (accessed Dec. 2024).
- Castro, E.B., Beard, J.J., Ochoa, R., Feres, R.J.F. 2018. Two species of *Acaricis* (Acari: Tenuipalpidae) from New Zealand, moved from the genus *Tenuipalpus*, with a key to the known species. *Acarologia*, 58(4): 855-867. <https://doi.org/10.24349/acarologia/20184290>
- Castro, E.B., Mesa, N.C., Feres, R.J.F., Moraes, G.J., Ochoa, R., Beard, J.J., Demite, P.R. 2024. Tenuipalpidae Database. Available from: <http://www.tenuipalpidae.ibilce.unesp.br> [Accessed Dec 2024].
- Collyer, E. 1973. New species of the genus *Tenuipalpus* (Acari: Tenuipalpidae) from New Zealand, with a key to the world fauna. *N.Z. J. Sci.*, 16: 915-955.

- Khanjani, M., Gotoh, T. 2008. False spider mites of the genus *Pentamerismus* McGregor (Acari: Tenuipalpidae) from Iran. *Zootaxa*, 1768: 52-60. <https://doi.org/10.11646/zootaxa.1768.1.3>
- Lindquist, E.E. 1985. Anatomy, phylogeny and systematics. 1.1.1. External anatomy. In: Helle, W., Sabelis, M.W. (eds.), *World Crop Pest*, Vol. 1A. Spider mites, their biology, natural enemies and control. Amsterdam, Elsevier, pp. 3-28.
- Mahdavi, S.M., Asadi, M., Paktinat-Saeij, S., Ghanbarzadeh, M.A., Ziaei-Rad, H. 2022. A new species of *Dolichotetranychus* (Trombidiformes: Tenuipalpidae) damaging *Dracaena trifasciata* (Asparagaceae) in Iran. *Syst. Appl. Acarol.*, 27(10): 2012-2024.
- Mark, A.F., Bliss, L.C. 1970. The high-alpine vegetation of Central Otago, New Zealand. *NZ J. Botany*, 8: 381-451.
- Mark, A.F. 1994. Patterned ground activity in a southern New Zealand high-alpine cushionfield. *Arct. Alp. Res.*, 26: 270-280.
- Mesa, N.C., Ochoa, R., Welbourn, W.C., Evans, G.A., Moraes, G.J. de 2009. A catalog of the Tenuipalpidae (Acari) of the world with a key to genera. *Zootaxa*, 2098: 1-185. <https://doi.org/10.11646/zootaxa.2098.1.1>
- Scott, M.B., Dickinson, K.J.M., Barratt, B.I.P., Sinclair, B.J. 2008. Temperature and moisture trends in non-sorted earth hummocks and stripes on the Old Man Range, New Zealand: implications for mechanisms of maintenance. *Permafr. Periglac. Process.*, 19: 305-314. <https://doi.org/10.1002/ppp.627>
- Xu, Y., Zhang, Z.-Q. 2013. New Zealand Tenuipalpidae (Acari: Trombidiformes): A new species of *Acaricis* from Cyperaceae and its ontogenetic patterns in chaetotaxy. *Syst. Appl. Acarol.*, 18(4): 357-388. <https://doi.org/10.11158/saa.18.4.6>
- Xu, Y., Zhang, Z.-Q. 2018. *Tenuipalpus* (Acari: Trombidiformes: Tetranychosida: Tenuipalpidae). Landcare Research, Lincoln, New Zealand, 163 pp. <https://doi.org/10.7931/J2/FNZ.77>
- Zhang, Z.-Q., Fan, Q.-H. 2004. Redescription of *Dolichotetranychus ancistrus* Baker & Pritchard (Acari: Tenuipalpidae) from New Zealand. *Syst. Appl. Acarol.*, 9: 111-131. <https://doi.org/10.11158/saa.9.1.17>