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# Two species of *Acaricis* (Acari: Tenuipalpidae) from New Zealand, moved from the genus *Tenuipalpus*, with a key to the known species

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## ABSTRACT

*Acaricis* Beard & Gerson (Acari: Tenuipalpidae) is a small genus of flat mites with three species described from Australian and New Zealand sedges (Poales: Cyperaceae). In this article, we redescribe two species, *Tenuipalpus montanus* Collyer and *T. alpinus* Collyer, and move them to the genus *Acaricis*, so that these species become *Acaricis montanus* (Collyer) **comb. nov.** and *A. alpinus* (Collyer) **comb. nov.**. These two species share several characters with other *Acaricis* that species of *Tenuipalpus* do not. A key to the world species of *Acaricis* is also proposed.

**Keywords** flat mites, false spider mites, taxonomy, *Acaricis montanus*, *Acaricis alpinus*

**Zoobank** <http://zoobank.org/F90E71E2-A31B-4FEF-A1E3-FEF3C55055EA>

## Introduction

*Acaricis* Beard & Gerson (Acari: Tenuipalpidae) is a small genus of flat mites with three species described from Australia and New Zealand sedges, family Cyperaceae (Order Poales) (Beard & Gerson 2009; Xu & Zhang 2013). Beard & Gerson (2009) erected the genus based on description of two species: *A. plana*, collected on *Scleria sphacelata* F. Muell., and *A. danutae*, collected on *Carex* sp., both from Australia. Later, Xu & Zhang (2013) described *A. urigersoni*, collected on *Gahnia lacera* (R. Lesson ex A. Rich.) Steud., from New Zealand.

In this article, we redescribe two species, *A. montanus* (Collyer, 1973) collected on *Pimelea sericeovillosa* Hook. (Thymelaeaceae; Order Malvales), and *A. alpinus* (Collyer, 1973), collected on “mat plants on rocks” (indeterminate family), moving them to the genus *Acaricis* from *Tenuipalpus* Donnadieu. These two species were described based on specimens collected in New Zealand.

## Materials and methods

Measurements for the paratypes are given in micrometers (µm). The terminology used follows that of Lindquist (1985) and Mesa *et al.* (2009). Leg chaetotaxy is adapted from Lindquist (1985), Zhang & Fan (2004), Xu & Fan (2010) and Seeman & Beard (2011). Tarsal setae are presented as the total number followed by the number of solenidia in parentheses.

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The paratypes used in the redescription are deposited in the National Insect and Mite Collection, National Museum of Natural History, Smithsonian Institution (NMNH), located in the Systematic Entomology Laboratory (SEL), USDA, Beltsville, Maryland, USA, and at the Natural History Museum (BMNH), located in London, England, UK.

## Taxonomy

### Family Tenuipalpidae Berlese, 1913

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

*Acaricis* Beard & Gerson, 2009: 31; Mesa *et al.* (2009): 113; Xu & Zhang 2013: 357  
Type species *Acaricis plana* Beard & Gerson, 2009

### Diagnosis (Based on Xu & Zhang 2013)

**Female** — Body elongate, usually more than twice as long as wide; palpus usually four segmented. Anterior margin of prodorsum with median forked projection forming a notch (elongate in Aust. species; short in NZ species); prodorsum with two or three pairs of setae (*sc1*, *sc2* present; *v2* present or absent); setae *sc2* lanceolate or acicular. Dorsal opisthosoma with nine pairs of setae: *c3*, *d1*, *d3*, *e1*, *e3*, *f2*, *f3*, *h1* present; setae *c1*, *c2*, *d2*, *e2* absent; setae *h2* elongate and filiform. Venter with two pairs of *4a* setae; setae *g1* inserted anterior to *g2* on membranous genital flap; setae *ps3* inserted far anterior to *ps2*. Leg chaetotaxy: tarsi I–II with seta *ft''* present, *ft'* absent; tarsi III–IV with seta *ft'* present, *ft''* absent; tarsi I–II with seta *ft''* and tarsi III–IV with seta *ft'* elongate, filiform, inserted on short tubercle; trochanter IV with one seta or nude (seta *v'* present or absent). Leg setal formulae (legs I–IV): femora 4-4-2-2 or 4-4-2-1, genua 2-2-1-0 or 2-2-0-0, tibiae 5-5-3-3 or 5-5-3-2; setae *d*, *l'*, *l''* on femora, genua and tibia I–II thickened, barbed, inserted in lateral position.

**Male**— tarsi I–II with two solenidia (all species); tarsi III–IV with one solenidion (except *A. danutae* without solenidia).

### Remarks

All previous known species of *Acaricis* have a body more than twice as long as wide, while in *A. montanus* and *A. alpinus* the body is marginally less than twice as long as wide. However, the lower body lengths presented here for these two species may be due to the age and mounting media of the specimens, and it is possible that the lengths could be longer in freshly mounted specimens, as has been observed by Beard *et al.* (in press). In the original description, the female *A. alpinus* is 354 long and 170 wide (approx. 2.1 times longer than wide) (here 290–300, 150–160, 1.8–1.9, respectively) and the male is 292 long and 146 wide (exactly 2 times longer than wide) (here 230, 125, 1.8, respectively). The female *A. montanus* is 370 long and 216 wide (approx. 1.7 times longer than wide) (here 330–360, 190, 1.7–1.9, respectively). Collyer (1973) does not provide a range for the lengths and widths of these two species, and the single measurements provided are assumed to represent the holotype in each case. The delimiting marker points for our length and width measurements are the setae *v2–h1* and *sc2–sc2*, and although the exact delimiting points for body measurements were not described by Collyer (1973), based on the first description in her paper, the length was the full body including gnathosoma and the width was taken at the widest point on the specimen. With this in mind, a difference between the two sets of measurements would be expected, and our measurements would be expected to be lower than Collyer's as ours are based on distances between dorsal setae and not between the limits of body margins on flattened specimens. Our measurements are 54–64 shorter in length (=18–28%) and 10–20 shorter in width (=6–12%) than the original description for *A. alpinus* females, and 30–40 shorter in length (=8–11%) and 26 shorter in width (=12%) for female *A. montanus*. As a comparison, Beard *et al.* (in press) found that body measurements from older specimens mounted in PVA were approximately 14% shorter and 10% narrower than those from fresh specimens mounted in Hoyer's medium.

Results

*Acaricis montanus* (Collyer, 1973)  
*Tenuipalpus montanus* Collyer, 1973: 949  
 (Figures 1–4)

Diagnosis

**Female** — Anterior margin of prodorsum with a short median forked projection forming a shallow notch. Prodorsum with oblique to transverse striations; prodorsal setae *v2* and *sc1* minute; *sc2* short lanceolate, thick; palpi four segmented, with setal formula 0, 0, 2, 2. Central region of opisthosoma with series of transverse striations and lateral region with few longitudinal striations; setae *c1* absent; setae *c3*, *d1*, *d3*, *e1* and *e3* minute; setae *f2*, *f3*, and *h1* short lanceolate, thick; *h2* elongate and filiform. Ventral integument completely striated; setae *1a*, *4a1*, *4a2* elongate, filiform; two pairs of *4a* setae; setae *g1* inserted marginally anterior to *g2* on membranous genital flap; setae *ag*, *g1–g2* and *ps2–ps3* smooth. Leg chaetotaxy (legs I–IV): femora 4-4-2-1, genua 2-2-1-0, tibiae 5-5-3-3, tarsi 8(1)-8(1)-5-5. Body 1.7–1.9 X longer than wide.

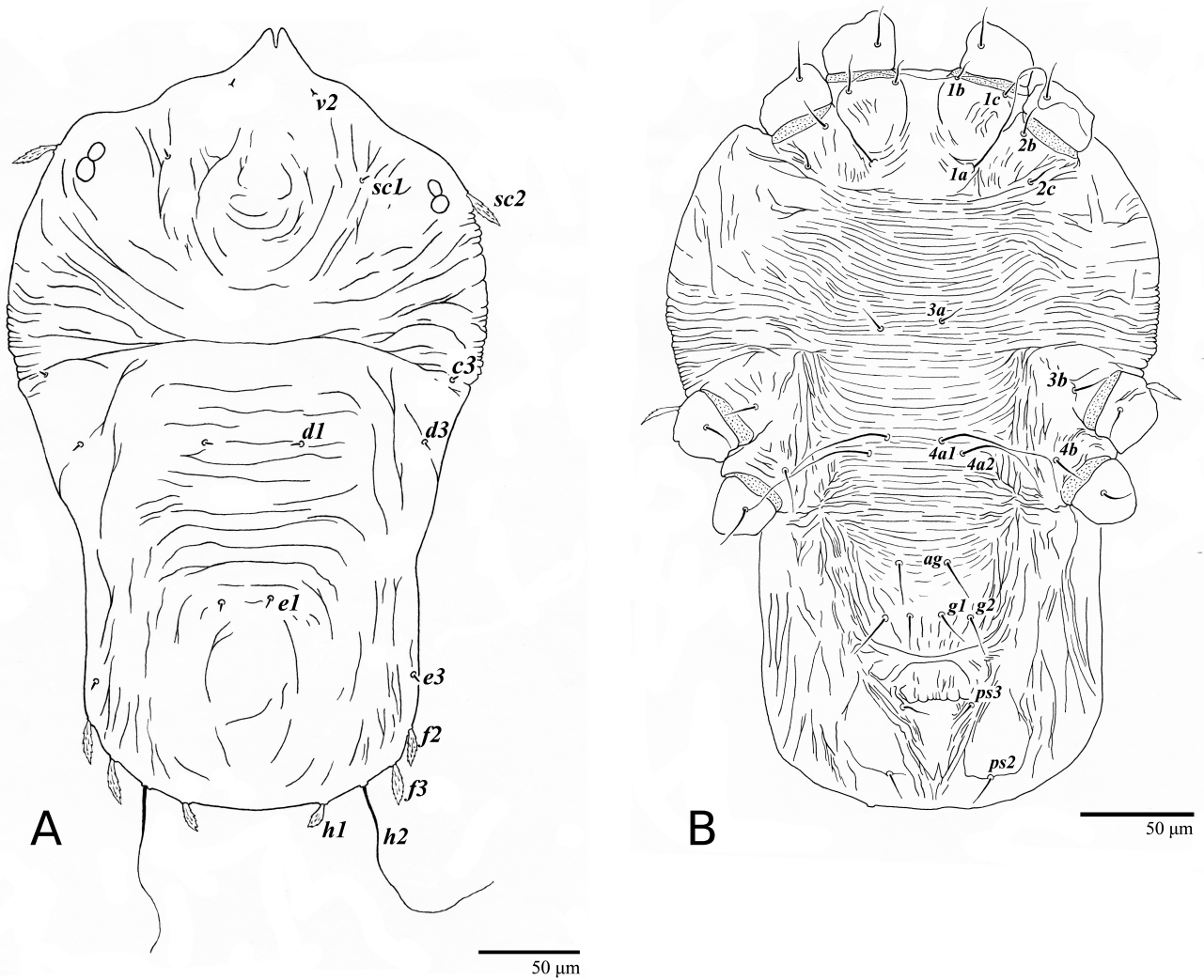


Figure 1 *Acaricis montanus* (Collyer) female. A – dorsum; B – venter.

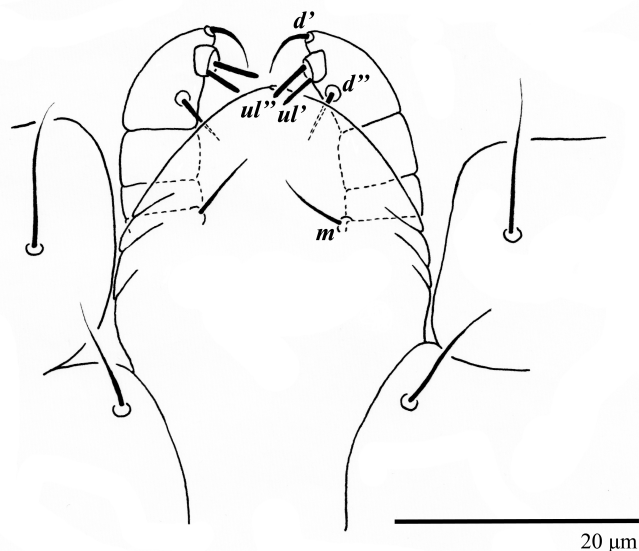


**Figure 2** Differential interference contrast (DIC) image of *Acaricis montanus* (Collyer) female – dorsum.

**Type material examined**

**Paratypes** — 1 female collected on *Pimelea sericeo-villosa* Hook. (Thymelaeaceae), with litter and soil from beneath this shrub, Mount Grey, 1250m elevation, Turret Range, Lake Manapouri area, New Zealand, 09.i.1970, coll. A.C.E. (NMNH); 1 female collected on seepage sward of *Astelia linearis* (Asteliaceae), *Dracophyllum* (Epacridaceae), *Forstera* (Stylidiaceae), *Phyllachne* (Stylidiaceae), Mt Barber, 1100m, Wilmot Pass, West of Lake Manapouri, New Zealand, 8.i.1970, coll. J.S.D. and J.M.H (BMNH).

**Remarks** — The details of the collection data as written on the paratype slide deposited in the NMNH are different to what was presented by Collyer in the original description.



**Figure 3** *Acaricis montanus* (Collyer) female: ventral infracapitulum.

## Redescription

### Female (Figures 1–4, n=2).

**Body measurements** — distance between setae  $v2-h1$  330–360,  $sc2-sc2$  190; other measurements:  $v2-v2$  40–42,  $sc1-sc1$  90–92,  $c3-c3$  185–195,  $d1-d1$  47–48,  $d3-d3$  160–165,  $e1-e1$  18–20,  $e3-e3$  150–160,  $f2-f2$  140–150,  $f3-f3$  125–130,  $h1-h1$  63–70,  $h2-h2$  100.

**Dorsum (Figures 1A, 2)** — Anterior margin of prodorsum with short median forked projection forming a shallow notch. Prodorsum with oblique striations; prodorsal setae  $v2$  and  $sc1$  minute, and  $sc2$  short, thick lanceolate and barbed. Central region of opisthosoma with transverse striations and lateral region with few longitudinal striations; setae  $c1$  absent;  $c3$ ,  $d1$ ,  $d3$ ,  $e1$  and  $e3$  minute; setae  $f2$ ,  $f3$ , and  $h1$  short, thick lanceolate and barbed;  $h2$  elongate and filiform. Setal lengths:  $v2$  4,  $sc1$  4–5,  $sc2$  20–23,  $c3$  3–4,  $d1$  4–5,  $d3$  3–4,  $e1$  4,  $e3$  4–5,  $f2$  15–17,  $f3$  19–21,  $h1$  12–13,  $h2$  100–105.

**Venter (Figure 1B).** Ventral integument mostly with fine transverse striations; setae  $1a$ ,  $4a1$ ,  $4a2$  elongate and filiform; two pairs of setae  $4a$ ; setae  $g1$  inserted marginally anterior to  $g2$  on membranous genital flap; setae  $ag$ ,  $g1-g2$  and  $ps2-ps3$  smooth; other ventral setae fine and smooth. Setal lengths:  $1a$  120–135,  $1b$  9–10,  $1c$  10–12,  $2b$  12–14,  $2c$  10,  $3a$  9–11,  $3b$  12–14,  $4a1$  85–95,  $4a2$  90–105,  $4b$  11–13,  $ag$  15–17,  $g1$  16–17,  $g2$  18–20,  $ps2$  12–13,  $ps3$  11–12.

**Gnathosoma (Figure 3)** — Palpi four segmented, setae formula: 0, 0, 2, 2; tibia with two setae,  $d'$  6,  $d''$  6, tarsus with two eupathidia, 4–5, 5. Ventral setae  $m$  6; distance between setae  $m-m$  14–15.

**Legs (Figure 4)** — Chaetotaxy (from coxae to tarsi): I 2-1-4-2-5-8(1), II 2-1-4-2-5-8(1), III 1-2-2-1-3-5, IV 1-1-2-0-3-5. Tarsus I–II each with one abaxial solenidion  $\omega''$  7 and 6, respectively, and two eupathidia,  $p\zeta'-p\zeta''$  (tarsi I 7, 7; tarsi II 6, 6).

**Male** — Unknown.

**Remarks** — According to Collyer (1973), this species was also collected on moss, *Celmisia* (Asteraceae), *Senecio* (Asteraceae), *Gaultheria* (Ericaceae), *Coprosma* (Rubiaceae), *Haastia sinclairii* (Asteraceae), grasses (Poaceae) in New Zealand. This collection data suggests that the true host association(s) are unknown.

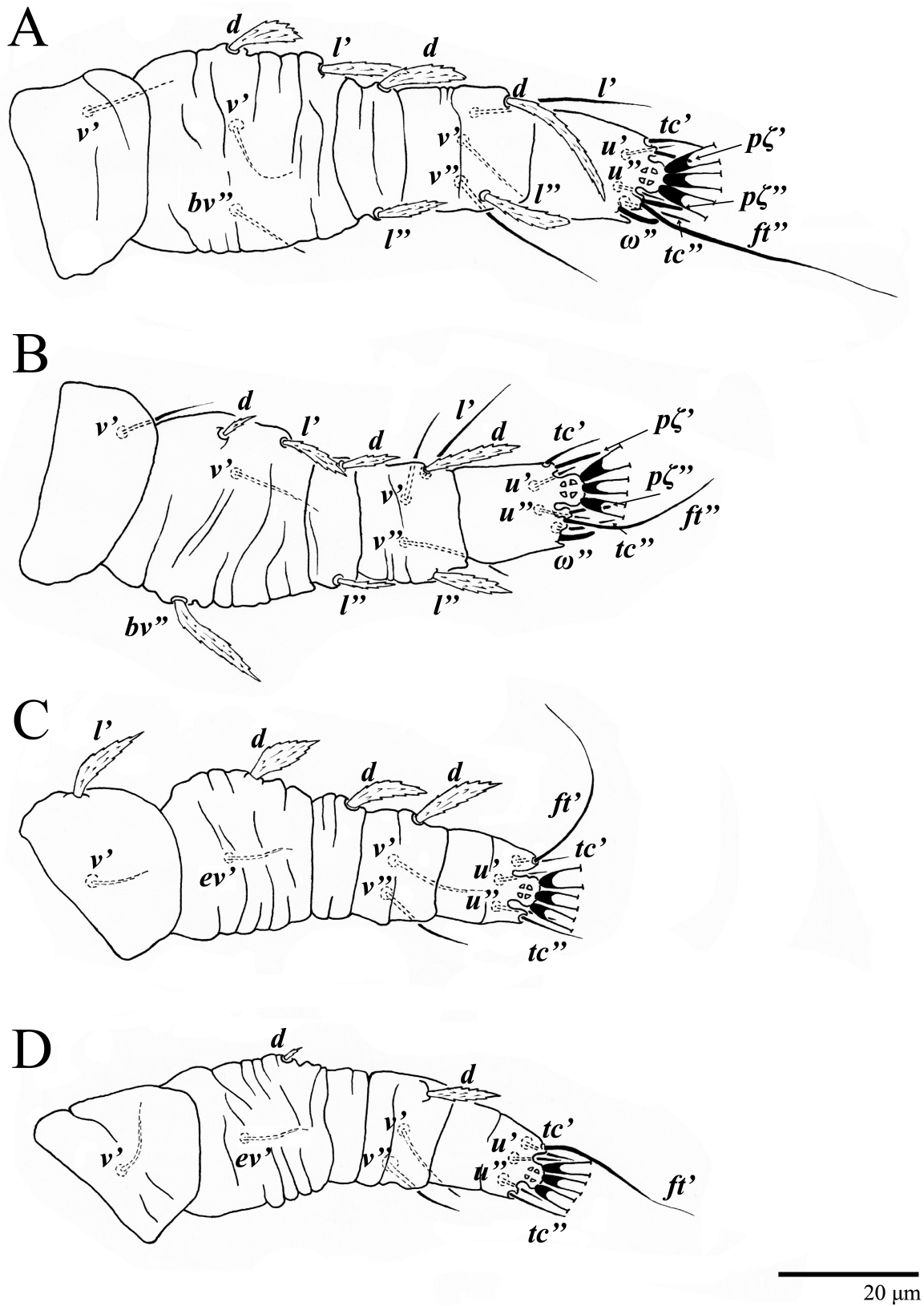
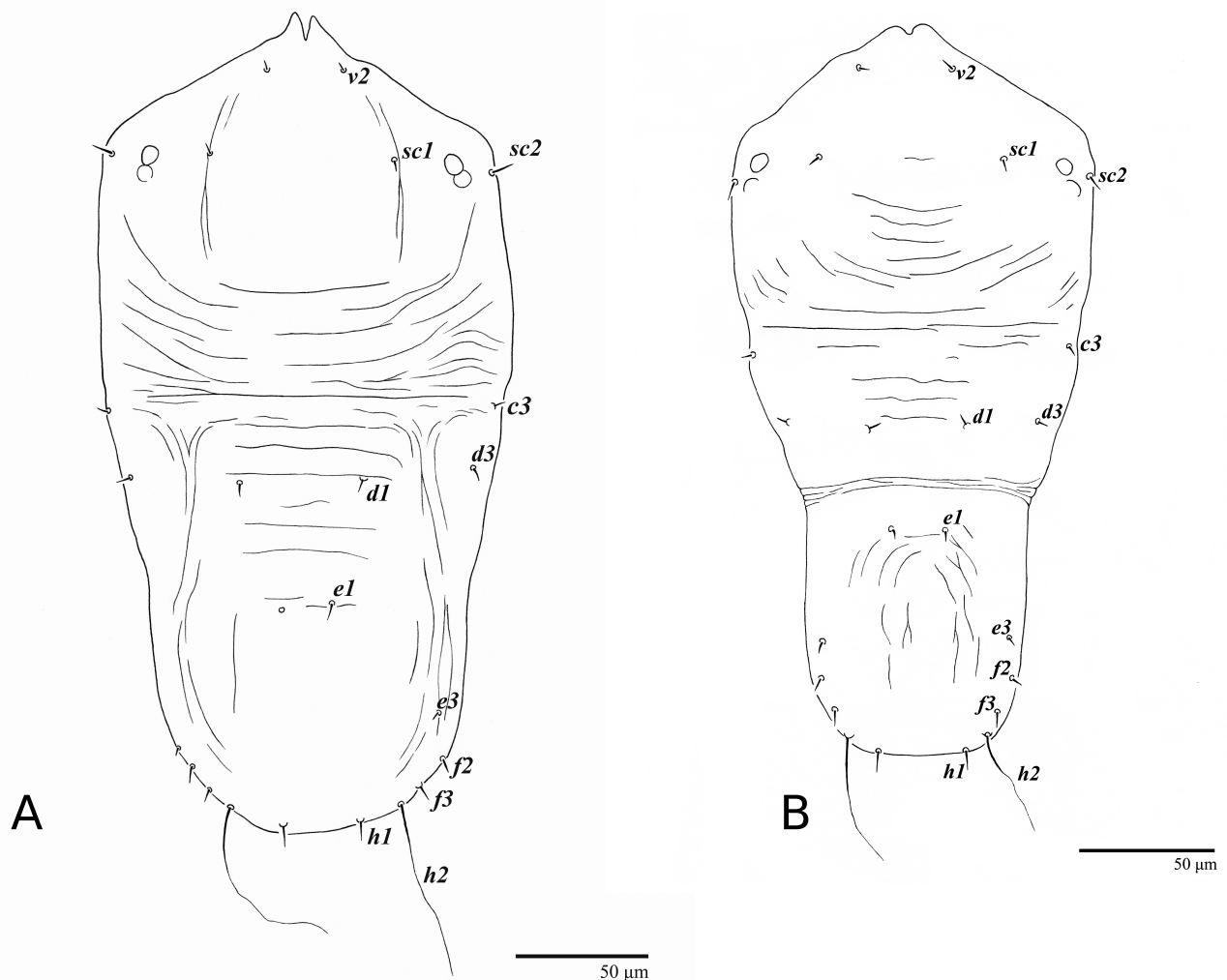


Figure 4 *Acaricis montanus* (Collyer) female, dorsal aspect, right side, of: A – leg I; B – leg II; C – leg III; D – leg IV.

***Acaricis alpinus* (Collyer, 1973)**  
***Tenuipalpus alpinus* Collyer, 1973: 946.**  
**(Figures 5–9)**

**Diagnosis**

**Female** — Anterior margin of prodorsum with a short median forked projection forming a shallow notch. Prodorsum mostly smooth, with weak transverse striations posteriorly; prodorsal setae *v2*, *sc1* minute, smooth; setae *sc2* short, smooth, acicular; palps four segmented; central opisthosoma between setae *d1* and *e1* with few weak transverse striations, lateral opisthosoma with few weak longitudinal striations; dorsal opisthosomal setae short to minute, except setae *h2* elongate and filiform. Ventral integument mostly with fine transverse striations; setae *1a*, *4a1*, *4a2* elongate, filiform; setae *g1* inserted marginally anterior to *g2* on membranous genital flap; setae *ag*, *g1–g2* and *ps2–ps3* smooth. Leg chaetotaxy (legs I–IV): femora 4-4-2-1, genua 2-2-1-0, tibiae 5-5-3-3, tarsi 8(1)-8(1)-5-5. Body 1.8–1.9 X longer than wide. **Male**: Dorsal integument and setae like those of female; tarsi I–II each with two solenidia; tarsi III–IV with one solenidia.



**Figure 5** *Acaricis alpinus* (Collyer) A – female: dorsum; B – male: dorsum.





**Figure 6** Differential interference contrast (DIC) image of *Acaricis alpinus* (Collyer) (Female): dorsum.

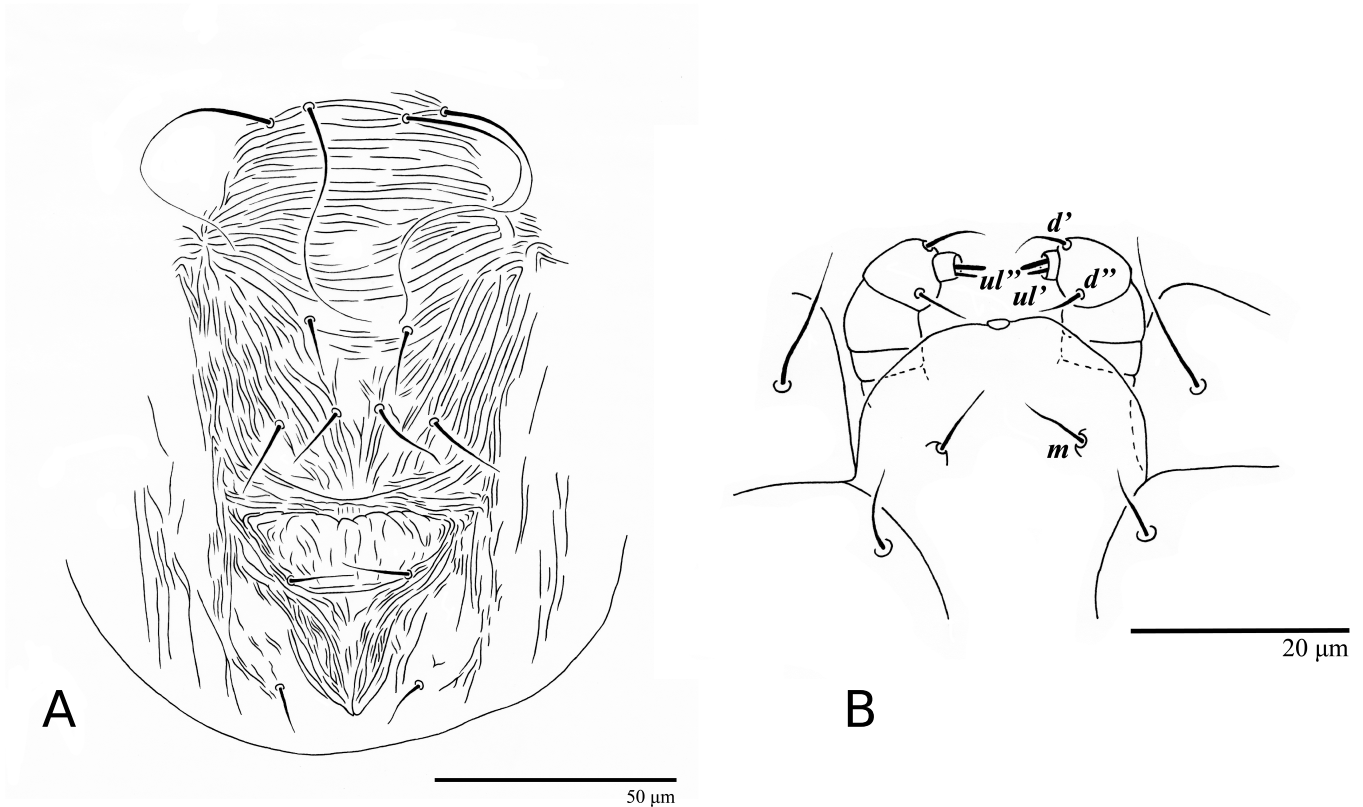
**Type material examined** — Paratypes: 1 female and 1 male collected from mixed sample of mat plants on rocks, Mount Robert Ridge circa 1830 m elevation, Nelson Lakes National Park, New Zealand; October 1969, coll. G.W.R. (NMNH); 1 female same data (BMNH).

**Redescription**

**Female (Figures 5–8, n=2)**

**Body measurements** — Distance between setae *v2–h1* 290–300, *sc2–sc2* 150–160; other measurements: *v2–v2* 32–33, *sc1–sc1* 74–78, *c3–c3* 135–150, *d3–d3* 125–145, *e1–e1* 22–25, *e3–e3* 100–105, *f2–f2* 102–105, *f3–f3* 86–87, *h1–h1* 30–36, *h2–h2* 67–70.

**Dorsum (Figures 5A, 6)** — Anterior margin of prodorsum with short median forked projection forming a shallow notch. Prodorsum mostly smooth with weak transverse striations posteriorly; prodorsal setae *v2*, *sc1* minute; setae *sc2* short, smooth; central opisthosoma



**Figure 7** *Acaricis alpinus* (Collyer) female. A – ventral opisthosoma; B – ventral infracapitulum.

between setae *d1* and *e1* with weak transverse striations; lateral opisthosoma with few weak longitudinal striations; dorsal opisthosomal setae short to minute, except setae *h2* elongate, filiform. Setal lengths: *v2* 3–4, *sc1* 4–5, *sc2* 7, *c3* 4, *d1* 3–4, *d3* 3–4, *e1* 4, *e3* 3–4, *f2* 5, *f3* 5, *h1* 6–7, *h2* 65–70.

**Venter (Figure 7A)** — Ventral integument with fine transverse striations; setae *1a*, *4a1*, *4a2* elongate, filiform; two pairs of setae *4a*; setae *g1* inserted marginally anterior to *g2* on membranous genital flap; setae *ag*, *g1*–*g2* and *ps2*–*ps3* smooth; other ventral setae fine and smooth. Setal lengths: *1a* 85–105, *1b* 9–11, *1c* 9–10, *2b* 11–12, *2c* 10–14, *3a* 10–12, *3b* 11–12, *4a2* 30–43, *4a2* 35–50, *4b* 8–10, *ag* 7–8, *g1* 8–9, *g2* 7–8, *ps2* 11–12, *ps3* 10–11.

**Gnathosoma (Figure 7B)** — Palpi four segmented, setae formula: 0, 0, 2, 2; tibia with two setae, *d'* 5, *d''* 5, tarsus with two eupathidia 3, 2. Ventral setae *m* 6–7; distance between setae *m*–*m* 12–13.

**Legs (Figure 8)** — Chaetotaxy (from coxae to tarsi): I 2-1-4-2-5-8(1), II 2-1-4-2-5-8(1), III 1-2-2-1-3-5, IV 1-1-2-0-3-5. Tarsi I–II each with one abaxial solenidion  $\omega''$  8 and 7, respectively, and two eupathidia distally  $p\zeta'$ – $p\zeta''$  (7, 7 for both tarsi).

#### Male (Figures 5B, 9, n=1)

**Body measurements** — Distance between setae *v2*–*h1* 230, *sc2*–*sc2* 125; other measurements: *v2*–*v2* 32, *sc1*–*sc1* 65, *c3*–*c3* 100, *d1*–*d1* 33, *d3*–*d3* 90, *e1*–*e1* 20, *e3*–*e3* 68, *f2*–*f2* 65, *f3*–*f3* 55, *h1*–*h1* 30, *h2*–*h2* 50.

**Dorsum (Figure 5B)** — Dorsal integument and setae similar to those of female. Setal lengths: *v2* 4, *sc1* 3, *sc2* 7, *c3* 4, *d1* 3, *d3* 3, *e1* 3, *e3* 3, *f2* 4, *f3* 5, *h1* 5, *h2* 55. **Venter.** Ventral integument and setae similar to those of female; setae *1a*, *4a1*, *4a2* elongate and filiform. Setal

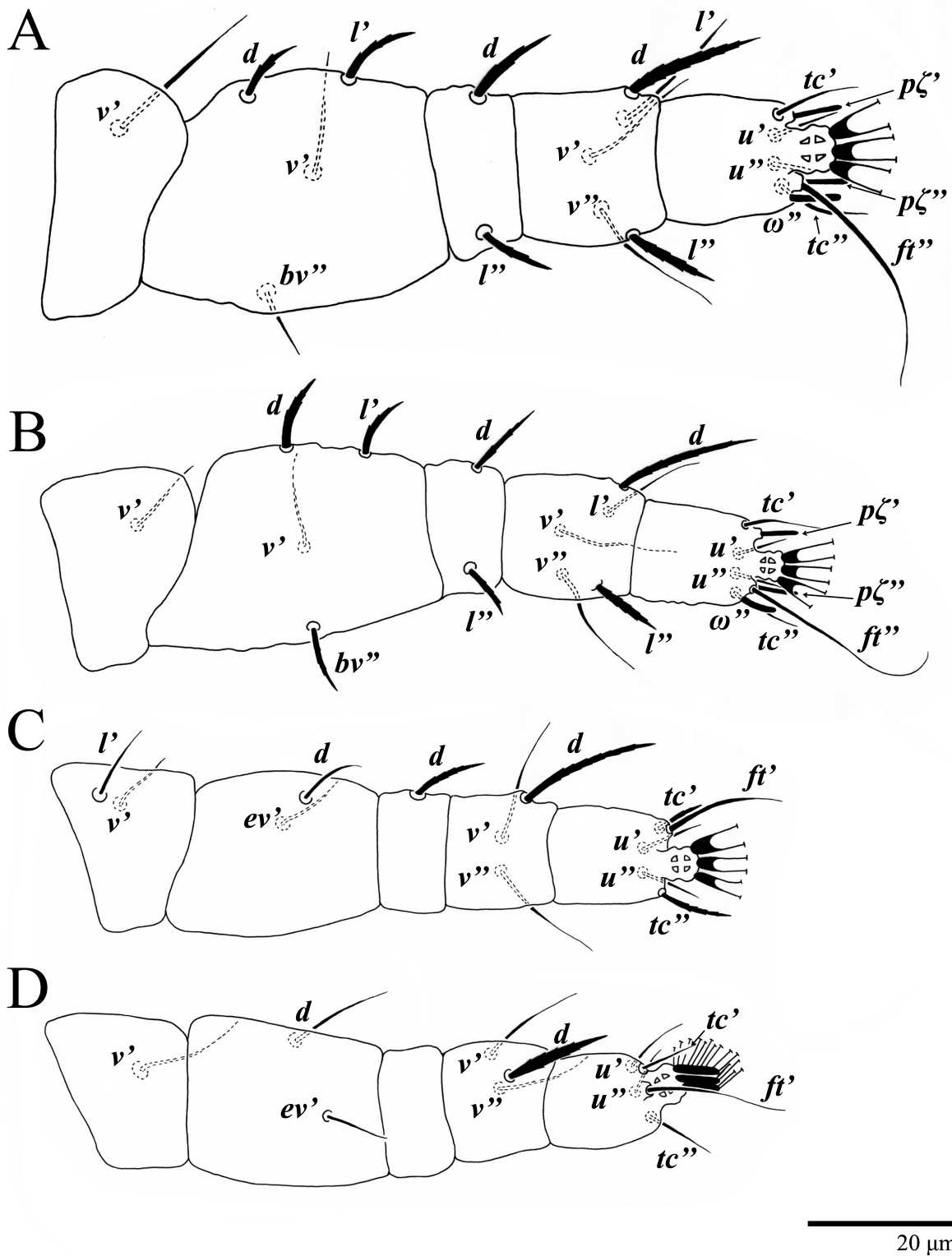


Figure 8 *Acaricis alpinus* (Collyer) female: dorsal aspect, right side, of: A – leg I; B – leg II; C – leg III; D – leg IV.

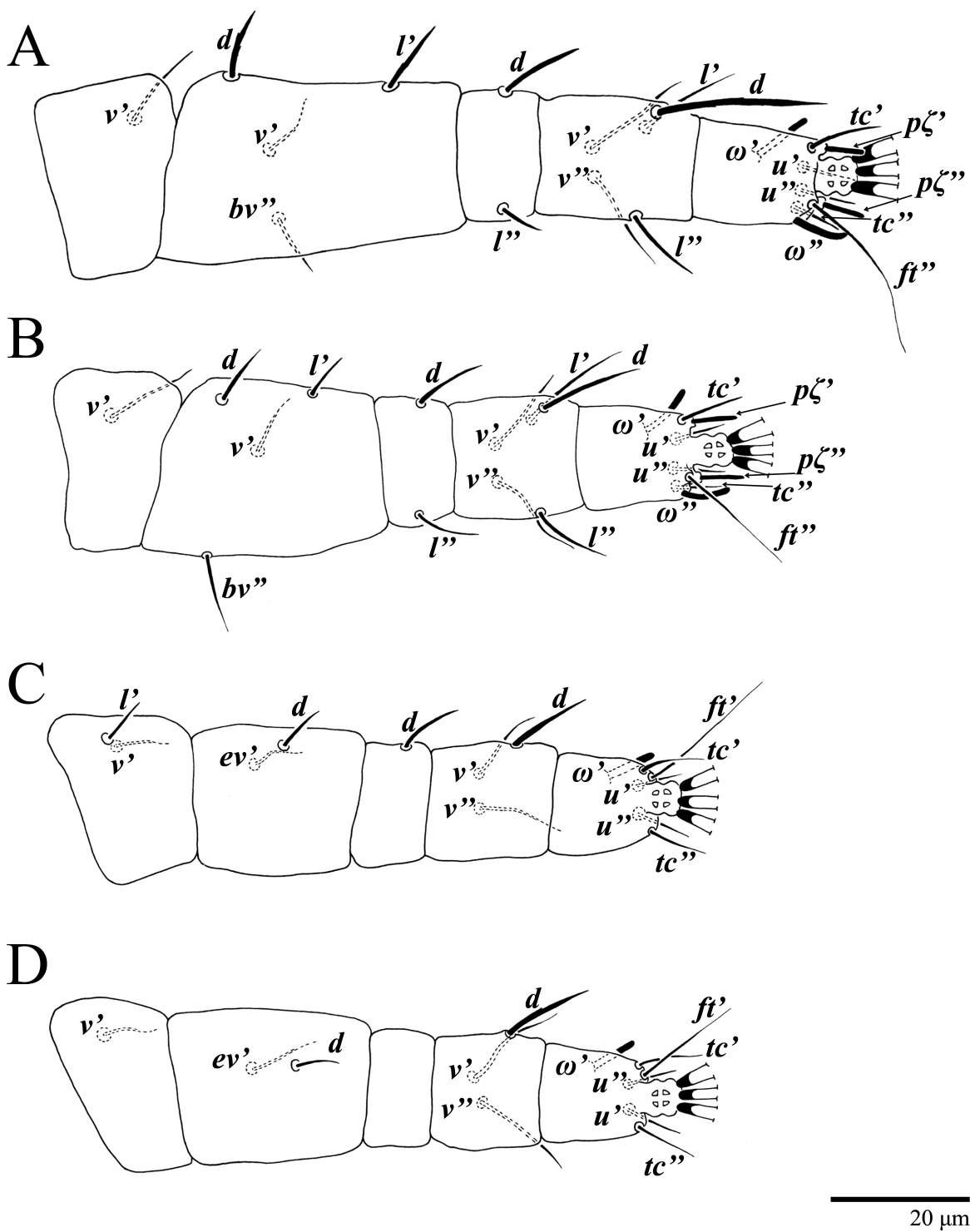


Figure 9 *Acaricis alpinus* (Collyer) male: dorsal aspect, right side, of: A – leg I; B – leg II; C– leg III; D – leg IV.

lengths: *Ia* 100, *Ib* 6, *Ic* 8, *2b* 8, *2c* 7, *3a* 13, *3b* 11, *4a1* 38, *4a2* 40, *4b* 8, *ag* 7, *g1* 13, *g2* 13, *ps2* 8, *ps3* 6.

**Gnathosoma** — Similar to that of female; tibia with two setae, *d'* 5, *d''* 6, tarsus with two eupathidia 3, 2. Ventral setae *m* 4; distance between setae *m–m* 13.

**Legs (Figure 9)** — Chaetotaxy (from coxae to tarsi): I 2-1-4-2-5-9(2), II 2-1-4-2-5-9(2), III 1-2-2-1-3-6(1), IV 1-1-1-0-3-6(1). Setae *d*, *l'*, *l''* on femora, genu and tibia I–II slightly thickened, weakly barbed. Tarsi I–II each with two solenidion (one abaxial, one adaxial), tarsi I *ω'* 7, *ω''* 7, tarsi II *ω'* 7, *ω''* 7, and two eupathidia *pζ'*–*pζ''* (all 6–7); tarsus III–IV each with one abaxial solenidion, tarsi III 6, tarsi IV 7.

## Remarks

According to Collyer (1973), this species was also collected from mixed mats of plants including: *Chionochoa crassiuscula* (Poaceae), *Astelia*, *Celmisia sessiliflora* (Asteraceae), *Cyathodes pumila* (Epacridaceae), *Gaultheria*, *Anisotome* (Apiaceae) and *Drosera* (Droseraceae) in New Zealand. This collection data suggests that the true host association(s) are unknown.

## Discussion

All previously known species of *Acaricis* were collected on plants of the family Cyperaceae; whereas *A. montanus* and *A. alpinus* were collected in association with many species and families of alpine heath plants, none of which were identified as Cyperaceae (Collyer 1973). In discussing *A. montanus* and *A. alpinus*, Collyer (1973) states herself that there “can be no certainty of their host plant relationships” as the specimens were collected from samples of mixed plants. Despite the apparent difference in host relationships, *A. montanus* and *A. alpinus* both share with other *Acaricis* species: anterior margin of prodorsum with median forked process, two pairs of ventral setae *4a*; dorsal setae *c1* is absent; the palps are four segmented with setae formula 0, 0, 2, 2; genital setae *g1* are inserted (marginally) anterior to *g2*; setae *ft'* are suppressed on tarsus I–II and *ft''* suppressed on tarsi III–IV; setae *ft''* are filiform on tarsi I–II; and the males have two solenidia on tarsi I–II. *Acaricis alpinus* males also share one solenidion on tarsus III–IV with *A. plana* and *A. urigersoni* (male not known for *A. montanus*; *A. danutae* males without solenidion on tarsus III–IV). Additional solenidia on tarsus III are also commonly seen in species of *Tenuipalpus* sensu stricto, but are not commonly seen on tarsus IV (Castro *et al.* 2015). *Acaricis montanus* and *A. alpinus* differ to all other *Acaricis* in having a seta on trochanter IV, while the other three known species have a nude trochanter IV. The other New Zealand species, *A. urigersoni*, is the only *Acaricis* to have prodorsal setae *v2* absent, it also has different chaetotaxy on leg IV to all other species in the genus, with only one seta on femur IV (seta *d* present, *ev'* absent), only two setae on tibiae IV (*v'*, *v''* present; *d* absent); and genua III–IV are nude (only genua IV nude in other *Acaricis* species). All three New Zealand species also share a short median forked process on the anterior margin of the prodorsum, which is much longer in the two Australian species.

## Key to species of *Acaricis* (based on adult females)

1. Prodorsal setae *v2* absent; prodorsal setae *sc1* minute, bifurcate; dorsal opisthosomal setae *e3* lanceolate; femora IV with one seta (*d* present; *ev'* absent); genua III–IV nude; tibiae IV with two setae (*v'*, *v''* present; *d* absent) . . . . . *A. urigersoni* Xu & Zhang  
— Prodorsal setae *v2* present; prodorsal setae *sc1* acicular; dorsal opisthosomal setae *e3* minute, acicular or barbed; femora IV with two setae (*d*, *ev'* present); genua III with one seta (*d* present), genua IV nude; tibiae IV with three setae (*d*, *v'*, *v''* present) . . . . . 2
2. Body elongate, more than twice as long as wide; median forked projection on anterior margin of prodorsum long with deep notch; genital setae *g1* inserted well anterior to *g2* . . . . . 3

- Body almost twice as long as wide (1.7–1.9 X longer than wide); median forked projection on anterior margin of prodorsum short with shallow notch; genital setae *g1* inserted marginally anterior to *g2* ..... 4
3. Dorsal opisthosomal setae *e3* minute, fine; prodorsal setae *sc2* lanceolate, stout; dorsal seta *d* on femur III lanceolate, thickened ..... *A. plana* Beard & Gerson  
 — Dorsal opisthosomal setae *e3* short, thickened, barbed; prodorsal setae *sc2* short, barbed; dorsal seta *d* on femur III short, fine ..... *A. danutae* Beard & Gerson
4. Prodorsal setae *sc2* lanceolate, stout (20–23 µm) and distinctly longer than setae *v2* and *sc1* (both minute; 4–5 µm) ..... *A. montanus* (Collyer)  
 — Prodorsal setae *sc2* acicular, short, fine (7 µm) and slightly longer than *v2* and *sc1* (both minute; 3–5 µm) ..... *A. alpinus* (Collyer)

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