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Two new species of *Austrophthiracarus* (Acari: Oribatida: Phthiracaridae) from New Zealand

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Abstract

The genus *Austrophthiracarus* (Acari: Oribatida: Phthiracaridae) was represented in New Zealand by four species prior to this work. In this paper, two new species of *Austrophthiracarus* are described from the South Island, New Zealand: *Austrophthiracarus cronadun* **sp. nov.** collected near Cronadun, Buller and *Austrophthiracarus tawhai* **sp. nov.** from Catlins State Forest, Otago. A key to all known species of *Austrophthiracarus* in New Zealand is provided.

Key words: Ptyctimous mites, Oribatida, Phthiracaridae, *Austrophthiracarus*, new species, New Zealand

Introduction

Ptyctimous mites, which have the ability to fold the aspidosoma under the opisthosoma, are one of the primitive groups of oribatid mites. They are typical and important representatives of soil mites, including four groups: protoplophorids, mesoplophorids, euphthiracarids and phthiracarids. Before 1989, the fauna of ptyctimous mites in New Zealand was poorly studied, with only four recorded species (Ramsay 1966, Wallwork 1966, Luxton 1985). The total was later increased to 45 species—or over 10-fold increase—by Niedbala (1989, 1993, 1994, 2000, 2006) and Niedbala & Colloff (1997).

This paper concerns the phthiracarid genus *Austrophthiracarus*, which was erected by Balogh and Mahunka (1978) with *A. radiatus* from Queensland as type species. Till the end of 2012, more than 60 species were described or included in this genus (Niedbala 2000, 2011; Subías 2012). Most species of this genus have been found in the Southern Hemisphere, except some individual species with distribution in the Palaearctic Region (Niedbala 2000, 2008, 2011; Kaczmarek & Niedbala 2002). According to Niedbala (2000), the genus *Austrophthiracarus* is characterised as having genital setae arranged in two rows, setae g_6 close to or even above g_4 , at least setae g_6 and g_7 far away from paraxial region, adanal setae far away from paraxial margin, setae d on tibiae IV short, coupled with solenidia. During the first author's visit to Landcare Research in Auckland in April 2012, we identified two new species from New Zealand Arthropod Collection, with both species having character states matching those defined for the genus *Austrophthiracarus* by Niedbala (2000). The purpose of this paper is to give detailed descriptions of the two new species and to provide a key to facilitate identification of all known species of *Austrophthiracarus* in New Zealand.

Methods

Measurements and descriptions are based on specimens mounted in temporary cavity slides that were studied using a light microscope equipped with a drawing attachment.

Terminology generally follows Niedbala (1992, 2000). The unit of measurement is micrometre (μm).

All holotype specimens studied are deposited in the New Zealand Arthropod Collection, Landcare Research, Auckland (NZAC). Paratype specimens are split between NZAC and Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun (NIGA).

Descriptions of new species

Austrophthiracarus cronadun sp. nov.

(Figs. 1–9)

Material examined: Holotype: adult (NZAC, in alcohol, 73/9), New Zealand: Caplestone Bio. Res. Br., B.F.U.P., from litter, 12 Jan., 1973, leg. J. C. Watt¹. Paratype: one adult (NIGA, in alcohol, 73/9), same data as holotype.

Etymology. The new species is named after Cronadun—the small town closest to the type locality; it is used here as a noun in apposition.

Description. *Measurements:* Holotype: Prodorsum: length 270, width 228, height 102, setae: *ss* 35, *ro* 30, *le* 20, *ex* 25; notogaster: length 610, width 430, height 390; setae: *c*₁ 175, *ps*₁ 170, *ps*₂ 150, *ps*₃ 150, *ps*₄ 50; ventral region: *ad*₁ 130, *ad*₂ 127, *an*₁ 90, *an*₂ 90; genitoaggenital plate 125×160, anoadanal plate 117×225. Paratype: Prodorsum: length 300, width 230, height 100; notogaster: length 593, width 425, height 380.

Integument. Colour yellowish. Surface of body punctate.

Prodorsum (Figs. 1–2). Median carina and lateral carinae absent; sigillar fields distinct, dorsal region longer than lateral regions; posterior furrows absent; sensilli (*ss*) short with narrow pedicel and broad head, covered with minute spines and truncate distally; interlamellar setae (*in*) vestigial; rostral setae (*ro*) spiniform, thin, short, rough and semi-erect; lamellar (*le*) and exobothridial setae (*ex*) short and fine; comparative lengths of setae: *ss*>*ro*>*ex*>*le*; mutual distance of setae: *in-in*>*ro-ro*.

Notogaster (Fig. 1). 19 pairs of setae present, moderately long (*c*₁/*c*₁–*d*₁=0.95), robust, covered with small spines in distal half, setae *c*₁ longest, setae *ps*₄ thinner and shortest; setae *c*_{1–3} slightly far away from anterior border, setae *c*₂ more so than *c*₁ and *c*₃; four additional setae present (*h*₁', *ps*₁', *ps*₂', *ps*₃') with distribution as depicted in Fig. 1; vestigial setae *f*₁ not observed; two pairs of lyrifissures *ia* and *im* present.

Gnathosoma (Figs. 5–7). Subcapitulum normal (Fig. 5); setae *h*, *m*, and *a* simple and smooth; setae *h* shorter than distance between them; adoral seta *or*₁ apparently flat with barbs; *or*_{2–3} simple and smooth; palp (Fig. 6) four segmented, femur and genu fused; palpal setation: 0-2-2-7(1); supracoxal seta simple and smooth; chelicera (Fig. 7) with two smooth setae (*cha*, *chb*).

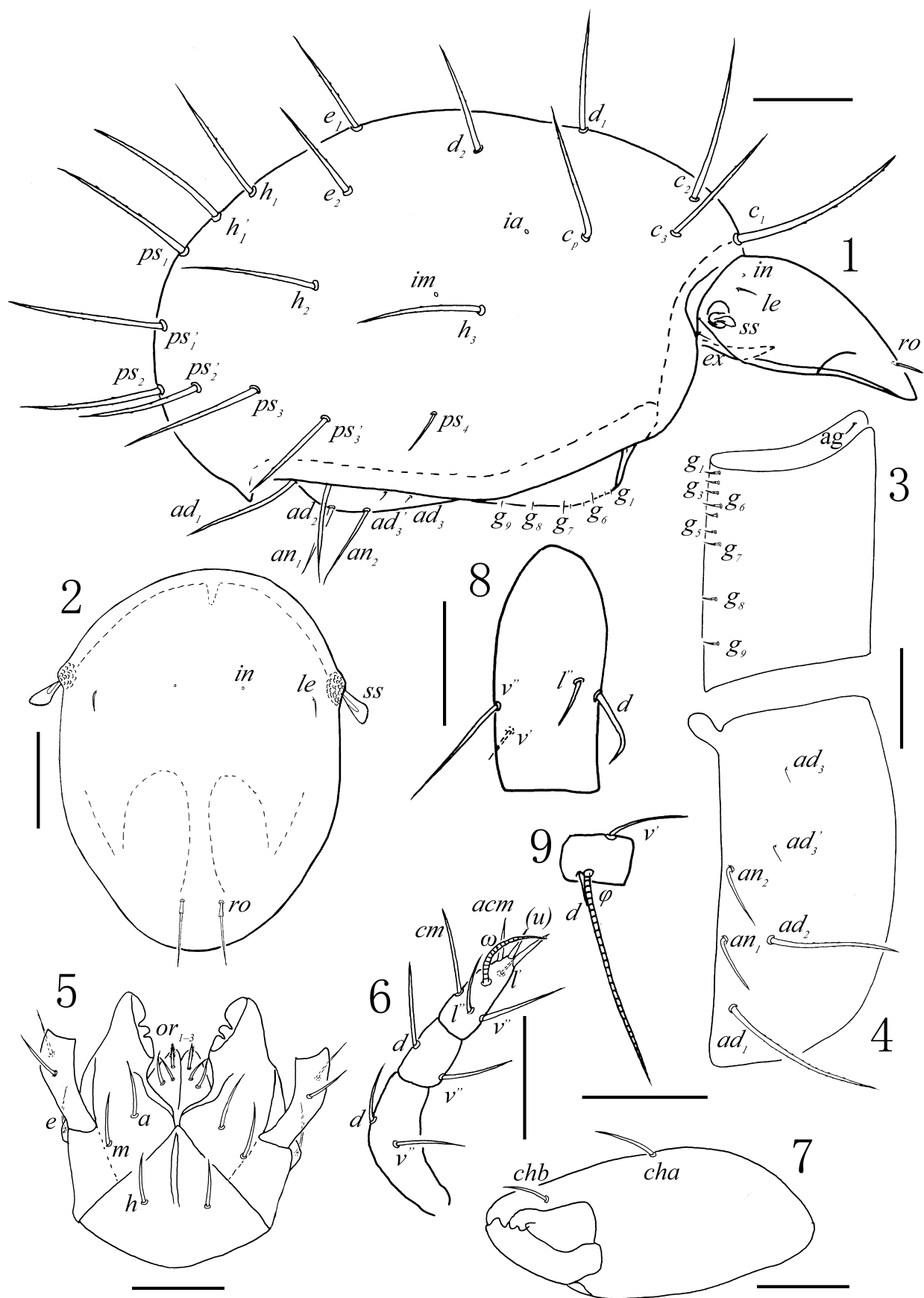
Ano-genital region (Figs. 1, 3–4). Nine pairs of genital setae (*g*) present, arranged in two rows with formula: 9(4+5): 0, their distribution as depicted in Fig. 3; one pair of aggenital setae (*ag*) present; anoadanal plates each with six setae, setae *ad*₁ and *ad*₂ rough, longer and thicker than other setae and anal setae (*an*), setae *ad*₁ longest, setae *ad*₃ and *ad*₃' minute, similar in length to genital setae.

Legs (Figs. 8–9). Setal counts for leg segments (excluding tarsi): I: 1-4-2(2)-5(1); II: 1-3-2(1)-3(1), III: 2-2-1(1)-2(1), IV: 2-1-1-2(1); setae *d* on femora I inserted at level of setae *v*"; setae *a*" on tarsi I and setae *ft*" on tarsi II curved distally; setae *a*" on tarsi II curved distally; setae *s* and *pv*' on tarsi IV present; setae *s* on tarsi I and II absent; setae *d* on tibiae IV short, coupled with solenidia; all legs monodactylous.

Distribution. Known only from the type locality.

Remark. This new species is similar to *Austrophthiracarus hallidayi* Niedbala & Colloff, 1997 in the presence of narrow dorsal region of sigillar fields longer than lateral regions, lateral carinae absent, rostral and lamellar setae short, *ro*>*le*, *in-in*>*ro-ro*, 19 pairs of setae present, additional setae present in *h* and *ps* series, setae *c*₂ more far away from anterior border than *c*₁ and *c*₃, two pairs of lyrifissures present, genital setae arranged with similar formula, and setae *d* on femora I inserted at level of setae *v*", but can be easily distinguished from the latter species by the following nine characters (a versus b): in *A. cronadun* sp. nov., (1a) interlamellar setae vestigial; (2a) exobothridial setae present; (3a) head of sensilli much broader and truncate distally; (4a) distance between rostral

1. Bio. Res. = Biological Reserve; Br. = Buller; B.F.U.P. = Beech Forest Utilization Project. Additional information about the site from NZAC litter sample log book: The litter sample was collected under *Weimannia racemosa*, *Nothofagus truncata*, *N. menziesii* and *Quintinia serrate* near the main ridge of the reserve, 4.5 km S.E. Cronadun.



FIGURES 1–9. *Austrophthiracarus cronadun* sp. nov.: 1, lateral view of body (legs removed); 2, prodorsum, dorsal view; 3, left side of genito-aggenital plate; 4, left side of ano-adanal plate; 5, subcapitulum, palpi removed; 6, palp, antiaxial view; 7, chelicera, antiaxial view; 8, femur I; 9, tibia IV. Scale bars: 1, 2, 3, 4, 8, 9=100 μ m; 5, 6, 7=50 μ m.

setae longer; (5a) notogastral setae stronger and relatively shorter, $c_1/c_1-d_1 < 1$; (6a) setae h_1 ' situated between h_1 and ps_1 ; (7a) five setae inserted at the ps_2 level; (8a) setae h of mentum shorter than distance between them; (9a) setae ad_3 and ad_3' minute, similar in length with genital setae. In *A. hallidayi*, (1b) interlamellar setae present; (2b) exobothridial setae vestigial; (3b) head of sensilli fusiform, narrow and slightly pointed distally; (4b) distance between rostral setae shorter; (5b) notogastral setae thinner and longer, $c_1/c_1-d_1 = 1.27$; (6b) setae h_1 ' situated between ps_1 and h_2 ; (7b) four setae inserted at the ps_2 level; (8b) setae h of mentum longer than distance between them; (9b) setae ad_3 and ad_3' much longer than genital setae.

This new species is also similar to New Zealand species *Austrophthiracarus pulchellus* Niedbala, 1993 in the presence of vestigial interlamellar setae, but can be easily distinguished from the latter species by the following nine characters (a versus b): in *A. cronadun* sp. nov., (1a) dorsal region of sigillar fields longer than lateral regions; (2a) head of sensilli much broader and truncate distally; (3a) exobothridial setae present; (4a) notogaster with 19 pairs of setae; (5a) notogastral setae longer; (6a) setae g_7 situated postero-lateral of g_3 ; (7a) setae h of mentum present; (8a) setae ad_3 and ad_3' minute, similar in length with genital setae; (9a) setae v'' on femora I present; in *A. pulchellus*, (1b) dorsal region of sigillar fields similar in length with lateral regions; (2b) head of sensilli rounded, but not truncate distally; (3b) exobothridial setae vestigial; (4b) notogaster with 18 pairs of setae; (5b) notogastral setae much shorter; (6b) setae g_7 situated at the level of g_4 ; (7b) setae h of mentum vestigial; (8b) setae ad_3 and ad_3' much longer than genital setae; (9b) setae v'' on femora I absent.

Austrophthiracarus tawhai sp. nov.

(Figs. 10–19)

Material examined: Holotype: adult (NZAC, in alcohol, 72/105), New Zealand: Catlins S. F. Otago, from litter, 20 Jan., 1972, leg. J. S. Dugdale². Paratypes: five adults (NZAC, in alcohol, 72/105), same data as holotype; one adult (NIGA, in alcohol, 72/105), same data as holotype.

Etymology. The new name (noun in apposition) is from Māori Tāwhai (silver beech, *Nothofagus menziesii*) endemic to New Zealand. This new species was collected from the litter in a silver beech forest.

Description. *Measurements:* Holotype: Prodorsum: length 495, width 385, height 210, setae: ss 40, ro 20, le 40, in 20, ex 15; notogaster: length 1090, width 810, height 830; setae: c_1 310, d_1 305, e_1 310, h_1 308, ps_1 320; ventral region: ad_1 255, ad_2 250, ad_3 25, ad_3' 15, an_1 170, an_2 170; genitoaggenital plate 200×280, anoanal plate 225×450. Paratypes: Prodorsum: length 405–500, width 330–365, height 140–150; notogaster: length 955–1060, width 660–710, height 590–700.

Integument. Colour brown. Surface of body finely punctate.

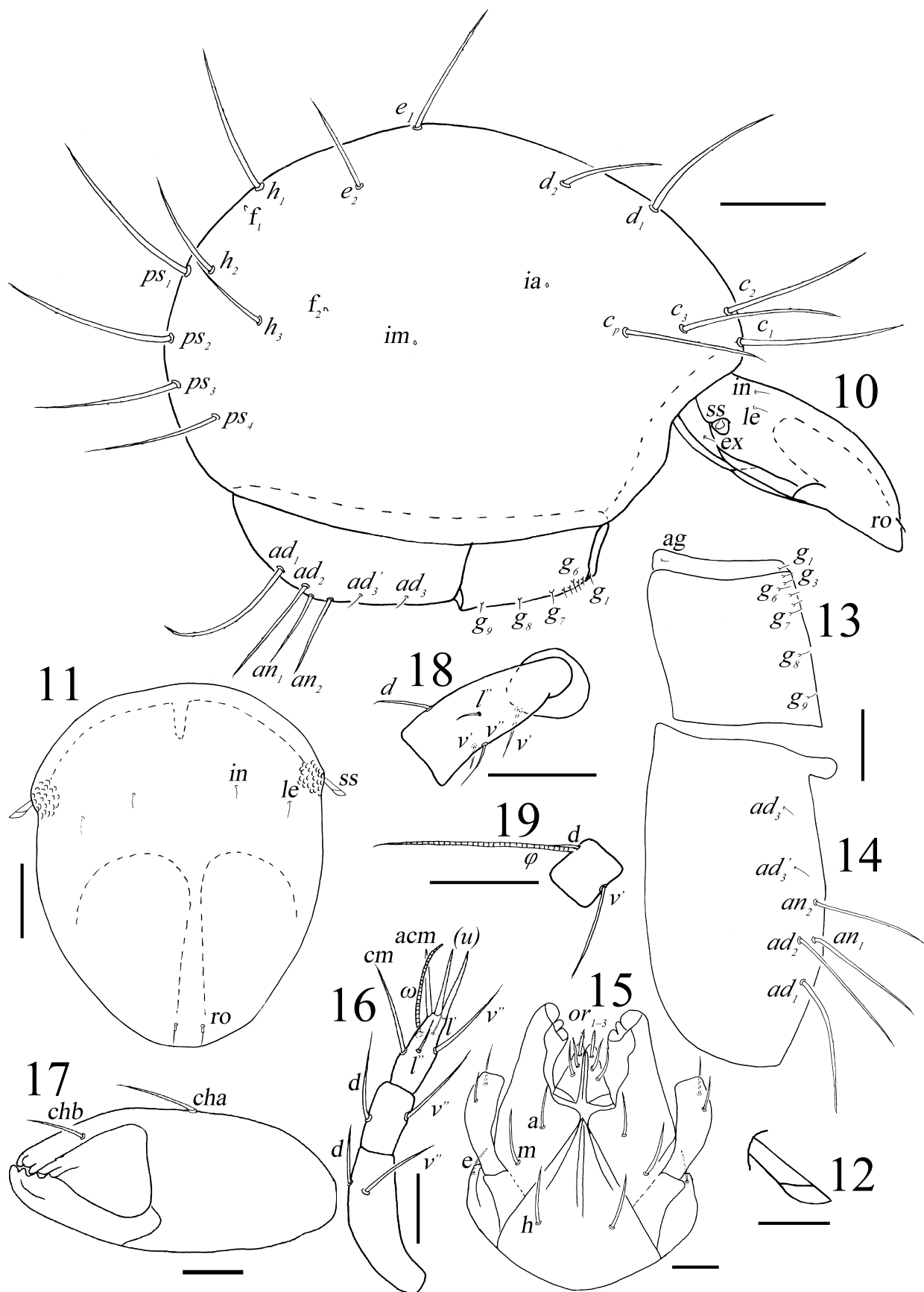
Prodorsum (Figs. 10–12). Median carina and lateral carinae absent; sigillar fields distinct, dorsal region narrow, longer than lateral regions; posterior furrows absent; sensilli (ss) short and smooth, with slightly broad head; other prodorsal setae (in , le , ro , ex) short and thin; comparative length: $ss=le > ro=in > ex$; mutual distance of setae: $in-in > ro-ro$.

Notogaster (Fig. 10). 15 pairs of setae present, moderately long ($c_1/c_1-d_1=0.98$), robust, covered with small spines in distal half, setae ps_1 longest, setae d_2 shortest; setae c_{1-3} slightly far away from anterior border, setae c_3 more so than c_1 and c_2 ; vestigial setae f_1 posterior to setae h_1 ; two pairs of lyrifissures ia and im present.

Gnathosoma (Figs. 15–17). Subcapitulum normal (Fig. 15); setae h , m , and a simple and smooth; setae h shorter than distance between them; adoral seta or_1 apparently flat with barbs; or_{2-3} simple and smooth; palp (Fig. 16) four segmented, femur and genu fused; palpal setation: 0-2-2-7(1); supracoxal seta simple and smooth; chelicera (Fig. 17) with two smooth setae (cha , chb).

Ano-genital region (Figs. 10, 13–14). Nine pairs of genital setae (g) present, arranged in two rows with formula: 9(4+4): 1, their distribution as depicted in Fig. 13; one pair of aggenital setae (ag) present; anoanal plates each with six setae, setae ad_1 and ad_2 rough, longer and thicker than other setae and anal setae (an), setae ad_3 and ad_3' smooth and minute, similar in length to genital setae.

2. S. F. = State Forest. Additional information about the site from NZAC litter sample log book: This litter sample was collected under *Nothofagus menziesii* in a river reserve east of Wilsons Plantation.



FIGURES 10–19. *Austrophthiracarus tawhai* sp. nov.: 10, lateral view of body (legs removed); 11, prodorsum, dorsal view; 12, sensillus, dorsal view; 13, right side of genitoaggenital plate; 14, right side of anoadanal plate; 15, subcapitulum, palpi removed; 16, palp, antiaxial view; 17, chelicera, antiaxial view; 18, trochanter and femur I; 19, tibia IV. Scale bars: 10, 18, 19=200 μ m; 11, 13, 14=100 μ m; 12=25 μ m; 15, 16, 17=50 μ m.

Legs (Figs. 18–19). Setal counts for leg segments (excluding tarsi): I: 1-4-2(2)-5(1); II: 1-3-2(1)-3(1), III: 2-2-1(1)-2(1), IV: 2-1-1-2(1); setae *d* on femora I inserted at level of setae *v*''; setae *a*'' on tarsi I and setae *ft*'' on tarsi II curved distally; setae *a*'' on tarsi II curved distally; setae *s* and *pv*' on tarsi IV present; setae *s* on tarsi I and II absent; setae *d* on tibiae IV short, coupled with solenidions; all legs monodactylous.

Distribution. Known only from the type locality.

Remark. This new species is similar to *Austrophthiracarus aureus* Niedbała, 2000 in the presence of short and thin prodorsal setae (*in, le, ro, ex*), four pairs of adanal setae present, setae *ad*₃ and *ad*₃' smooth and minute, setae *v*' on femora I present, but can be easily distinguished from the latter species by the following twelve characters (a versus b): in *A. tawhai* sp. nov., (1a) surface of body finely punctuate, never foveolate; (2a) head sensilli smooth and narrow; (3a) *ss=le>ro=in>ex*; (4a) 15 pairs of setae present, with same shape, $c_1/c_1-d_1 < 1$; (5a) setae *c*₃ more far away from anterior border than *c*₁ and *c*₂; (6a) only two pairs of lyrifissures present; (7a) vestigial setae *f*₁ posterior to setae *h*₁; (8a) setae *h* of mentum shorter than distance between them; (9a) genital setae arranged with formula: 9(4+4): 1; (10a) setae *ad*₃' more close to paraxial margin, all adanal setae in same longitudinal level; (11a) setae *d* on femora I inserted at level of setae *v*', more close to distal end of article; (12a) setae *ft*'' on tarsi II curved distally; in *A. aureus*, (1b) margins of body weakly foveolate; (2b) head sensilli weakly spinose, broader and rounded distally; (3b) *in=le>ss=ex>ro*; (4b) 18 pairs of setae present, with unequal size, $c_1/c_1-d_1 = 1.1$; (5b) setae *c*₂ more far away from anterior border than *c*₁ and *c*₃; (6b) three pairs of lyrifissures present; (7b) vestigial setae *f*₁ dorsally of setae *h*₁; (8b) setae *h* of mentum longer than distance between them; (9b) genital setae arranged with formula: 9(4+5): 0; (10b) setae *ad*₃' more far away from paraxial margin, adanal setae not in same longitudinal level; (11b) setae *d* on femora I inserted at level of setae *v*'', far away from distal end of article; (12b) setae *ft*'' on tarsi II straight distally.

Key to species of *Austrophthiracarus* reported from New Zealand

- 1 Sensilli long, setiform, without distinctly swollen head; posterior part of notogaster with peculiar structure of protuberance *A. daimonios* Niedbała, 2000
- Sensilli short, club-like or fusiform; posterior part of notogaster without peculiar structure of protuberance. 2
- 2 Notogaster with more than 20 pairs of setae; interlamellar setae long and thick *A. neotrichus* (Wallwork, 1966)
- Notogaster with fewer than 20 pairs of setae; interlamellar setae vestigial or short and thin. 3
- 3 Interlamellar setae vestigial 4
- Interlamellar setae present 5
- 4 Exobothridial setae and setae *v*'' on femora I present. *A. cronadun* sp. nov.
- Exobothridial setae and setae *v*'' on femora I absent *A. pulchellus* Niedbała, 1993
- 5 Notogaster with 15 pairs of setae; vestigial setae *f*₁ posterior to setae *h*₁ *A. tawhai* sp. nov.
- Notogaster with 18 pairs of setae; vestigial setae *f*₁ dorsally of setae *h*₁. *A. aureus* Niedbała, 2000

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