

New species of Oppiidae from New Zealand

(Acari, Oribatida)

Sergey G. Ermilov & Maria Minor

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Two new species of oribatid mites of the family Oppiidae are described from the Mt Richmond Forest Park in New Zealand. *Lanceoppia* (*Lanceoppia*) *operta* sp. nov. differs from *Lanceoppia* (*Lanceoppia*) *willmanni* Hammer, 1968 by the smaller body length, minute interlamellar setae, well-developed bothridial heads and presence of notogastral setae *c.* *Tripiloppia* *parafrigida* sp. nov. differs from *Tripiloppia* *frigida* Ermilov & Minor, 2015 by the smaller body size, costulae in distal part curved medially, lamellar setae inserted in median part of costulae, and developed humeral tubercles.

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Introduction

During taxonomic identification of oribatid mites from the Mt Richmond Forest Park in New Zealand, we found two new species of the family Oppiidae, one belonging to the genus *Lanceoppia* Hammer, 1962, the nominative subgenus, the other to *Tripiloppia* Hammer, 1968. The main goal of the paper is to describe these new species.

Lanceoppia was proposed by Hammer (1962) with *Lanceoppia hexapili* Hammer, 1962 as type species. The genus comprises six subgenera and 62 species (Subías 2004, updated 2018). The subgenus *Lanceoppia* (*Lanceoppia*) comprises 27 species which are distributed in the tropics, subtropics and the Australian region (Subías 2004, updated 2018). The subgeneric traits were listed in the key to superspecies taxa in Subías & Balogh (1989) and summarized by Hugo-Coetzee (2014). An identification key to many species of *Lanceoppia* (*Lanceoppia*) was given by Balogh & Balogh (2002).

Tripiloppia was proposed by Hammer (1968) with *Tripiloppia aokii* Hammer, 1968 as type species. The genus comprises 9 species, which are distributed in

the Australian region (Subías 2004, updated 2018). The generic traits and an identification key to known species of *Tripiloppia* were presented by Ermilov & Minor (2015).

Material and methods

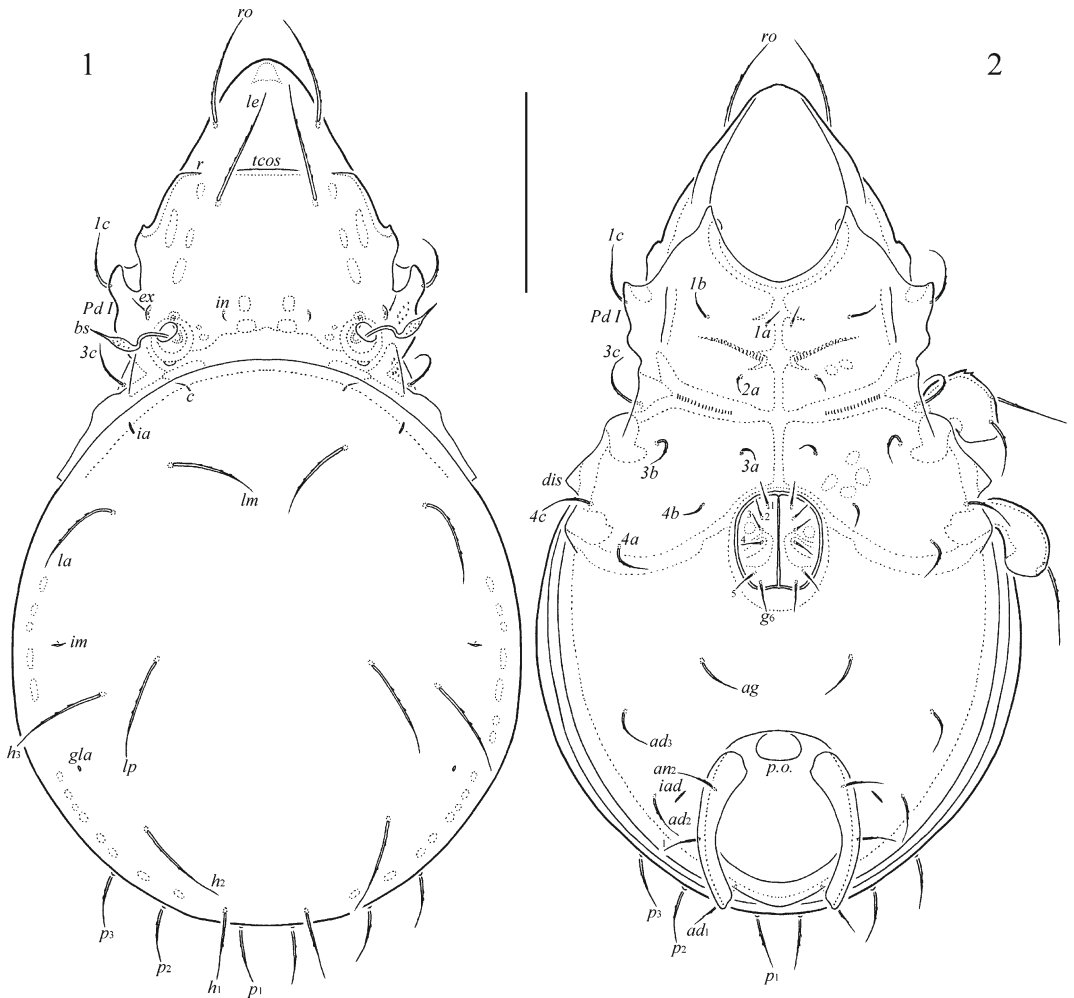
Material examined

The detailed collection locality and habitat for each new species is 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 % ECOH 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 identification of all taxa and for measurement and illustration of the new species. Body length was measured in lateral view, from the tip of the



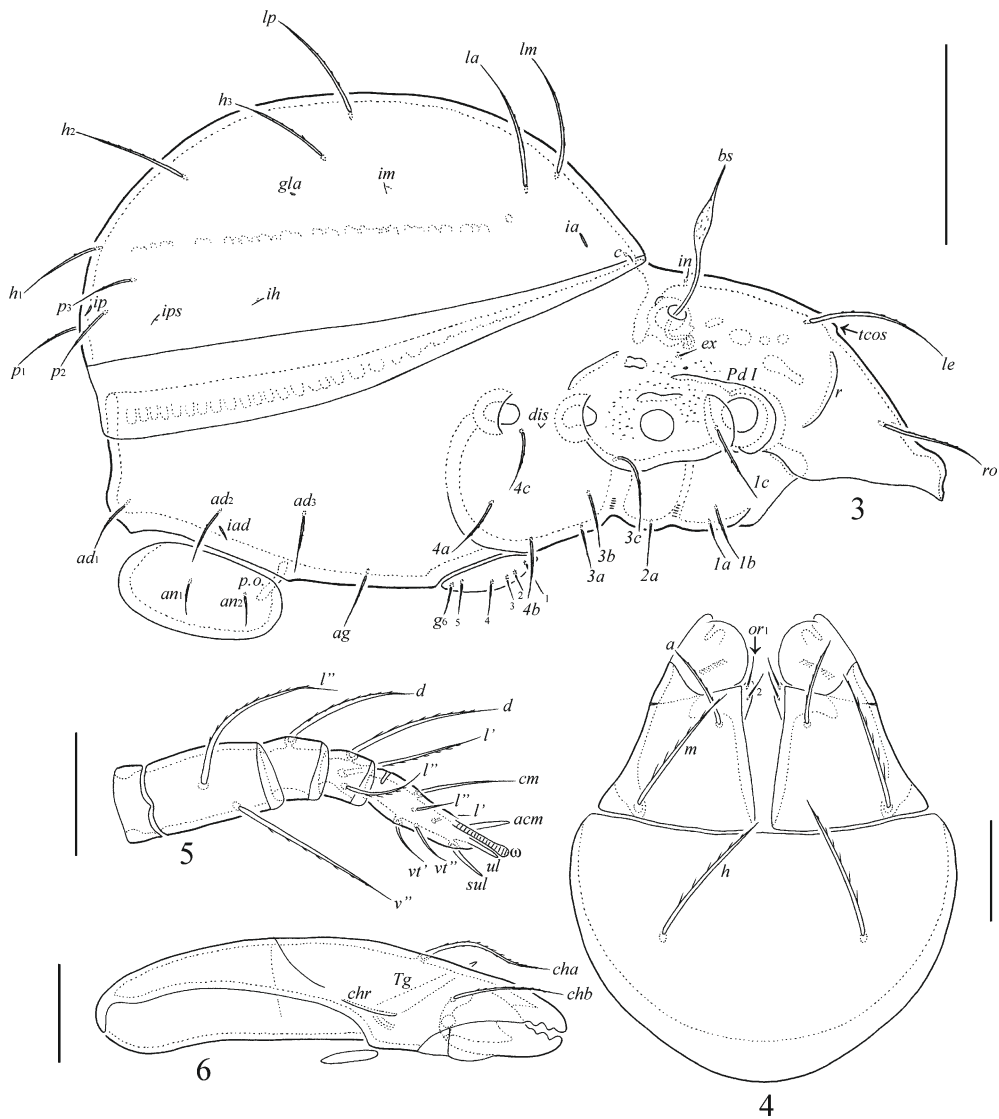
Figs 1-2. *Lanceoppia (Lanceoppia) operta* sp. nov., adult: **1.** dorsal view (legs not shown); **2.** ventral view (gnathosoma and legs except left trochanters III, IV not shown). Scale bar 100 μ m.

rostrum to the posterior edge of the notogaster. Notogastral width refers to the maximum width of notogaster in dorsal 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".

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

The following abbreviations are used: *cos* – costula; *tcos* – transcostula; *r* – lateral ridge of prodorsum; *ro*, *le*, *in*, *bs*, *ex* – rostral, lamellar, interlamellar, bothridial and exobothridial setae, respectively; *c*, *la*, *lm*, *lp*, *h*, *p* – notogastral setae; *ia*, *im*, *ip*, *ih*, *ips* – notogastral lyrifissures; *gla* – opisthotal gland opening; *h*, *m*, *a* – 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* – pedotectum I; *1a*, *1b*, *1c*, *2a*, *3a*, *3b*, *3c*, *4a*, *4b*, *4c* – epimeral setae; *dis* – discidium; *g*, *ag*, *an*, *ad* – genital, aggenital, anal and adanal setae, respectively; *iad* – adanal lyrifissure; *p.o.* – preanal organ; *Tr*, *Fe*, *Ge*, *Ti*, *Ta* – leg trochanter, femur, genu, tibia and tarsus, respectively; σ , ϕ – leg solenidia; ϵ – tarsus I famulus; *v*, *ev*, *bv*, *l*, *d*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* – leg setae.



Figs 3–6. *Lanceoppia (Lanceoppia) aperta* sp. nov., adult: 3. lateral view (gnathosoma and legs not shown); 4. subcapitulum, ventral view; 5. palp, right, antiaxial view; 6. chelicera, right, antiaxial view. Scale bar 100 μ m (3), 20 μ m (4–6).

Descriptions

Lanceoppia (Lanceoppia) aperta sp. nov.

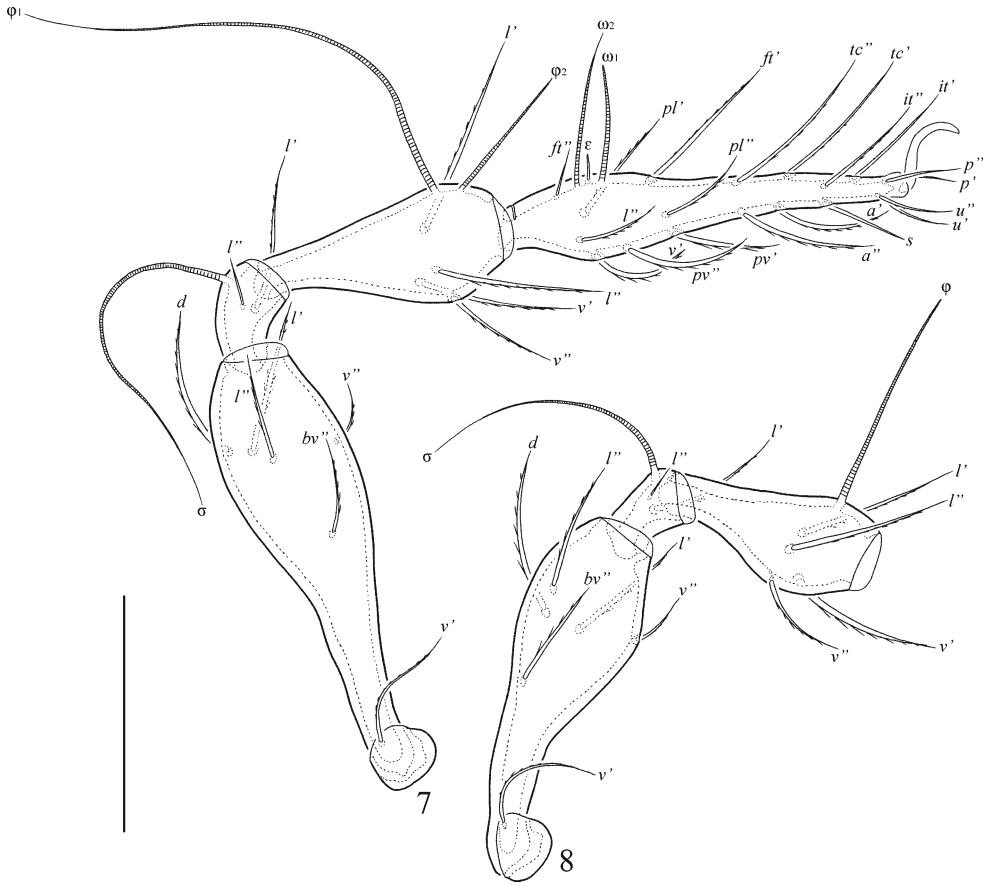
Figs 1–10

Diagnosis. Body size: 398–431 \times 224–240. Transcostula distinct, costulae completely absent. Rostral and lamellar setae long, setiform, barbed, interlamellar setae minute. Bothridial setae spindle-shaped, with well-developed erect setiform tip, barbed. Noto-

gastral setae *c* short, others setae of medium size, setiform, barbed. Epimeral and anogenital setae short, setiform, sparsely barbed (except smooth genital setae).

Description

Measurements. Body length: 398 (holotype, female), 398–431 (4 paratypes: 2 females and 2 males); notogaster width: 224 (holotype), 224–240 (4 paratypes). No difference between females and males in body size.



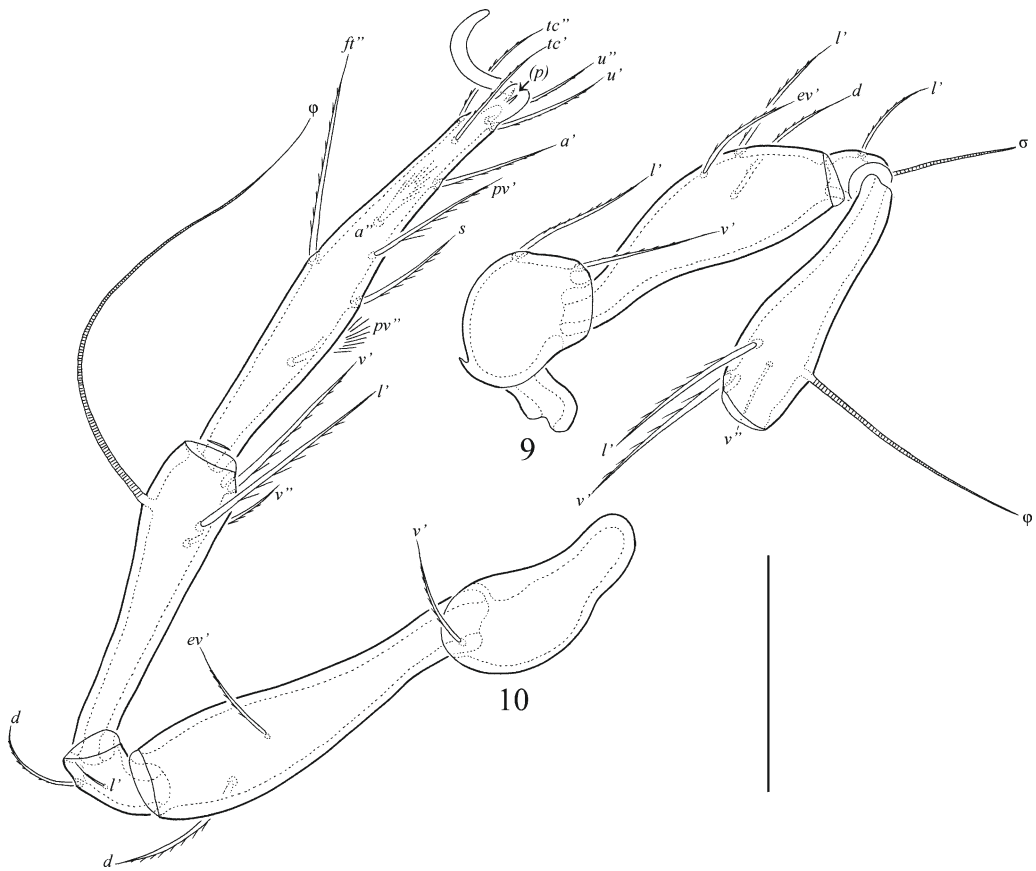
Figs 7-8. *Lanceoppia (Lanceoppia) aperta* sp. nov., adult: 7. leg I, right, antiaxial view; 8. leg II, without tarsus, right, antiaxial view. Scale bar 50 μ m.

Integument (Fig. 3). Body colour light brown. Body surface microfoveolate (visible under high magnification in dissected specimens). Lateral parts of body between bothridia and acetabula I-III tuberculate (diameter of tubercles up to 2).

Prodorsum (Figs 1, 3). Rostrum rounded. Costulae completely absent. Transcostula distinct, located anterior to insertions of lamellar setae. One pair of arch-like ridges present on lateral sides of prodorsum. Rostral (49-53) and lamellar (61-73) setae setiform, barbed. Interlamellar (4-6) and exobothridial (10-12) setae setiform, thin, smooth. Bothridial setae (77-82) spindle-shaped, with long stalk and elongated barbed head with well-developed erect setiform tip. Interbothridial tubercles absent. Interbothridial region with two pairs of muscle sigillae. Postbothridial tubercles slightly developed. Longitudinal rows of muscle sigillae anterior to bothridia poorly visible.

Notogaster (Figs 1, 3). Ten pairs of notogastral setae present: *c* (4) setiform, thin, smooth, others (*la*, *lm*, *lp*, *h*₂, *h*₃, 61-69; *h*₁, *p*₁-*p*₃, 32-41) setiform, barbed. Lyrifissures *ia* located in humeral parts, *im* anterolateral to *h*₃ and distanced from them, *ip* between *p*₁ and *p*₂, *ih* and *ips* on lateral parts of notogaster. Opisthonotal gland openings located posterolateral to *h*₃.

Gnathosoma (Figs 4-6). Subcapitulum longer than wide (90-94 \times 61-69). Subcapitular setae setiform, barbed, *a* (16-18) shorter and thinner than *m* (28-32) and *h* (28-32). Adoral setae (6) setiform, thin, smooth. Palps (61-65) with setation 0-2-1-3-8(+ ω). Solenidion of palptarsi bacilliform, swollen distally. Postpalpal setae (8) spiniform, smooth. Chelicerae (90-94) with two setiform, barbed setae, *cha* (38-30) longer than *chb* (20-22). Antiaxial part of chelicerae with diagonal ridge. Trägårdh's organ narrowly triangular.



Figs 9–10. *Lanceoppia (Lanceoppia) aperta* sp. nov., adult: **9.** leg III, without tarsus, left, ventroantiaxial view; **10.** leg IV, left, antiaxial view. Scale bar 50 μ m.

Epimeral and lateral podosomal regions (Figs 2, 3). Epimeral setal formula 3–1–3–3. Setae (1a, 2a, 3a, 16–20; 1c, 3c, 36–41, others 24–28) setiform, sparsely barbed. Discidia triangular, pointed distally.

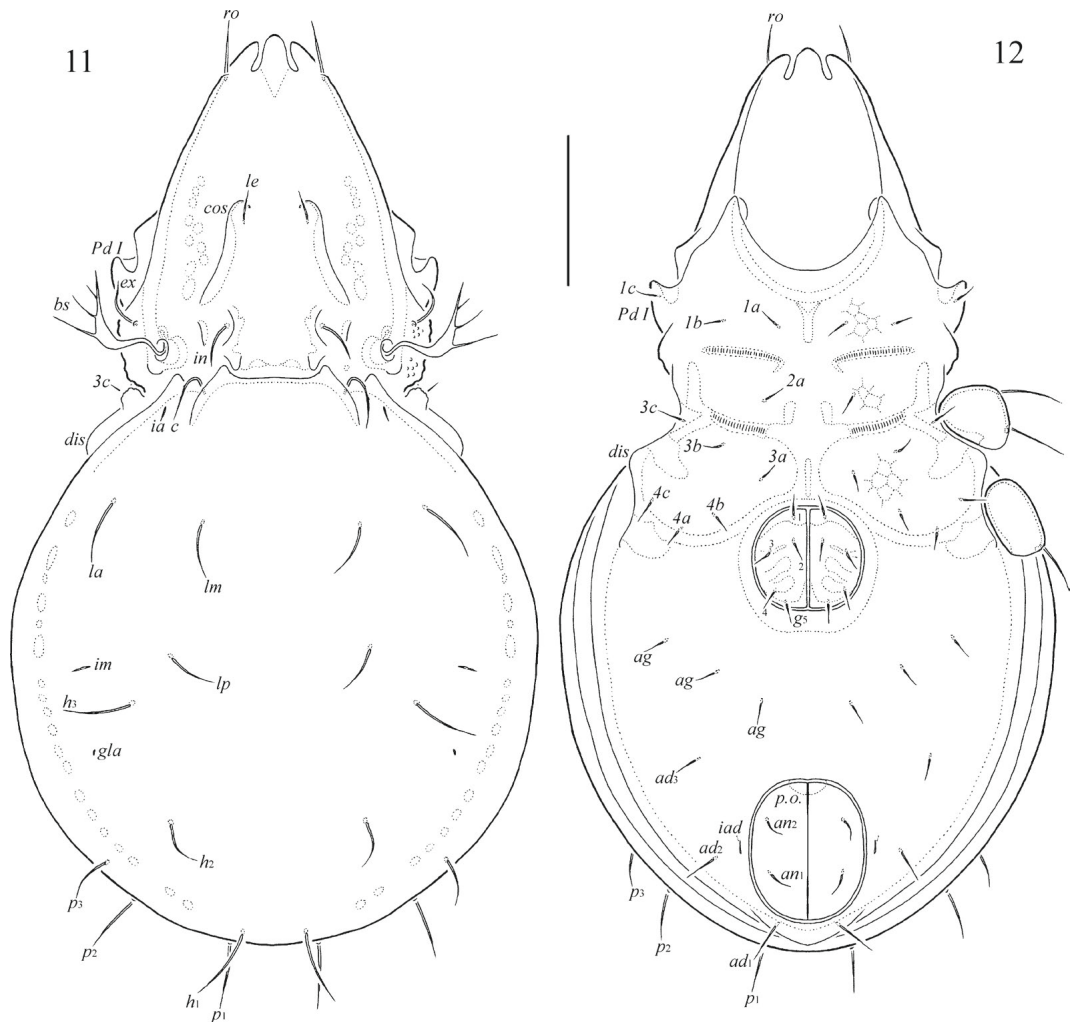
Anogenital region (Figs 2, 3). Six pairs of genital setae ($g_2, g_3, 8$ –10; others 14–16) setiform, thin, smooth. One pair of aggenital (24–28), three pairs of adanal (24–28) and two pairs of anal (14–16)

setae setiform, sparsely barbed. Adanal lyrifissures distinct, in typical inverse apoanal position.

Legs (Figs 7–10). Claw of each leg smooth. Porose areas on femora I–IV and on trochanters III, IV poorly visible. Trochanters III with one or two teeth posteriorly. Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–3–12)

Table 1. Leg setation and solenidia of adult *Lanceoppia (Lanceoppia) aperta* sp. nov. and *Tripiloppia parafrigida* sp. nov. 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.

Leg	Tr	Fe	Ge	Ti	Ta
I	v'	$d, (l), bv'', v''$	$(l), \sigma$	$(l), (v), \phi_1, \phi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', \epsilon, \omega_1, \omega_2$
II	v'	$d, (l), bv'', v''$	$(l), \sigma$	$(l), (v), \phi$	$(ft), (tc), (it), (p), (u), (a), s, (pv), l'', \omega_1, \omega_2$
III	l', v'	d, l', ev'	l', σ	$l', (v), \phi$	$(ft), (tc), (it), (p), (u), (a), s, (pv)$
IV	v'	d, ev'	d, l'	$l', (v), \phi$	$ft'', (tc), (p), (u), (a), s, (pv)$



Figs 11–12. *Tripiloppia parafrigida* sp. nov., adult: **11.** dorsal view (legs not shown); **12.** ventral view (gnathosoma and legs except left trochanters III, IV not shown). Scale bar 50 μ m.

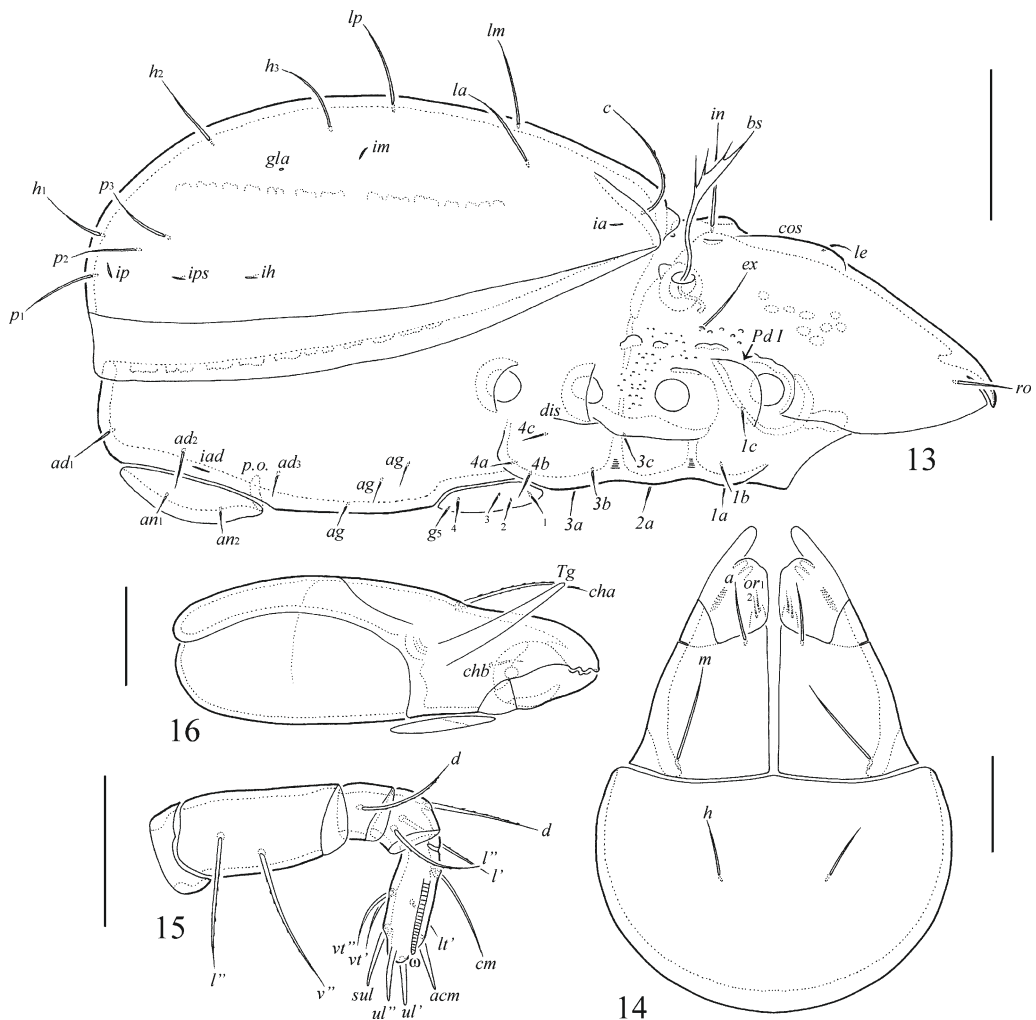
[0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus of tarsi I short, setiform, erect, located between solenidia ω_1 and ω_2 . Solenidia ω_1 , on tarsi I, ω_1 and ω_2 on tarsi II bacilliform, ϕ_2 on tibiae I, ϕ on tibiae II and III and σ on genua III thickened, blunt-ended, erect, other solenidia setiform.

Material examined. Holotype (female) and 4 paratypes (2 females and 2 males): New Zealand, South Island, Tasman region, Mount Richmond Forest Park, high alpine zone of Ben Nevis peak, 1616 m a. s. l., 41°33.000' S, 173°04.491' E, in soil under carpet grass *Chionochloa australis* (Buchanan) Zotov and some *Lycopodium fastigiatum* R.Br., sample BNA T3–5, 24 January 2017 (collected by M. Minor).

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

Etymology. The specific name *operta*, gender feminine, means “hidden, concealed”, in Latin referring to the dense layer of carpet grass under which the newly described species lives.

Remarks. *Lanceoppia* (*Lanceoppia*) *operta* sp. nov. is morphologically most similar to *Lanceoppia* (*Lanceoppia*) *willmanni* Hammer, 1968 from New Zealand in having spindle-shaped bothridial setae, well-developed transcostula and long rostral and lamel-



Figs 13–16. *Tripiloppia parafrigida* sp. nov., adult: 13. lateral view (gnathosoma and legs not shown); 14. subcapitulum, ventral view; 15. palp, right, antiaxial view; 16. chelicera, left, paraxial view. Scale bar 50 μ m (13), 20 μ m (14–16).

lar setae. However, the new species differs from *L. (L.) willmanni* by the smaller body length (398–431 versus 530–570 in *L. willmanni*), minute interlamellar setae (versus medium size), well-developed bothridial heads (versus less developed, narrow) and notogastral setae *c* present (versus absent).

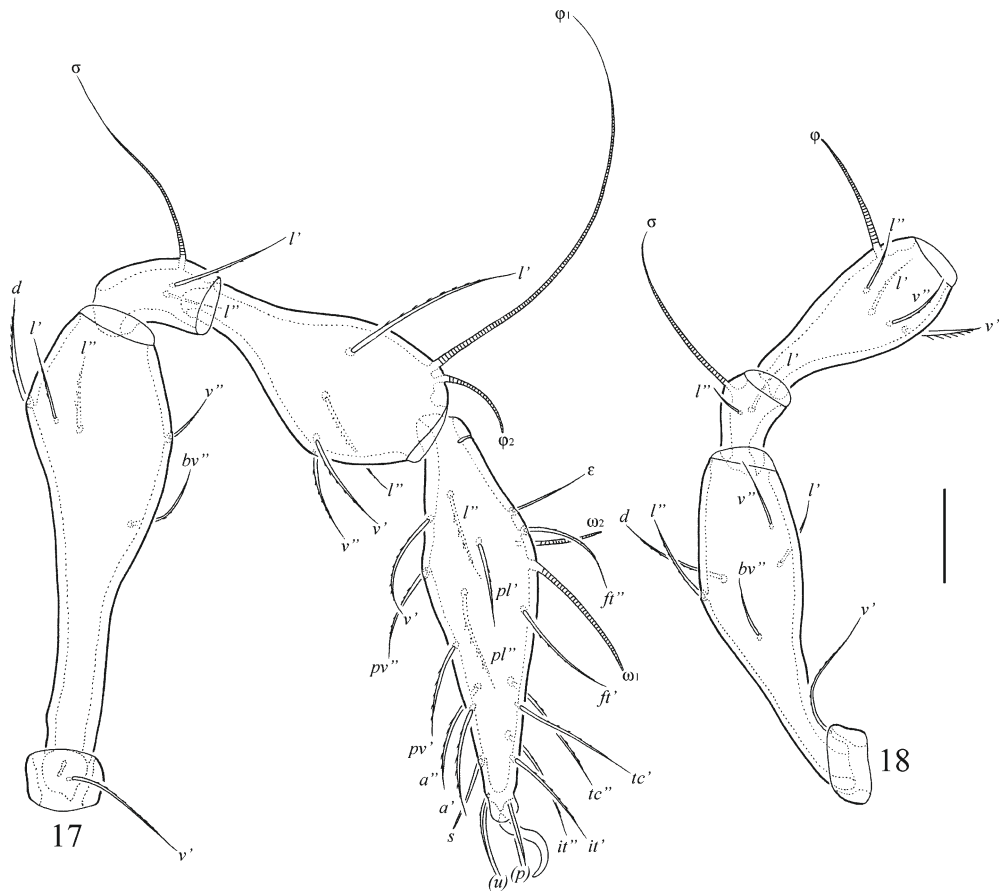
***Tripiloppia parafrigida* sp. nov.**
Figs 11–20

Diagnosis. Body size: 315–332 \times 166–182. Rostrum tripartite, median part rounded. Costulae long, with ends curved and directed medially. Rostral, lamellar

and interlamellar setae setiform, slightly barbed, *in* longest, *le* shortest and thinnest. Bothridial setae with lanceolate head having 3 to 5 cilia. Notogaster anteriorly with short cristae and medial and humeral tubercles. Notogastral setae of medium size, setiform, *c* longest, sparsely barbed, others smooth. Epimeral and anogenital setae short, setiform, smooth.

Description

Measurements. Body length: 315 (holotype, male), 315–332 (3 paratypes: 2 females and 1 male); notogaster width: 166 (holotype), 166–182 (3 paratypes). No difference between females and males in body size.



Figs 17–18. *Tripiloppia parafrigida* sp. nov., adult: 17. leg I, left, paraxial view; 18. leg II, without tarsus, right, anti-axial view. Scale bar 20 μ m.

Integument (Fig. 13). Body colour light brown. Body surface microfoveolate (visible under high magnification in dissected specimens). Lateral parts of body between bothridia and acetabula I–III tuberculate (diameter of tubercles up to 2).

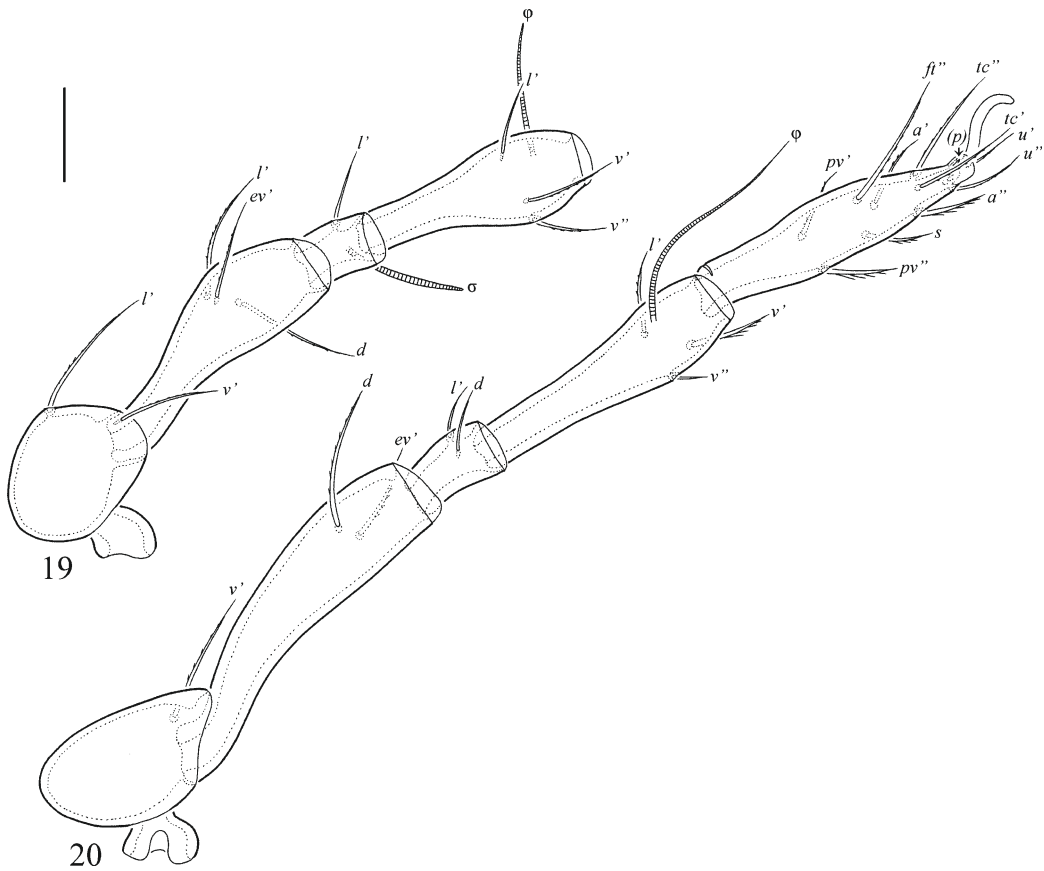
Prodorsum (Figs 11, 13). Rostrum tripartite, median part rounded, two deep incisions well visible. Costulae strong, parallel, their ends curved and directed medially. Rostral (20–24), lamellar (10–12), interlamellar (36–41) and exobothridial (24–28) setae setiform, slightly barbed, *le* thinnest. Bothridial setae (57–61) with long stalk, lanceolate head, having 3 to 5 cilia of different lengths. Interbothridial and postbothridial tubercles present. Interbothridial region without muscle sigillae. Longitudinal rows of muscle sigillae anterior to bothridia poorly visible.

Notogaster (Figs 11, 13). Trapezoid protrusion, cristae, medial and humeral tubercles well-developed in anterior part of notogaster. Ten pairs of notogastral

setae setiform, *c* (41–45) sparsely barbed, others (*la*, *lm*, *lp*, *h*₂, *h*₃, 32–36; *h*₁, *p*₁–*p*₃, 24–32) smooth. Lyrifissures *ia* located in humeral parts, *im* anterolateral to *h*₃ and distanced from them, *ip* between *p*₁ and *p*₂, *ih* and *ips* on lateral parts of notogaster. Opisthonotal gland openings located posterolateral to *h*₃.

Gnathosoma (Figs 14–16). Subcapitulum longer than wide (86–94 \times 57–61). Subcapitular setae setiform, smooth, *m* (20) longer and thicker than *a* (12) and *h* (12). Adoral setae (4) setiform, thin, smooth. Palps (61–65) with setation 0–2–1–3–8(+ ω). Solenidion of palptarsi bacilliform. Postpalpal setae (10) spiniform, smooth. Chelicerae (86–94) with two setiform, barbed setae, *cha* (26–28) longer than *chb* (6–8). Trägårdh's organ narrowly triangular.

Epimeral and lateral podosomal regions (Figs 12, 13). Epimeral setal formula 3–1–3–3. Setae (10–12) setiform, smooth. Discidia triangular, rounded distally.



Figs 19–20. *Tripiloppia parafrigida* sp. nov., adult: 19. leg III, without tarsus, left, ventroantiaxial view; 20. leg IV, right, paraxial view. Scale bar 20 μ m.

Anogenital region (Figs 12, 13). Five pairs of genital (10–12), three pairs of aggenital (10–12), three pairs of adanal (ad_1 , ad_2 , 14–16; ad_3 , 10–12) and two pairs of anal (10–12) setae setiform, smooth. Adanal lyrifissures distinct, in typical paraanal position.

Legs (Figs 17–20). Claw of each leg smooth. Porose areas on femora I–IV and on trochanters III, IV poorly visible. Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [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. Famulus of tarsi I long, setiform, located posterior to seta ft'' . Solenidia ω_1 and ω_2 on tarsi I, II, ϕ_2 on tibiae I, ϕ on tibiae II and III and σ on genua III bacilliform or thickened, blunt-ended, other solenidia setiform.

Material examined. Holotype (male) and 3 paratypes (2 females and 1 male): New Zealand, South Island, Tasman region, Mount Richmond Forest Park, high alpine zone of Ben Nevis peak, 1616 m a. s. l., 41°33.000' S,

173°04.491' E, in soil under carpet grass *Chionochloa australis* (Buchanan) Zotov and some *Lycopodium fastigiatum* R.Br., sample BNA T3–5, 24 January 2017 (collected by M. Minor).

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

Etymology. The specific name *parafrigida* refers to the similarity between the new species and *Tripiloppia frigida* Ermilov & Minor, 2015.

Remarks. *Tripiloppia parafrigida* sp. nov. is morphologically most similar to *Tripiloppia frigida* Ermilov & Minor, 2015 from New Zealand in having the bothridial setae with lanceolate head, short lamellar setae, five pairs of genital setae and notogastral setae of medium size. However, the new species differs by smaller body size (315–332 \times 166–182 versus 415–

448×215–249 in *T. frigida*), distal end of costulae curved medially, lamellar setae inserted close to distal part of costulae (versus costulae straight, not curved distally; lamellar setae inserted in the median part of costulae), and humeral tubercles developed (versus absent).

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