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Tenuipalpidae (Acari: Trombidiformes) from Casuarinaceae (Fagales)

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Abstract

The Tenuipalpidae associated with the Casuarinaceae are reviewed, including one new genus, *Palpipalpus* **gen. nov.**, twelve new species, and seven redescriptions. Two new generic records for Australia are established, *Pentamerismus* and *Philippipalpus*. The new species are: *Chaudhripalpus costacola* Beard and Seeman **sp. nov.**, *Crossipalpus gersoni* Beard and Seeman **sp. nov.**, *Crossipalpus raveni* Beard and Seeman **sp. nov.**, *Magdalenapalpus caperatus* Beard and Seeman **sp. nov.**, *Magdalenapalpus forsteri* Seeman and Beard **sp. nov.**, *Pentamerismus sititoris* Beard and Seeman **sp. nov.**, *Pentamerismus hicklingorum* Seeman and Beard **sp. nov.**, *Pentamerismus wardo* Seeman and Beard **sp. nov.**, *Palpipalpus hesperius* Beard and Seeman **sp. nov. gen. nov.**, *Philippipalpus flumaquercus* Beard and Seeman **sp. nov.**, *Philippipalpus belah* Beard and Seeman **sp. nov.**, and *Philippipalpus nigraquercus* Seeman and Beard **sp. nov.** *Meyeraepalpus delfinadae* Smiley *et al.*, is reinstated based on new material and an analysis of its phylogenetic relationships. *Crossipalpus muellerianae* Smiley *et al.*, *Crossipalpus verticillatae* Smiley *et al.*, and *Tegopalpus conicus* Womersley are redescribed and rediagnosed from the original type specimens and newly collected material; and *Chaudhripalpus creelae* (Smiley *et al.*), *Magdalenapalpus strandtmanni* (Smiley *et al.*) and *Philippipalpus agohoi* Corpuz-Raros are redescribed and rediagnosed from type material only. All flat mite species were host-specific. Up to three species of flat mite were collected from a single she-oak species. Leg setation and ontogeny are reviewed for the taxa studied. A key to Tenuipalpidae from Casuarinaceae is provided. A phylogeny of the subfamily Tegopalpinae found the following relationships: *Meyeraepalpus* (*Australopalpus*, *Crossipalpus*, *Palpipalpus* (*Magdalenapalpus* (*Philippipalpus* (*Chaudhripalpus* + *Tegopalpus*))))). Our preliminary analysis of the Tegopalpinae suggested the group is monophyletic and its sister group is *Phytoptipalpus*.

Key words: taxonomy, systematics, revision, new species, key, she-oak

Introduction

The flat mites (Tetranychoida: Tenuipalpidae) comprise over 1,100 described species in 38 genera that are parasitic on flowering plants, conifers and ferns (Mesa *et al.* 2009; Beard & Ochoa 2011; Navajas & Ochoa 2013; Beard *et al.* 2013). Of these, seven species in six genera (all in subfamily Tegopalpinae sensu Smiley and Gerson 1996) are recorded from evergreen shrubs and trees in the plant family Casuarinaceae, commonly called she-oaks: *Chaudhripalpus creelae* (Smiley *et al.*, 1996), *Crossipalpus muellerianae* Smiley *et al.*, 1996, *Crossipalpus verticillatae* Smiley *et al.*, 1996, *Magdalenapalpus strandtmanni* (Smiley *et al.*, 1996), *Meyeraepalpus delfinadae* Smiley *et al.*, 1996, *Philippipalpus agohoi* Corpuz-Raros, 1978, and *Tegopalpus conicus* Womersley, 1940. All these species are from Australia except *Ph. agohoi*, which was recorded from The Philippines.

The Casuarinaceae (she-oaks) is a Gondwanan family comprised of 96 species, dioecious (mostly) or monoecious, in four genera that range naturally throughout Australia, Southeast Asia and the western Pacific. Three of the four genera occur in Australia, *Casuarina* (6 species, 17 worldwide), *Allocasuarina* (wholly endemic, 58 species) and *Gymnostoma* (1 species, 18 worldwide); while the fourth genus, *Ceuthostoma* (2 species worldwide) occurs in Malesia (Johnson & Wilson 1989). She-oaks all have drooping, ribbed evergreen twigs (resembling pine needles) with leaves that are reduced to minute scales or teeth arranged in whorls that form sheaths at each node. To the human eye this foliage appears an inhospitable habitat for mites, but the ribs, scales and pubescence, as well as their woody cone-like fruits, provide ample habitat for a surprising diversity of flat mites (Figs 66, 122).

Smiley & Gerson (1996) erected the subfamily Tegopalpinae to accommodate flat mites with a gnathosoma concealed beneath the anterior margin of the prodorsum. This character is present only in adult females, as immatures and adult males have a fully exposed gnathosoma. Prior to the current study, eight species were classified in the Tegopalpinae, including the seven species listed above that were all collected from she-oak hosts, in addition to *Australopalpus alphitoniae* Smiley and Gerson, 1995, collected from red ash, *Alphitonia excelsa* (Rhamnaceae). Though Smiley & Gerson (1995) and Smiley *et al.* (1996) provided several additional diagnostic characters for the Tegopalpinae, they are all homoplasious within the Tenuipalpidae. As Kane (2003) did not find support for the subfamily in a phylogeny based on the presence or absence of leg and body setae, the concealed gnathosoma is consequently the only feature that currently defines the Tegopalpinae.

Herein we describe twelve new species and one new genus of flat mites, all collected from she-oaks in Australia, redescribe all other Tenuipalpidae species previously collected from Casuarinaceae, resurrect the genus *Meyeraepalpus* Smiley *et al.*, 1996 and conduct a cladistic analysis on all species of the Tegopalpinae.

Materials and methods

Mites were collected and mounted in either PVA or Hoyer's medium (Walter & Krantz 2009) directly from field collected samples, and were examined at 1000 times using a DIC Zeiss Axioscope™ or Nikon Eclipse 80i™. Live specimens and specimens in 70% ethanol were used for low temperature scanning electron microscopy (LT-SEM) studies. Specimens for LT-SEM were secured to 15 mm x 30 mm copper plates using ultra smooth, round (12 mm diameter), carbon adhesive tabs (Electron Microscopy Sciences, Inc., Hatfield, PA, USA). The specimens were frozen conductively, in a Styrofoam box, by placing the plates on the surface of a pre-cooled (-196°C) brass bar whose lower half was submerged in liquid nitrogen (LN₂). After 20–30 seconds, the holders containing the frozen samples were transferred the Quorum PP2000 cryo-prep chamber (Quorum Technologies, East Sussex, UK) attached to an S-4700 field emission scanning electron microscope (Hitachi High Technologies America, Inc., Dallas, TX, USA). The specimens were etched inside the cryotransfer system to remove any surface contamination (condensed water vapour) by raising the temperature of the stage to -90°C for 10–15 min. Following etching, the temperature inside the chamber was lowered below -130°C, and the specimens were coated with a 10 nm layer of platinum using a magnetron sputter head equipped with a platinum target. The specimens were transferred to a pre-cooled (-130°C) cryostage in the LT-SEM for observation. An accelerating voltage of 5 kV was used to view the specimens. Images were captured using a 4 pi Analysis System (Durham, NC, USA). Images were sized and placed together to produce a single figure using Adobe® Photoshop CS 5.0. Because the specimens were not tightly

secured to the adhesive tabs it was possible to remove the specimens from the LT-SEM and turn the specimens over to the ventral position for additional imaging.

All measurements are given in micrometers (μm) as the range followed by the holotype data (when examined) in square brackets. Body size was measured between dorsal setae *v2-h1* for length and between *sc2-sc2* for width (Saito *et al.* 1999). Setae were measured from the centre of the setal base to the tip of the seta; distances between setae were measured as the distance from the inside edge of one setal base to the other (i.e. the minimum distance between two setal bases). Leg setal numbers are written as the total number of phaneres followed by number of solenidia in parentheses. Leg segments are abbreviated as follows: coxa cx, trochanter tr, femur fe, genu ge, tibia ti, tarsus ta.

Setation. Leg setation follows Lindquist (1985a), as was presented in the theses of Quiros-Gonzalez (1985) and Kane (2003). Despite these prior works, leg setation has rarely been provided in descriptions of tenuipalpids, with the notable exception of *Dolichotetranychus ancistrus* Baker and Pritchard, 1956 in Zhang & Fan (2004). Recent papers such as the redescription of *Tenuipalpus orilloi* Rimando, 1962 (in Xu & Fan 2010) and description of *Aegyptobia yertle* Seeman and Beard, 2011 have established leg setation as a standard addition to descriptions of flat mites. The latter publication demonstrated the diagnostic value of leg setation for species determination, in addition to highlighting the crucial data that simple setal counts can potentially overlook. The setation and ontogeny of leg and coxisternal setae is presented in Table 1.

Body setation essentially follows Grandjean (1939) and Lindquist (1985a). As with all tetranychoid taxa, no setae are added to the dorsal idiosoma during ontogeny. The maximum number of dorsal idiosomal setae is 16 pairs: prodorsum *v2*, *sc1* and *sc2*; and dorsal opisthosoma *c1-3*, *d1-3*, *e1-3*, *f2-f3* and *h1-2*. The three pairs of setae on the prodorsum are stable, i.e. always present, with the exception of *Tenuipalpus elegans* (Collyer) which lacks setae *v2* (Collyer 1969). The dorsal opisthosoma bears 5–13 pairs of setae, of which *c3*, *d3*, *e3*, *h1*, *h2* are stable. Dorsal setae *f1* and *h3* are always absent in the Tenuipalpidae (Mesa *et al.* 2009).

Prodorsal lobes versus the rostral shield. In Prostigmata, the term ‘rostrum’ was previously used for what is now referred to as the infracapitulum or gnathosoma. The rostral shield was recently defined, for the family Tenuipalpidae, as a sclerotised plate-like structure at the anterior margin of the propodosoma (Mesa *et al.* 2009). However, this term has been used incorrectly to describe a wide variety of prodorsal notches, lobes and projections present at the anterior margin of the prodorsum in the Tenuipalpidae, including: a simple notched projection of the prodorsal shield anterior to setae *v2* as seen in many species of *Aegyptobia* and *Pentamerismus* (Figs 124a, b, respectively); a significant forked projection of the prodorsal shield itself, anterior to setae *v2*, as in *Pseudoleptus* and *Acaricis* (Figs 124c, d, respectively); a broad plate emerging from just below the surface of the prodorsum, extending from trochanter II to trochanter II out over the gnathosoma, anterior to setae *v2*, as seen in *Brevipalpus* and *Cenopalpus* (Figs 124e, f, respectively); a deep incision of the prodorsal shield that forms a pair of fleshy lobes, with the notch reaching to level with, or posterior to, setae *v2*, as in *Magdalenapalpus* and *Philippipalpus* (Figs 42, 43; 95a, 103a, respectively); a pair of blunt, broadly triangular fleshy lobes, anterior to and retracted under the anterior margin of prodorsum, originating from the soft cuticle between the gnathosoma and prodorsum, as in *Chaudhripalpus*, *Meyeraepalpus* and *Tegopalpus* (Figs 2, 7; 56, 57a, b; 110, 111, respectively).

Here, we restrict the term ‘rostral shield’ to structures that arise from the rostrum *sensu van der Hammen* (1980) (i.e., the anterior dorsal extremity of the prosoma), and has the form of a shield, i.e., sclerotised cuticle. Consequently, prodorsal notches and prodorsal lobes, which arise from the prodorsal shield, and fleshy rostral lobes, are not considered homologous with a true rostral shield. None of the taxa treated herein have a rostral shield.

Phylogenetic analysis. A preliminary parsimonial analysis was conducted to test the monophyly of each genus. The analysis included 28 taxa. *Tuckerella revelata* Beard and Walter, 2005, was selected as an outgroup to the Tenuipalpidae. The ingroup included all 16 species of Tegopalpinae, being represented by 13 terminal taxa, with the four *Philippipalpus* being treated as one taxon because they shared the same character states. Eleven non-tegopalpine flat mite taxa were selected. These were: *Meyeraepalpus delfinadae*, a purported tegopalpine mite; *Aegyptobia bromi* Khanjani *et al.*, 2012a, a member of the *macswaini*-group of *Aegyptobia*; *A. yertle*, a member of the *tragardhi*-group of *Aegyptobia*; three species of *Pentamerismus* collected from she-oaks, described in this manuscript (two share the same states and are combined); *Phytoptipalpus kurdistaniensis* Khanjani *et al.*, 2012a; *Pseudoleptus iranensis* Khanjani *et al.*, 2012b; and an undescribed Australian species of *Raoiella*. The non-

tegopalpine taxa were selected because they were described from she-oaks in this manuscript (*Pentamerismus*), or because they did not have highly regressed morphology (all other genera).

A total of 53 characters were coded, of which 11 were parsimony-uninformative. All characters were unordered and equally weighted. Parsimony analyses were made with PAUP 4.0b10 (Swofford 2002) using a heuristic stepwise search with random addition (1000 replications, one tree held at each replication). Bremer support values were calculated with TreeRot version 2 (Sorenson 1999). The final trees were produced from PAUP 4.0b10 or edited with Winclada (Nixon 1999).

Abbreviations

ANIC	Australian National Insect Collection, CSIRO Entomology, GPO Box 1700, Canberra, 2601, Australia
BRI	Queensland Herbarium, Brisbane Botanic Gardens Mt Coot-tha, Toowong, Brisbane, Queensland, 4066, Australia
MAGNT	Museum and Art Gallery of the Northern Territory, Bullocky Point, Fannie Bay, Northern Territory, 0820, Australia
QM	Queensland Museum, PO Box 3300, South Brisbane, Queensland, 4101, Australia
SAM	South Australian Museum, North Terrace, Adelaide, South Australia, 5000, Australia
USNM	National Museum of Natural History (Smithsonian), United States National Mite Collection located at Systematic Entomology Laboratory (SEL), Beltsville Agricultural Research Centre West, United States Department of Agriculture (USDA), Building 005, 10300 Baltimore Ave, Beltsville, Maryland, 20705, USA
WAM	Western Australian Museum, Locked Bag 49, Welshpool DC, Perth, Western Australia, 6106, Australia
WINC	Waite Insect and Nematode Collection, Entomology Unit, South Australian Research and Development Institute, Adelaide (EUSARDI), South Australia, Australia

Systematics

Family Tenuipalpidae

Subfamily Tegopalpinae

Chaudhripalpus Mesa, Welbourn and Evans, 2009

Type species. *Crossipalpus creelae* Smiley, Frost and Gerson, 1996, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 9 pairs of palmate setae; *c2*, *d2*, *e2*, and *f2* absent; setae *h2* similar in size and form to other dorsal setae; palps 4-segmented, palp setal formula 0, 0, 0, 2(1); immature stages with anterior margin of prodorsum smoothly rounded, without projections/notches; ventral plate absent; 3 pairs of pseudanal setae (*ps1–3*) on well developed plates. *Adult female:* cuticle between gnathosoma and prodorsum produced into 1 pair of blunt, broadly triangular membranous lobes (with median notch formed between the lobes), anterior to and folded under anterior margin of prodorsum and setae *v2*, often appear slightly retracted back into body; gnathosoma completely concealed by prodorsum; genital plate weakly developed, membranous; metapodal plates not developed; coxae I without *1c*; trochanters I–IV 1-1-1-0 or 0-0-1-0 (*v'* present or absent on tr I–II, absent on tr III–IV; *l'* always present on tr III); femora I–IV 3-3-2-1; genua I–IV bare; tibiae 4-4-3-3; tarsi I–IV without *tc''*.

Males unknown.

Species. Two species: *Ch. creelae*, *Ch. costacola*.

Hosts and distribution. Casuarinaceae, Australia.

Remarks. Mesa *et al.* (2009) state the following characters for the genus *Chaudhripalpus*: five-segmented palps with two simple setae, terminal podomere short, with one simple seta, one eupathidium and an elongate solenidion; ventral setae *4a* absent; aggenital (*ag*), genital (*g*) and pseudanal (*ps*) setae smooth. However on examining the type series, we found these characters to be incorrect. The correct characters are as follows: four-segmented palps with no simple setae, terminal podomere with one solenidion and one seta-like eupathidium; ventral setae *4a* present; aggenital, genital and pseudanal setae are all barbed (*ps3* only weakly barbed).

Chaudhripalpus is close to the monotypic genus *Tegopalpus*, differing only in having a four segmented palp (three segmented in *Tegopalpus*) and in having setae *v''* present on tibiae I–IV. This genus is tentatively retained as a separate genus, as the three segmented palp of *Tegopalpus* is autapomorphic within the Tegopalpinae and other mites found on Casuarinaceae.

Males remain unknown for *Chaudhripalpus*, but like the closely related genus *Tegopalpus*, we expect that the male and female solenidia would be of similar length and size.

***Chaudhripalpus creelae* (Smiley, Frost and Gerson, 1996)**

(Figs 1–6)

Crossipalpus creelae Smiley, Frost and Gerson, 1996: 176, fig. 21.

Chaudhripalpus creelae, Mesa *et al.* 2009: 57, fig. 19.

Type material examined. Holotype female ex. Bull-Oak *Allocasuarina luehmannii* (Casuarinaceae) [feeding on bark of branchlets], **AUSTRALIA:** South Australia, 16 km E Mt Mary, 14 December 1995, coll. W. Frost [on same slide as 2 paratypes of *Ch. creelae* and 2 specimens of *Magdalenapalpus strandtmanni* (Smiley, Frost and Gerson) (WINC)]. Paratypes. 11 females, 4 protonymphs, 1 larva, same data as holotype except 28 February 1996 (6 slides; WINC); 4 females and 1 protonymph, same data as holotype (5 slides; only 1 female in good condition); 1 female, same data as holotype except 28 February 1996 (on same slide as 1 female of *Ma. strandtmanni*; USNM); 1 female and 1 deutonymph, same data as holotype except 28 February 1996 (on same slide as 1 female of *Ma. strandtmanni*; USNM).

Diagnosis. Prodorsal cuticle with coarse, longitudinally lineate sculpturing. Dorsal opisthosomal cuticle with longitudinal striate sculpturing posteriorly; longitudinal folding between setae *c1-d1* and *d1-e1*; oblique folds and striate sculpturing laterally. Dorsal setae concave. Ventral setae *ps1-2* lanceolate, barbed, seta *ps3* smooth. Trochanters I–IV 1-1-1-0 (*v'* present on tr I–II, added in adult, *v'* absent on tr III–IV; *l'* present on tr III, added in protonymph).

FEMALE (*n* = 18). *Dorsum*. (Figs 1, 2a, b) Body measurements: distance between setae *v2-h1* 235–280 [265]; *sc2-sc2* 86–100 [92]; other measurements: *v2-v2* 27–35 [32], *sc1-sc1* 73–89 [84], *c1-c1* 22–26 [26], *c3-c3* 105–120 [115], *d1-d1* 16–26 [22], *d3-d3* 93–110 [96], *e1-e1* 17–27 [22], *e3-e3* 98–109 [100], *f3-f3* 88–96 [96], *h1-h1* 21–25 [25], *h2-h2* 57–69 [69]. Gnathosoma entirely or almost entirely concealed beneath anterior margin of prodorsum (Figs 2a, b). Cuticle between gnathosoma and prodorsum produced to form 1 pair of blunt, broadly triangular membranous lobes (with median notch formed between lobes), anterior to and folded under anterior margin of prodorsum; lobes often appear slightly retracted back into prosoma, under an anterior fold (Fig. 2); setae *v2* inserted on (Fig. 1) or under edge of anterior fold (Figs 2a, b). Prodorsal shield weakly developed; cuticle with longitudinal folds and striations. Opisthosomal shield weakly developed; cuticle with longitudinal folds between *c1-c1* and posterior to *e1-e1*; cuticle with transverse to oblique folds between central setae and lateral setae. All dorsal setae palmate, barbed, concave like a scoop (see *v2* in Fig. 1; setae *f3*, *h1*, *h2* in Fig. 3). Setal lengths: *v2* 16–20 [16], *sc1* 14–17 [16, 17], *sc2* 14–21 [18], *c1* 15–18 [16, 17], *c3* 16–21 [17, 19], *d1* 13–16 [13, 14], *d3* 16–21 [18, 20], *e1* 13–15 [13, 14], *e3* 15–21 [19], *f3* 15–20 [18, 19], *h1* 12–17 [15], *h2* 14–20 [17, 18]. *Palps*. (Fig. 2) Setal formula 0, 0, 0, 2 (1s+1e). Tarsal eupathidium seta-like 7–10 [10] long; solenidion 7–9 [8] long. *Venter*. (Fig. 3) Cuticle with fine transverse striae between setae *1a-3a*; striae longitudinal between setae *3a-4a*; band of striae transverse midway between *4a* and *ag*; striae anterior *ag* longitudinal, fine; striae surrounding genital region

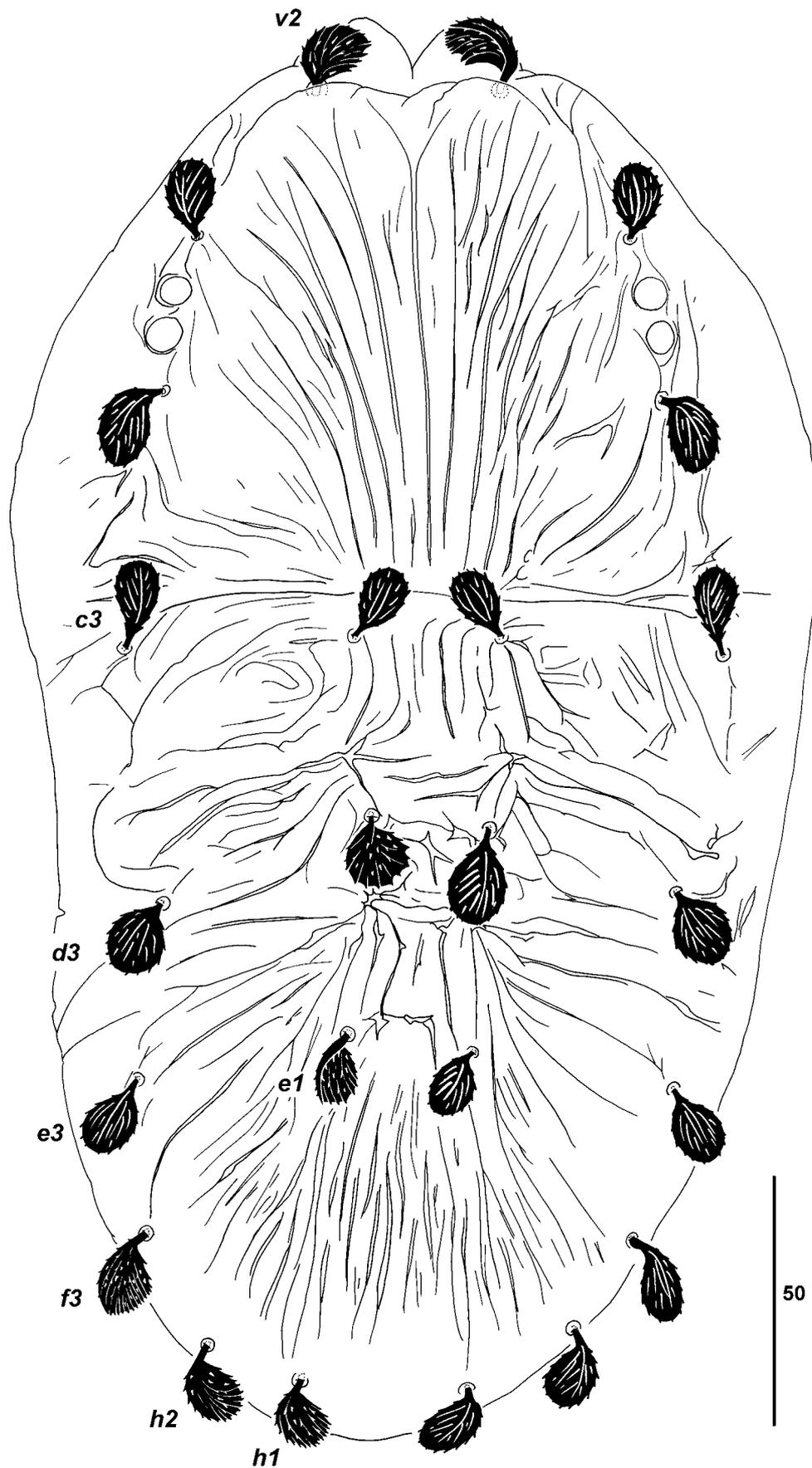


FIGURE 1. *Chaudhripalpus creelae* (Smiley, Frost and Gerson), adult female, dorsum.

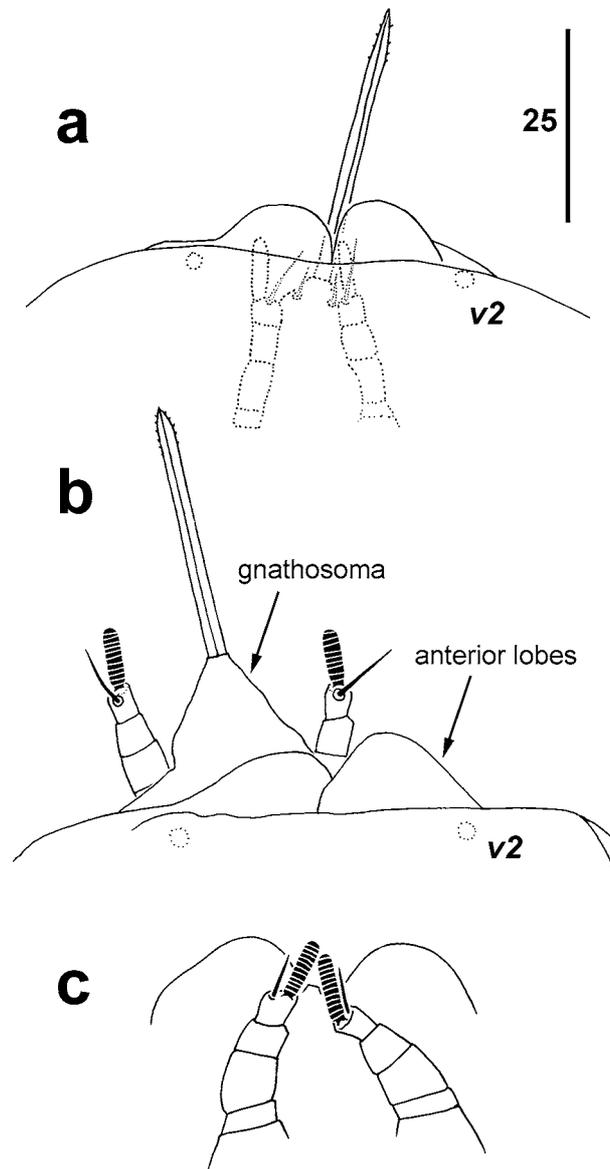


FIGURE 2. *Chaudhripalpus creelae* (Smiley, Frost and Gerson), adult female, anterior margin of prodorsum, a. dorsal view indicating position of gnathosoma, setae *v2* inserted under anterior fold; b. dorsal view with detail of palps and gnathosoma partially exposed, setae *v2* inserted under anterior fold; c. ventral view with details of palps.

broadly separated, coarse, mostly longitudinal. Genital flap weakly developed, mostly smooth with some weak folds centrally; genital setae inserted in more-or-less transverse row along posterior margin of flap, *g1* inserted slightly posterior to level of *g2*; *g1-2* broadly lanceolate, strongly barbed; *ag* lanceolate, barbed. Pseudanal setae *ps1-3* inserted medially on weakly defined anal plates in longitudinal line; *ps1-2* broadly lanceolate, broader than *ps3*, strongly barbed; *ps3* lanceolate, weakly barbed. Coxal setae *1b, 2b, 3b, 4b* fine, weakly barbed; setae *2c* thickened, barbed; setae *1a, 3a, 4a* with thickened bases, tapering to fine tip. Setal lengths: *1a* 29–58 [29], *1b* 16–27 [16], *2b* 15–26 [18], *2c* 16–19 [17], *3a* 31–55 [31], *3b* 14–23 [14], *4a* 23–52 [34], *4b* 13–22 [13], *ag1* 11–17 [11, 15], *g1* 11–16 [15], *g2* 11–15 [15], *ps1* 8–11 [11], *ps2* 8–13 [11], *ps3* 9–12 [12]. *Spermatheca*. Not visible. *Legs*. (Fig. 4) Setal formula for legs I–IV (coxae to tarsi): 1-1-3-0-4-8(1), 2-1-3-0-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 9–11 [9, 10] long, ta II 9–11 [9, 10] long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I with both 6–7 [7] long; ta II with both 6–7 [6, 7] long). Leg setation as in Table 1 except: cx I without *1c*, tr III–IV without seta *v'*; ge I–IV without setae; ta I–IV without seta *tc''*. Setae *v'* added to tr I–II.

DEUTONYMPH (1 paratype). *Dorsum*. Body measurements: distance between setae *v2-h1* 243, *sc2-sc2* 89; other measurements: *v2-v2* 28, *sc1-sc1* 78, *c1-c1* 22, *c3-c3* 122, *d1-d1* 23, *d3-d3* 93, *e1-e1* 21, *e3-e3* 93, *f3-f3* 88,

h1-h1 23, *h2-h2* 60. Dorsum with mostly weak transverse folds, some longitudinal on prodorsum. Triangular lobes between gnathosoma and prodorsum not developed; notch not developed. Dorsal setae with strongly developed basal stalk; Setal lengths: *v2* 16–17, *sc1* 14, *sc2* 15, *c1* 15–16, *c3* 16, *d1* 15, *d3* 17, *e1* 15, *e3* 15, *f3* 16, *h1* 12–13, *h2* 14. *Palps*. (Fig. 5b) Palps similar to adult. Tarsal eupathidium 8 long, solenidion 4–5 long. *Venter*. (Fig. 5a) Cuticle with fine longitudinal striae on gnathosoma to setae *1a*; transverse striae between setae *1a* and just anterior to setae *ag*; longitudinal striae from just anterior setae *ag* to *g1*; longitudinal striae laterad genital region. Coxal setae fine, except *2c* thickened, barbed. Setal lengths: *1a* 42, *1b* 22, *2b* 16–18, *2c* 16–19, *3a* 40, *3b* 17, *4a* 28, *4b* 18, *ag1* 12–13, *g1* 12–13, *ps1* 7, *ps2* 6, *ps3* 7. *Legs*. Setal formula for legs I–IV 1-0-3-0-4-8(1), 2-0-3-0-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 anti-axial solenidion ω'' (6 long) and 2 eupathidia $p\zeta''$ - $p\zeta'''$ (6 long). Leg setation as in adult, except: tr I–III without *v'* (typical deutonymphal seta delayed to adult stage; see Table 1).

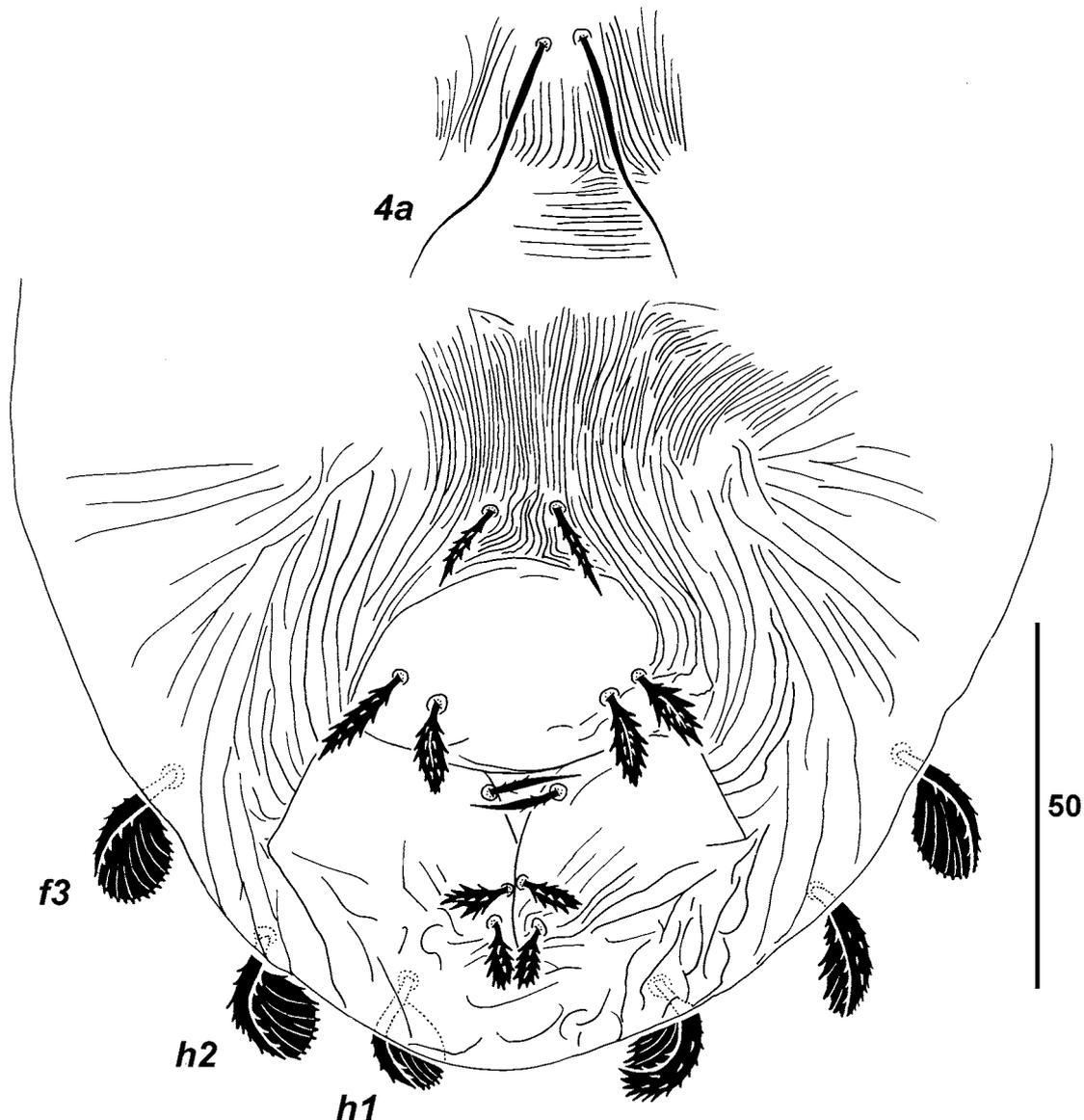


FIGURE 3. *Chaudhripalpus creelae* (Smiley, Frost and Gerson), adult female, posterior venter.

PROTONYMPH (5 paratypes). *Dorsum*. Body measurements: distance between setae *v2-h1* 170–195, *sc2-sc2* 75–80; other measurements: *v2-v2* 19–23, *sc1-sc1* 67–70, *c1-c1* 21–24, *c3-c3* 91–110, *d1-d1* 19–21, *d3-d3* 72–74, *e1-e1* 13–16, *e3-e3* 73–77, *f3-f3* 50–61, *h1-h1* 12–14, *h2-h2* 31–33. Gnathosoma exposed or partially concealed beneath anterior margin of prodorsum. Triangular lobes between gnathosoma and prodorsum not developed; notch not developed. Dorsum with sparse striae and folds between areas of smooth cuticle. Setae strongly spatulate or palmate with narrow stalk-like base. Setal lengths: *v2* 13–17, *sc1* 11–14, *sc2* 12–19, *c1* 13–15, *c3* 11–16, *d1* 11–17, *d3* 12–15, *e1* 13–15, *e3* 12–14, *f3* 11–14, *h1* 9–11, *h2* 11–13. *Palps*. Palps similar to adult; solenidion 3–4,

eupathidium 6–7. *Venter*: Cuticle with longitudinal striae on gnathosoma to setae *1a*; with transverse striae between setae *1a* and *ag*; with longitudinal striae laterad anal region. Coxal setae fine. Setal lengths: *1a* 28–32, *1b* 11–14, *2b* 8–14, *3a* 28–39, *3b* 13–15, *ag1* 11–13, *ps1* 7, *ps2* 7, *ps3* 7. *Legs*. Setal formula for legs I–IV (coxae to tarsi): 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4–5 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long). Leg setation as in deutonymph, except: seta *2c* absent; seta *4b* absent; tarsi IV without seta *tc'*. Setae *l'* added to tr III.

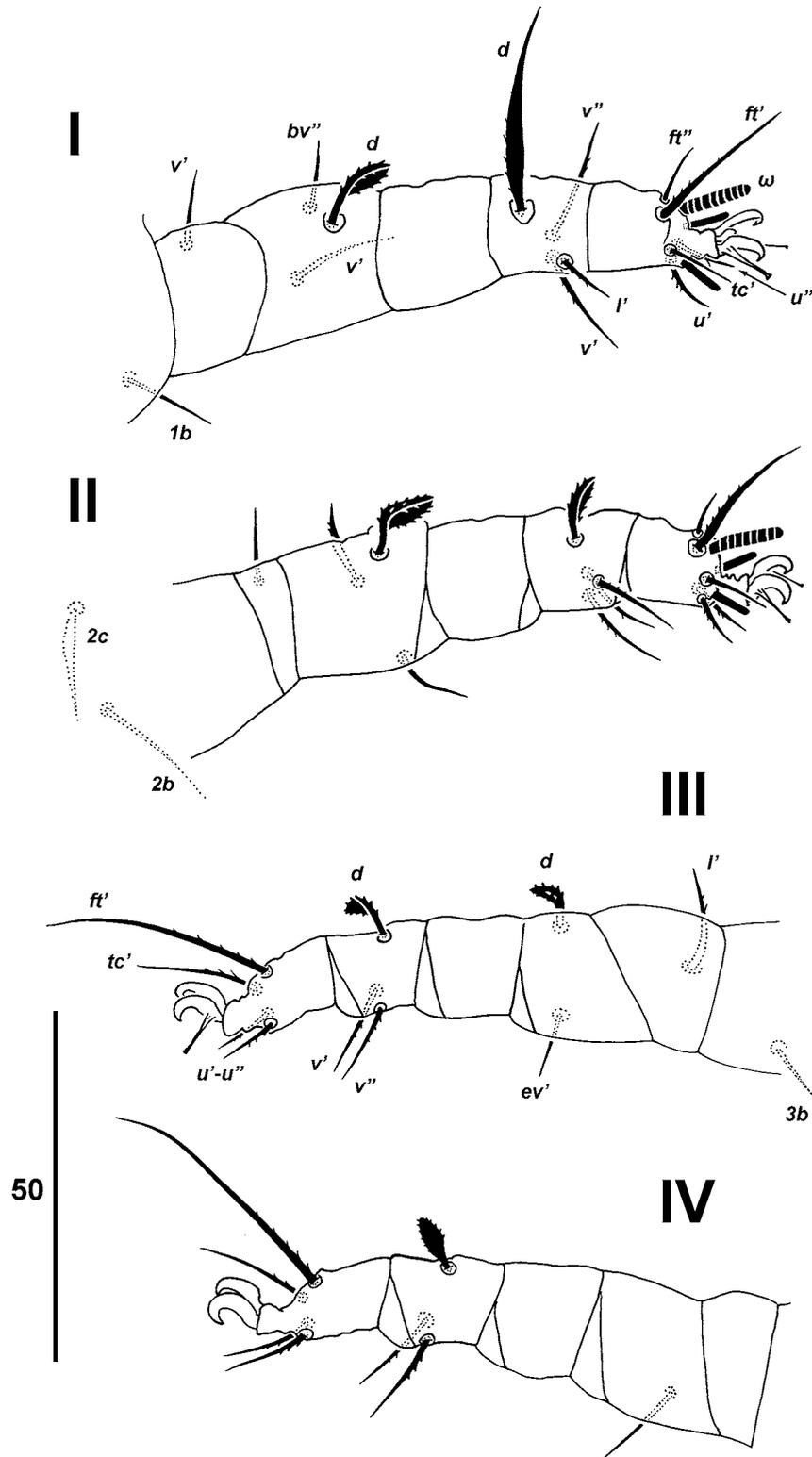


FIGURE 4. *Chaudhrupalpus creelae* (Smiley, Frost and Gerson), adult female, legs (left side), eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

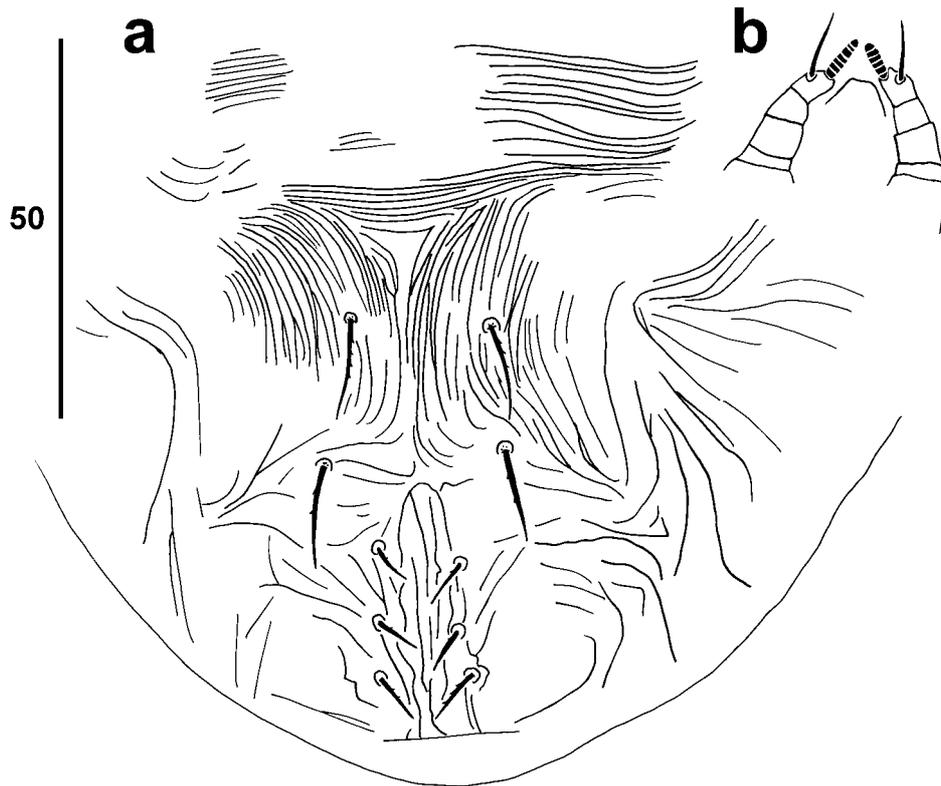


FIGURE 5. *Chaudhripalpus creelae* (Smiley, Frost and Gerson), deutonymph, a. posterior venter; b. detail of palps.

LARVA (2 paratypes). *Dorsum*. (Fig. 6) Body measurements: distance between setae *v2-h1* 155, *sc2-sc2* 67; other measurements: *v2-v2* 18, *sc1-sc1* 51, *c1-c1* 16, *c3-c3* 83, *d1-d1* 16, *d3-d3* 61, *e1-e1* 9, *e3-e3* 57, *f3-f3* 44, *h1-h1* 12, *h2-h2* 24. Prodorsal shield weakly developed, smooth. Opisthosoma without platelets, with coarse transverse wrinkled striae between *c1-d1*. All dorsal setae strongly palmate, barbed, with narrow stalk-like base, except *v2* tapered, setiform, barbed. Setal lengths: *v2* 15–16, *sc1* 8–9, *sc2* 10, *c1* 11–12, *c3* 10, *d1* 10, *d3* 11, *e1* 9, *e3* 9–10, *f3* 9–10, *h1* 7–8, *h2* 9–10. *Palps*. (Fig. 6) Palps similar to adult; 1 solenidion 3 long, and 1 seta-like eupathidium 5–7 long. *Venter*. Cuticle mostly transverse with some longitudinal striae around anal region. Coxal setae fine. Setal lengths: *1a* 21, *1b* 11, *3a* 24, *ps1* 5–6, *ps2* 5–6, *ps3* 5–6. *Legs*. (Fig. 6) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4–5 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long). Leg setation as in protonymph, except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*.

Hosts and distribution. This species was described from Bull-Oak *Al. luehmannii* near Mt Mary in South Australia.

Remarks. Mesa *et al.* (2009) listed incorrect leg setal counts (see above description for correct counts). The additional material examined in this study was not listed in the original description by Smiley *et al.* (1996). The host is incorrectly spelt on the slide as *Al. luehmanni*, instead of *Al. luehmannii*. This mite species exhibits an unusual ontogeny with the expression of seta *v'* on the trochanters, i.e. *v'* is delayed until the adult stage on trochanters I–II and is totally absent on trochanters III–IV (this seta usually first appears on trochanters I–III in the deutonymph, and on trochanters IV in the adult, see Table 1).

Chaudhripalpus creelae can be separated from *Ch. costacola* by the presence of *v'* on trochanters I–II and absence on tr III–IV (*v'* absent on tr I–IV in *Ch. costacola*, i.e. tr I, II, IV nude) and the presence of broadly lanceolate setae *ps1–2* (narrowly setiform in *Ch. costacola*).

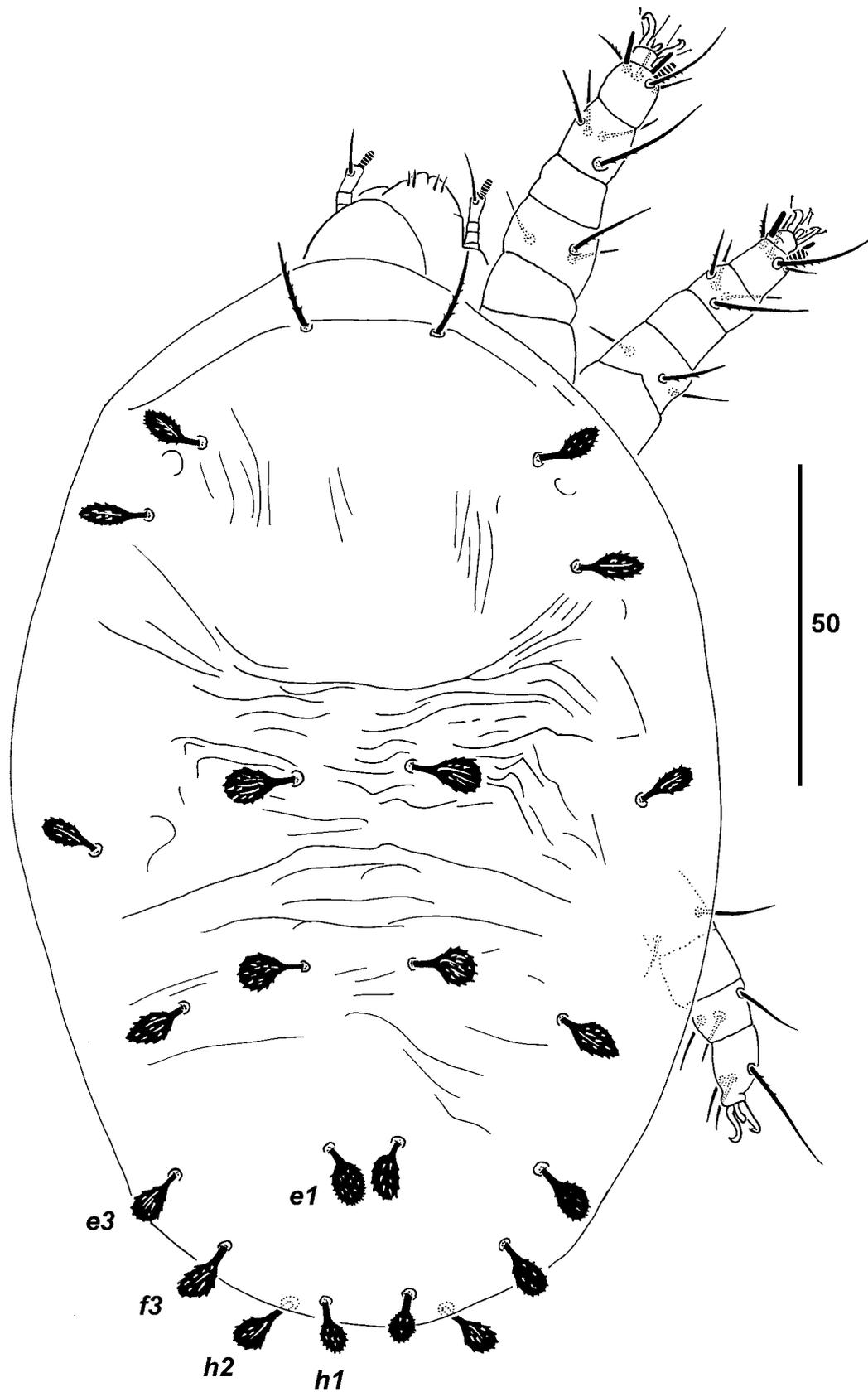


FIGURE 6. *Chaudhripalpus creelae* (Smiley, Frost and Gerson), larva, dorsum, with details of legs and palps.

***Chaudhripalpus costacola* Beard and Seeman sp. nov.**

(Figs 7–12)

Type material examined. Holotype female ex. Belah *Casuarina cristata* (Casuarinaceae), **AUSTRALIA:** New South Wales, 86 km S Goondiwindi, approx. 15 km N Moree, Newell Highway, 29°21'20"S 150°00'24"E, 21 August 2007, coll. J.J. Beard (QM). Paratypes. 4 females, 2 pharate females, 2 pharate deutonymphs, 1 protonymph, and 1 larva, same data as holotype (QM, ANIC).

Non-type material examined. 8 females, 7 pharate females, 4 deutonymphs, 11 protonymphs, 3 pharate protonymphs, and 11 larvae ex. *Ca. cristata*, **AUSTRALIA:** Queensland, 17 km west of Dalby on Moonie Highway, 27°14'13"S 151°08'52"E, 05 May 2007, coll. J.J. Beard and P.I. Forster (QM, USNM; BRI voucher PIF32479); 8 females, 2 protonymphs, and 4 larvae ex same host, **AUSTRALIA:** Queensland, 45 km south of Hebel along Castlereagh Highway, near Lightning Ridge, 28°44'43"S 148°09'12"E, 06 May 2007, coll. J.J. Beard and P.I. Forster (QM; BRI voucher PIF32488).

Diagnosis. Prodorsal shield with coarse, longitudinally lineate sculpturing. Dorsal opisthosomal cuticle with longitudinal striate sculpturing posteriorly; smooth cuticle between setae *c1-d1*; longitudinal folding between setae *d1-e1*; oblique folds and striate sculpturing laterally. Ventral setae *ps1-2* thin, barbed, seta *ps3* smooth. Trochanters I–IV 0-0-1-0 (*v'* absent on tr I–IV; *l'* present on tr III, added in protonymph). Spermathecal tube long, narrow, ca. 95 long before balloon-like membranous vesicle 4 long, 3 wide.

FEMALE (n = 21). *Dorsum*. (Fig. 7) Body measurements: distance between setae *v2-h1* 265–300 [300]; *sc2-sc2* 91–93 [91]; other measurements: *v2-v2* 38–40 [38], *sc1-sc1* 82–85 [83], *c1-c1* 24–28 [28], *c3-c3* 116–125 [125], *d1-d1* 20–25 [25], *d3-d3* 99–110 [108], *e1-e1* 22–26 [23], *e3-e3* 97–110 [110], *f3-f3* 88–99 [99], *h1-h1* 21–24 [24], *h2-h2* 63–74 [74]. Gnathosoma completely concealed beneath prodorsum. Anterior margin of prodorsum with 1 pair of blunt membranous triangular lobes originating from beneath prodorsal margin, notch formed between lobes 10–15 deep. Prodorsal shield weakly developed with coarse, longitudinal lineate pattern. Opisthosomal shield weakly developed with smooth cuticle medially, coarse, longitudinal-oblique lineate pattern laterally and posteriorly. Lateral cuticle surrounding shields weakly striated. All dorsal setae broadly lanceolate, barbed; medial opisthosomal setae shorter than lateral setae. Setal lengths: *v2* 17–18 [18], *sc1* 14–15 [15], *sc2* 17–20 [17], *c1* 13–16 [16], *c3* 18–19 [18], *d1* 10–11 [10], *d3* 16–19 [16], *e1* 9–10 [10], *e3* 16–18 [17], *f3* 17–18 [18], *h1* 12–13 [13], *h2* 15–17 [17]. *Palps*. (Fig. 8a) Setal formula 0, 0, 0, 2 (1s+1e). Tarsal eupathidium 6 long; solenidion 7 long. *Venter*. (Fig. 8b) Cuticle with fine transverse striae between setae *1a-3a*, longitudinal between setae *3a-4a*, transverse striae to midway between *4a* and *ag*, then longitudinal striae becoming coarse around genital area. Genital setae inserted in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital area smooth, membranous, 20–25 [25] long, 35–40 [35] wide; anal setae *ps1-3* inserted medially on weakly defined anal plates in longitudinal line. Coxal setae *1a*, *1b*, *2b*, *2c*, *3a*, *3b*, *4a*, *4b* fine; setae *g1-2* lanceolate, setae *agl*, *ps1-2* narrowly lanceolate, barbed, *ps3* fine. Setal lengths: *1a* 40–45 [broken], *1b* 20–25 [broken], *2b* 12–15 [12], *2c* 12–16 [13], *3a* 25–40 [25], *3b* 12–15 [12], *4a* 30–36 [35], *4b* 11–15 [15], *agl* 9–11 [9], *g1* 9–11 [11], *g2* 10 [10], *ps1* 6–7 [7], *ps2* 6–7 [7], *ps3* 5–6 [6]. *Spermatheca*. (Fig. 8c) Spermathecal tube long, narrow, becoming convoluted distally, maximum width 1, ca. 95 long before balloon-like spermatheca 4 long, 3 wide. Genital opening just anterior to setae *ps3*. *Legs*. (Fig. 9) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 2-0-3-0-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 9 [9] long, ta II 8 [8] long) and 2 eupathidia $p\zeta'-p\zeta''$ (6 long). Leg setation as in Table 1 except: cx I without *1c*; tr I–IV without *v'*; ge I–III without *l'*, ge I–II without *d*, *l''*; ta I–IV without *tc''*.

MALE. Unknown.

DEUTONYMPH (n = 5). *Dorsum*. (Fig. 10) Body measurements: distance between setae *v2-h1* 235–250, *sc2-sc2* 90–96; other measurements: *v2-v2* 25–29, *sc1-sc1* 83–88, *c1-c1* 22–25, *c3-c3* 114–122, *d1-d1* 20–23, *d3-d3* 88–96, *e1-e1* 18–20, *e3-e3* 88–97, *f3-f3* 79–85, *h1-h1* 18–22, *h2-h2* 48–56. Anterior prodorsal lobes not developed. Prodorsal shield smoothly rounded. Opisthosoma with setae *c1* on weak, irregular plate, *d1* on paired, weak, irregular platelets; otherwise coarse transverse striae between areas of smooth cuticle. Setal lengths: *v2* 13–15, *sc1* 13–15, *sc2* 15–16, *c1* 14–16, *c3* 14–17, *d1* 13–15, *d3* 15–17, *e1* 11–13, *e3* 12–14, *f3* 12–15, *h1* 10, *h2* 12–15. *Palps*. Palps similar to adult. Solenidion 4 long, eupathidium 4–5 long. *Venter*. (Fig. 11b) Cuticle with transverse striae becoming longitudinal posteriorly. Coxal setae fine. Setae *ps1-2* barbed, *ps3* smooth. Setal lengths: *1a* 22–25, *1b* 12–13, *2b* 9–11, *2c* 10–13, *3a* 17–20, *3b* 9–10, *4a* 16–22, *4b* 8–10, *agl* 8–10, *g1* 10–11, *ps1* 4–5, *ps2* 5, *ps3* 5. *Legs*. Setal formula for legs I–IV same as adult. Tarsi I and II each with 1 antiaxial solenidion ω'' (5 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long).

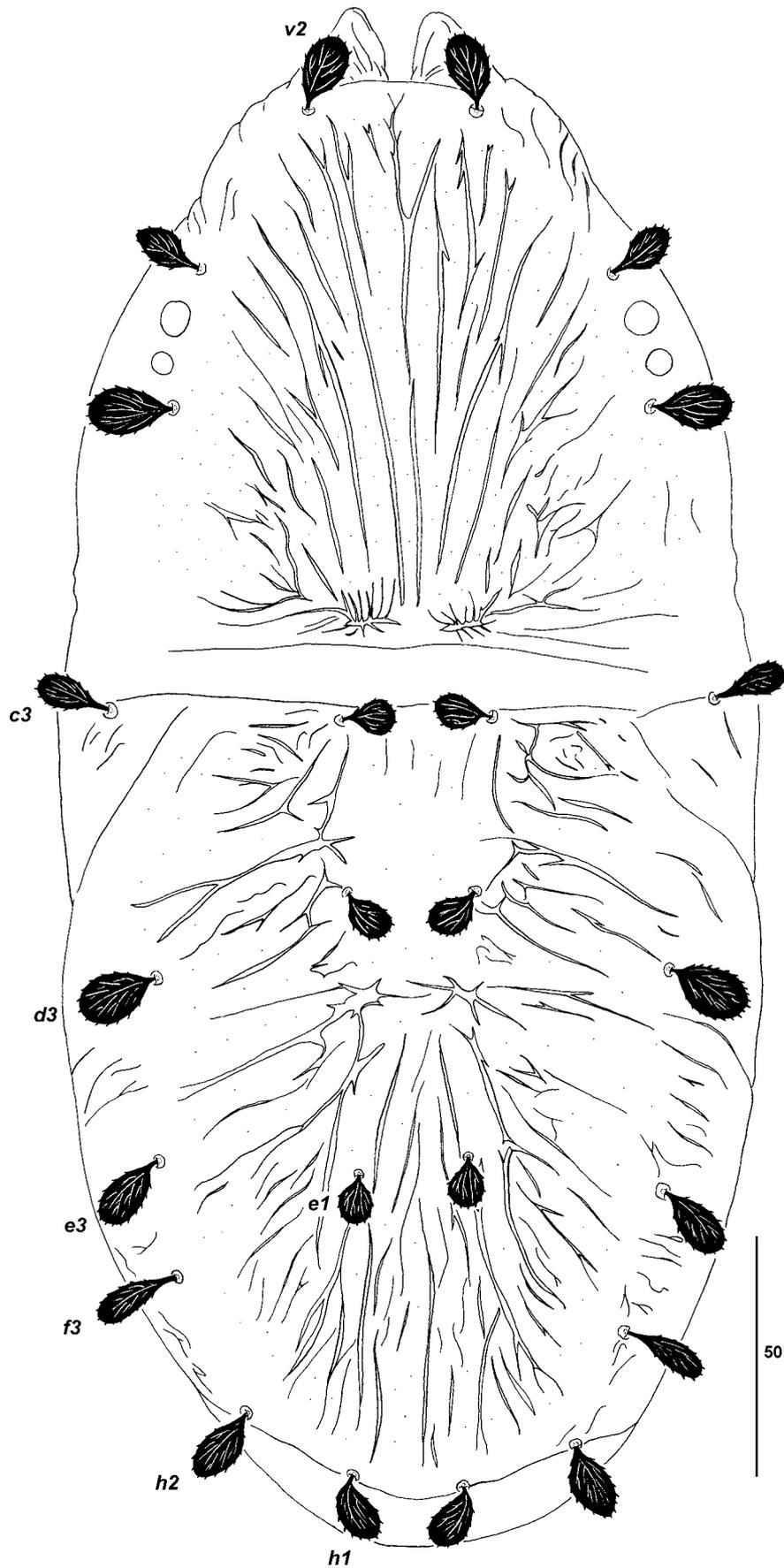


FIGURE 7. *Chaudhripalpus costacola* Beard and Seeman, adult female, dorsum.

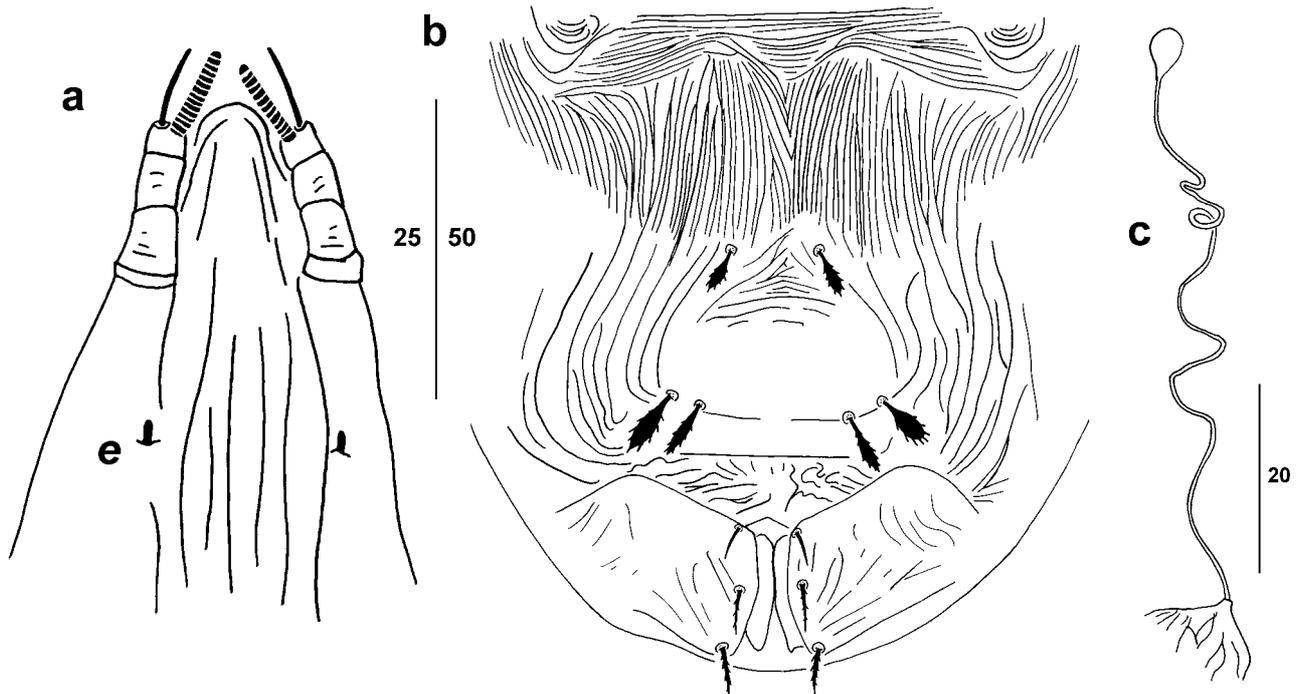


FIGURE 8. *Chaudhripalpus costacola* Beard and Seeman, adult female, a. detail of palps and dorsal gnathosoma (scale bar = 25 µm); b. posterior venter (scale bar = 50 µm); c. spermatheca.

PROTONYMPH (n = 3). *Dorsum*. Body measurements: distance between setae *v2-h1* 190–225, *sc2-sc2* 81–84; other measurements: *v2-v2* 23–25, *sc1-sc1* 68–70, *c1-c1* 21–22, *c3-c3* 110–113, *d1-d1* 19–23, *d3-d3* 82–85, *e1-e1* 16–19, *e3-e3* 76–79, *f3-f3* 67–69, *h1-h1* 17–25, *h2-h2* 36–43. Anterior prodorsal lobes not developed. Prodorsal shield weakly developed, smooth. Opisthosoma with setae *c1* and *d1* on paired, weak, irregular platelets; otherwise sparse striae between areas of smooth cuticle. Setal length: *v2* 12–15, *sc1* 10–12, *sc2* 14, *c1* 15, *c3* 14–16, *d1* 10–13, *d3* 11–15, *e1* 8–10, *e3* 13, *f3* 11, *h1* 7, *h2* 9–11. *Palps*. Palps similar to adult. Solenidion 3–4 long, eupathidium 4 long. *Venter*. Cuticle with transverse striae becoming longitudinal posteriorly. Coxal setae fine. Setal lengths: *1a* 25–30, *1b* 8–10, *2b* 8–10, *3a* 17–20, *3b* 6–9, *agl* 7–12, *ps1* 3–4, *ps2* 3–4, *ps3* 3–4. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5, 4–5 long). Leg setation as in deutonymph except: seta *1c* absent; seta *4b* absent; tarsi IV without *tc''*. Setae *l'* added to tr III.

LARVA (n = 16). *Dorsum*. (Fig. 12) Body measurements: distance between setae *v2-h1* 130–160, *sc2-sc2* 64–69; other measurements: *v2-v2* 20–21, *sc1-sc1* 55–60, *c1-c1* 17–18, *c3-c3* 87–96, *d1-d1* 18–19, *d3-d3* 58–61, *e1-e1* 8–11, *e3-e3* 46–57, *f3-f3* 33–41, *h1-h1* 8, *h2-h2* 14–22. Anterior prodorsal lobes not developed. Prodorsal shield weakly developed, smooth. Opisthosoma without platelets, with coarse transverse wrinkled striae, becoming oblique posteriorly. Setal lengths: *v2* 12–13, *sc1* 7–8, *sc2* 10–11, *c1* 9–10, *c3* 8–10, *d1* 8–9, *d3* 9–10, *e1* 6–8, *e3* 9–11, *f3* 9–10, *h1* 5–6, *h2* 9. *Palps*. Palps similar to adult except solenidion 3 long and eupathidium 5–6 long. *Venter*. (Fig. 11a) Cuticle with transverse striae becoming longitudinal posteriorly. Coxal setae fine. Setal lengths: *1a* 16–21, *1b* 11–12, *3a* 14–23, *ps1* 3–4, *ps2* 3–4, *ps3* 3–4. *Legs*. (Fig. 12) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (4 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; tarsi I–III without seta *tc'*.

Hosts and distribution. This species was collected from Belah, *Ca. cristata* from northwestern New South Wales and southwestern Queensland.

Etymology. The specific name is derived from *costa* (rib) and *cola* (dweller), alluding to the habit of these mites to lodge in between the ribs on stems of she-oaks.

Remarks. This species was a darkish matt red colour in life and was found on the stems, with *Pentamerismus sititoris* and *Philippipalpus belah*.

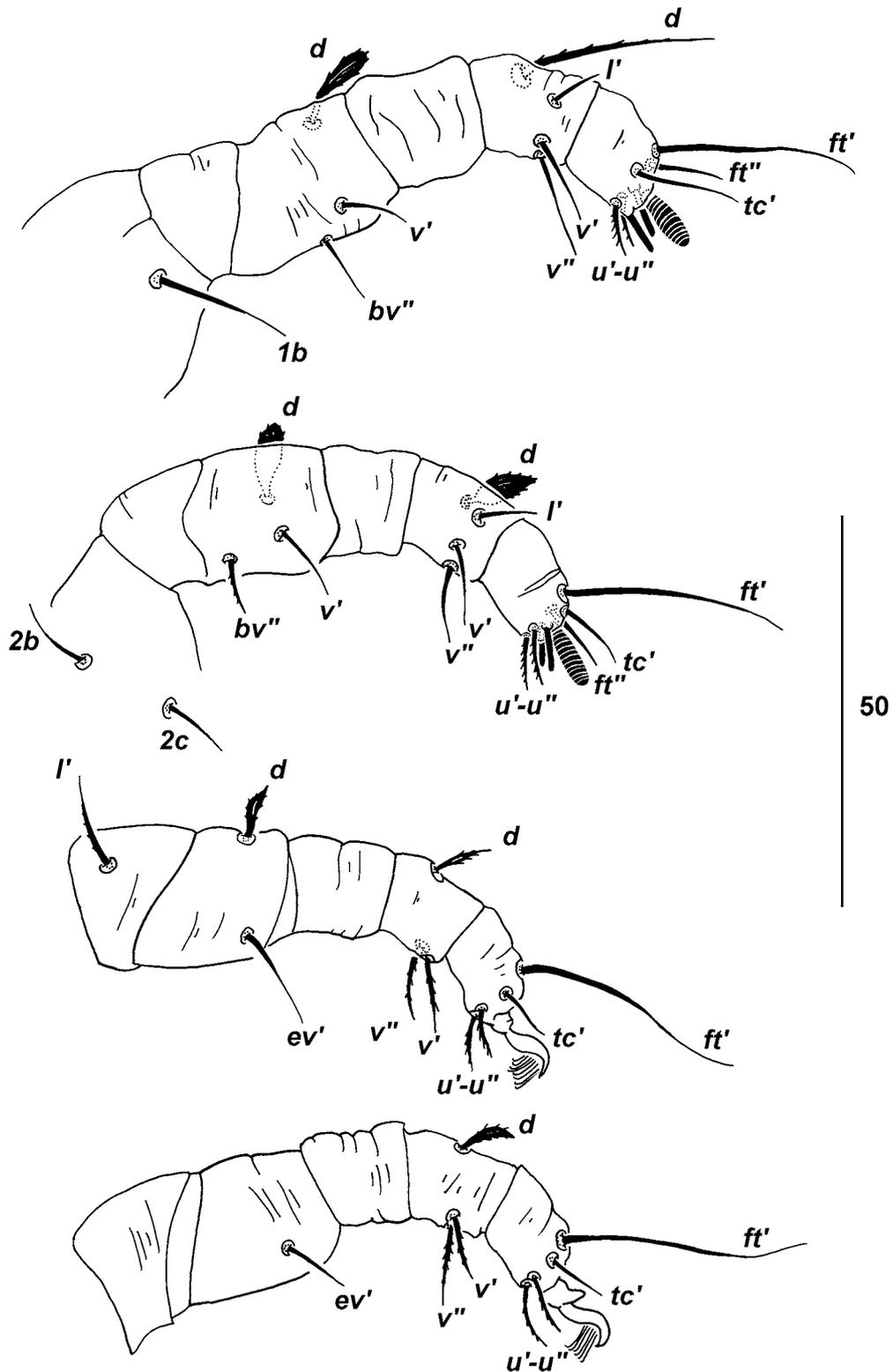


FIGURE 9. *Chaudhripalpus costacola* Beard and Seeman, adult female, legs (left side ventral view; claws not illustrated on legs I–II; solenidion ω'' and eupathidia ($p\zeta''$ - $p\zeta'''$) not labelled).

Chaudhripalpus costacola can be separated from *Ch. creelae* by the absence of v' on trochanters I–IV (present on tr I–II in *Ch. creelae*) and the presence of narrow setiform setae $ps1$ – 2 (broadly lanceolate in *Ch. creelae*).

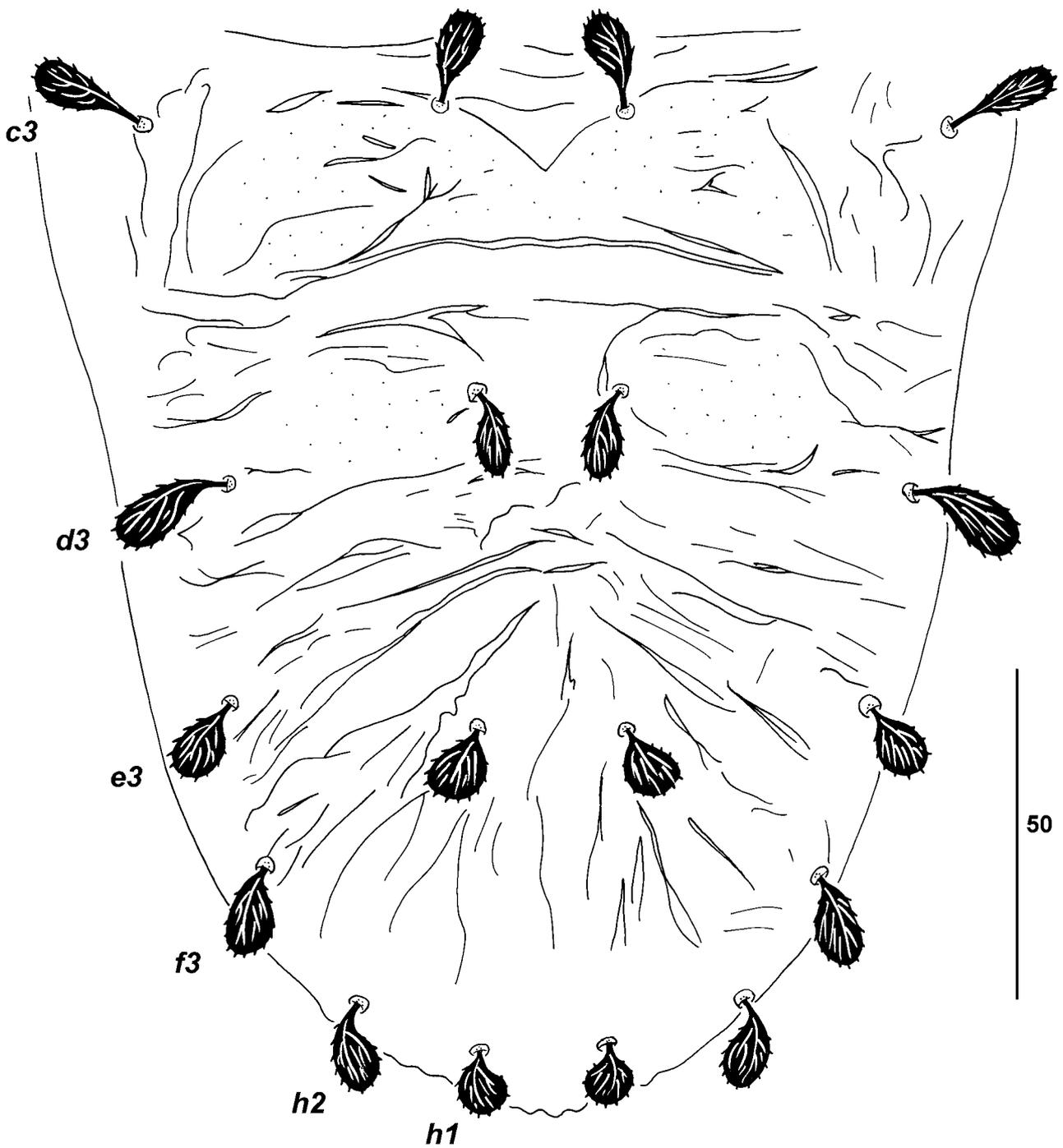


FIGURE 10. *Chaudhripalpus costacola* Beard and Seeman, deutonymph, dorsal opisthosoma.

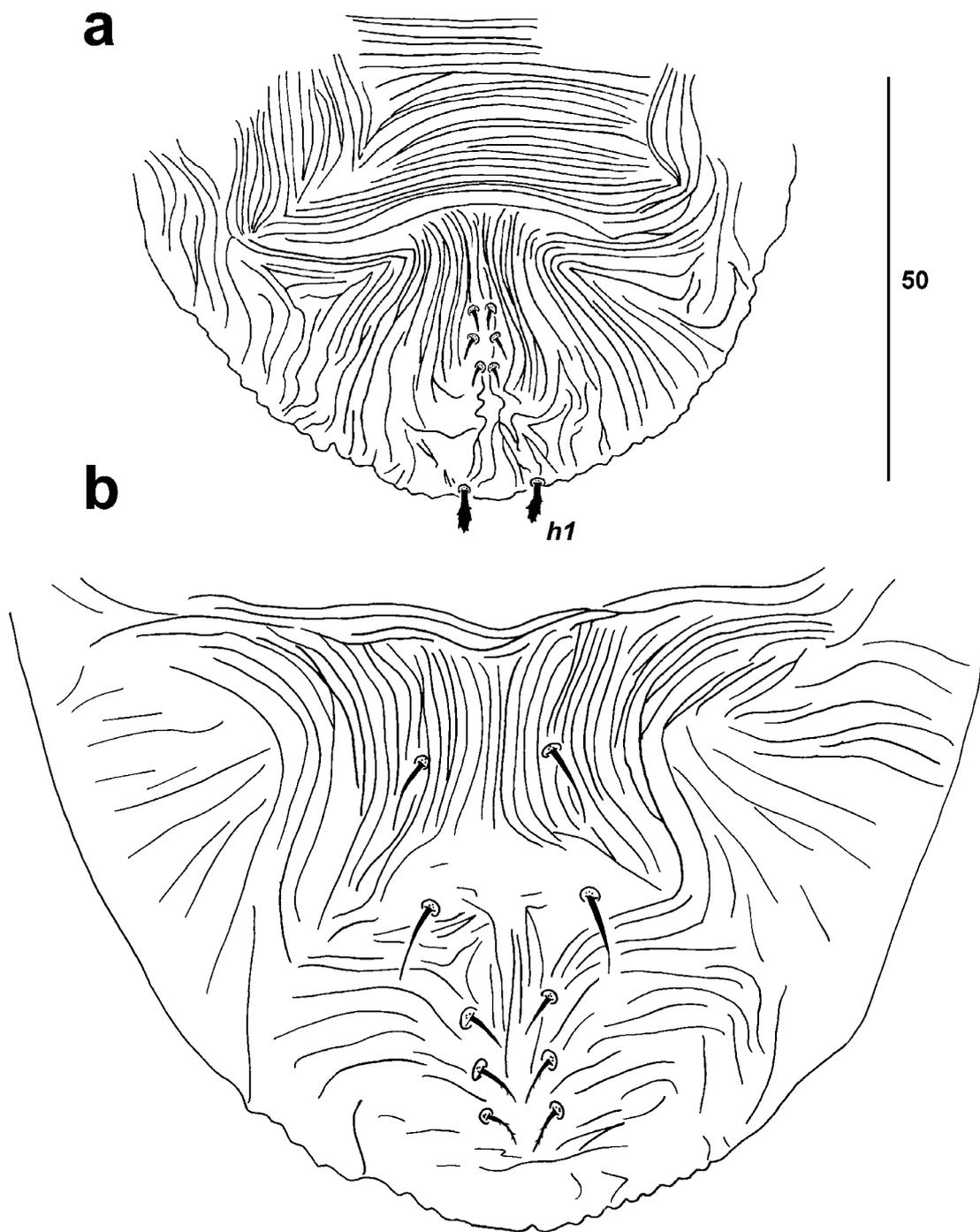


FIGURE 11. *Chaudhripalpus costacola* Beard and Seeman, immatures, a. larva posterior venter; b. deutonymph posterior venter.

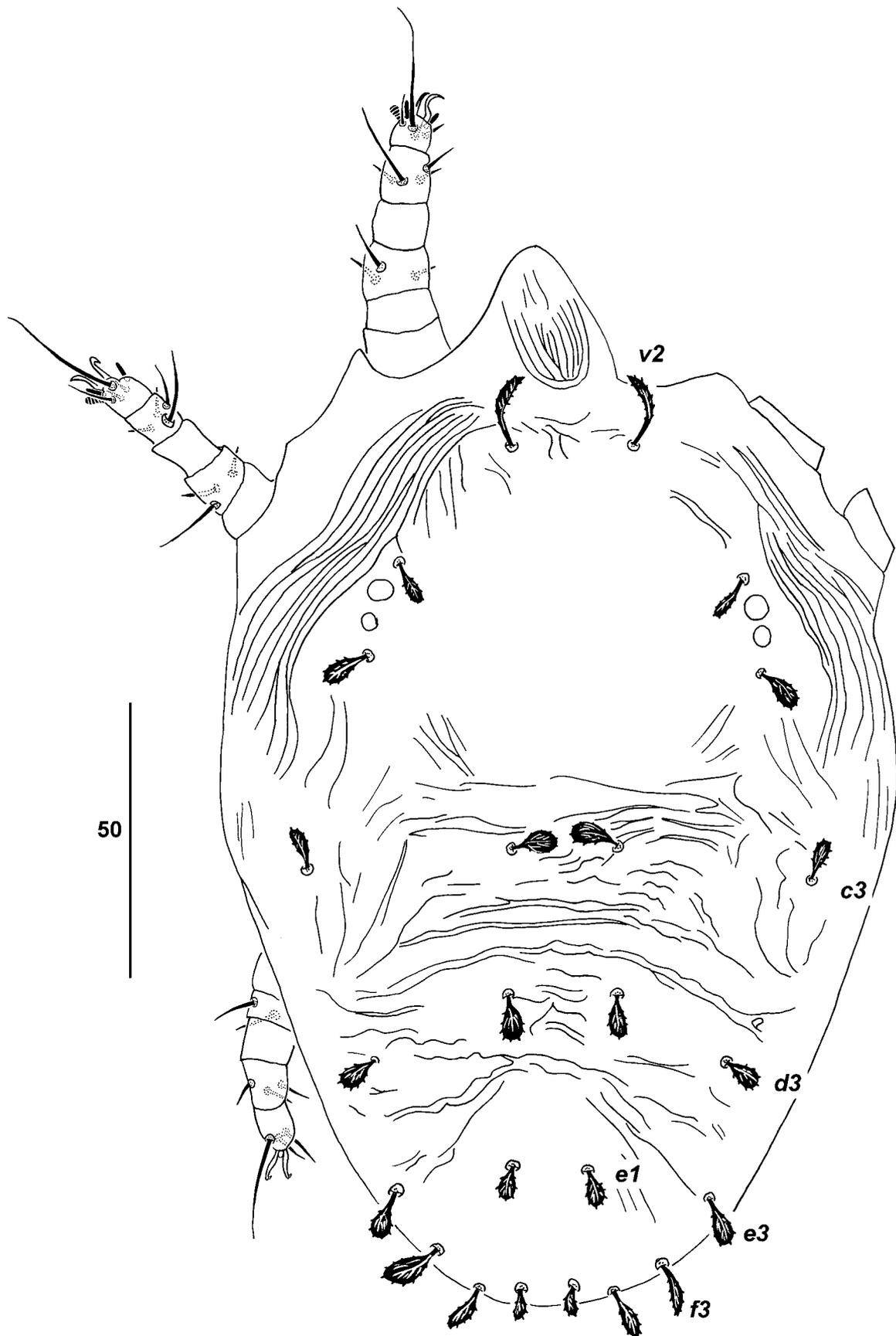


FIGURE 12. *Chaudhripalpus costacola* Beard and Seeman, larva, dorsum, with detail of legs.

***Crossipalpus* Smiley, Frost and Gerson, 1996**

Type species. *Crossipalpus verticillatae* Smiley, Frost and Gerson, 1996, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 12 pairs of thinly to broadly lanceolate setae; *c2*, *d2*, and *e2* present; setae *f2* absent; setae *e2* close to marginal position; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, setal formula 0, 0, 0, 1, 3(1); anterior margin of prodorsum smoothly rounded, without projections/notches; ventral plate absent; 2 pairs of pseudanal setae (*ps1–2*) on weakly developed anal plates. *Adult female:* anterior margin of prodorsum without projections, smoothly rounded, completely concealing the gnathosoma; genital plate membranous, weakly developed; metapodal plates not developed; coxae I without *1c*; trochanters I–IV 1-1-2-1; femora I–IV 3-3-2-1; genua I–IV 1-1-0-0 (ge I–II with either *l''* or *d* present); tibiae I–IV 4-4-3-3; tarsi I–IV with or without *tc''*. Setae *v'* added to tr IV in adult; *v'* added to tr I–III in deutonymph; *l'* added in protonymph. Solenidia of male much thicker and longer than those of female.

Species. Four species: *Cr. gersoni*, *Cr. muellerianae*, *Cr. raveni*, *Cr. verticillatae*.

Hosts and distribution. Casuarinaceae, Australia.

Remarks. All known *Crossipalpus* species have the setal formula for genua I–IV 1-1-0-0. In *Cr. muellerianae* and *Cr. verticillatae*, the seta present on ge I–II is *l''*, but in the two new species, *Cr. gersoni* and *Cr. raveni*, the seta is *d*. This difference is an example of how setal counts alone can conceal useful information that only chaetotaxy can present.

***Crossipalpus muellerianae* Smiley, Frost and Gerson, 1996**

(Figs 13–18)

Crossipalpus muellerianae Smiley, Frost and Gerson, 1996: 174, figs 19–20.

Type material examined. Holotype female ex. Slaty She-Oak *Allocasuarina muelleriana* (Casuarinaceae) [feeding on bark of branchlets], **AUSTRALIA:** South Australia, Flinders Ranges, St Mary's Peak, at 750 m, 3 October 1995, coll. W. Frost (WINC; on same slide as 7 paratype specimens). Paratypes. 2 females, 1 pharate female, 1 deutonymph, 3 protonymphs, 1 pharate larva, and 1 larva, same data as holotype (WINC; 2 slides, including holotype slide); deutonymph, same data as holotype, on slide with 2 females of *Me. delfinadae* (WINC).

Non-type material examined. 9 females, 3 pharate females, 3 deutonymphs, 1 pharate protonymph, and 1 larva ex. *A. muelleriana*, **AUSTRALIA:** South Australia, Adelaide, Athelston, Maryvale Road, Wadmore Park, 34°52'49"S 138°42'10"E, 21 April 2009, coll. J.J. Beard and C.J. Burwell (QM, USNM) (BRI voucher BRI [AQ818802]).

Diagnosis. Dorsal setae all thinly lanceolate and weakly barbed. Prodorsal setae *v2* obviously longer than setae *sc1*. Palpal segments elongated, thin. Genua I–II with seta *l''* without *d*; tarsi I–IV with seta *tc''*.

FEMALE (n = 12). *Dorsum.* (Fig. 13a) Body measurements: distance between setae *v2-h1* 335–370 [345]; *sc2-sc2* 93–105 [105]; other measurements: *v2-v2* 21–36 [29], *sc1-sc1* 79–89 [88], *c1-c1* 14–24 [24], *c2-c2* 81–96 [93], *c3-c3* 115–130 [130], *d1-d1* 19–27 [24], *d2-d2* 69–87 [85], *d3-d3* 99–115 [105], *e1-e1* 13–18 [14], *e2-e2* 93–105 [97], *e3-e3* 82–94 [85], *f3-f3* 63–76 [72], *h1-h1* 12–17 [12], *h2-h2* 41–52 [48]. Gnathosoma completely concealed beneath prodorsum. Anterior margin of prodorsum rounded; setae *v2* often inserted ventrally on anterior margin of prodorsum (Fig. 14). Prodorsal shield weakly developed with longitudinal to oblique folds and lines. Some transverse folds between dorsal shields, just anterior to *c*-setae. Opisthosomal shield weakly developed, mostly with oblique or longitudinal lines and weak folds; short series transverse folds across width of shield just anterior *e1-e1*; small areas of smooth cuticle between setae *c1-c1* and *d1-d1* and between *d1-d2*. Lateral cuticle surrounding shields mostly smooth, with few coarse striae and weak folds. Most dorsal setae thin and barbed; setae *v2*, *sc2*, *e3*, *f2*, *f3*, and *h2* longer and thicker than other dorsal setae; setae *h1* short, palmate to lanceolate. Setal lengths: *v2* 21–26 [23, 25], *sc1* 8–13 [12], *sc2* 11–20 [18, 19], *c1* 6–8 [7, 8], *c2* 6–11 [9], *c3* 10–16 [13, 14], *d1* 4–7 [5, 6], *d2* 6–9 [7, 9], *d3* 10–15 [12, 13], *e1* 4–8 [6, 7], *e2* 10–15 [14, 15], *e3* 17–22 [20], *f3* 20–24 [22, 23], *h1* 5–10 [7, 8], *h2* 20–24 [22, 23]. *Palps.* (Figs 13b, 14) Setal formula 0, 0, 0, 1, 3 (1s+2e). Tibial seta 9–12 [10] long; tarsal eupathidia 4–7 [5] long (thin, tapered; could be seta), 5–8 [6, 7] long (thick, blunt); solenidion 4–6 [5, 6] long.

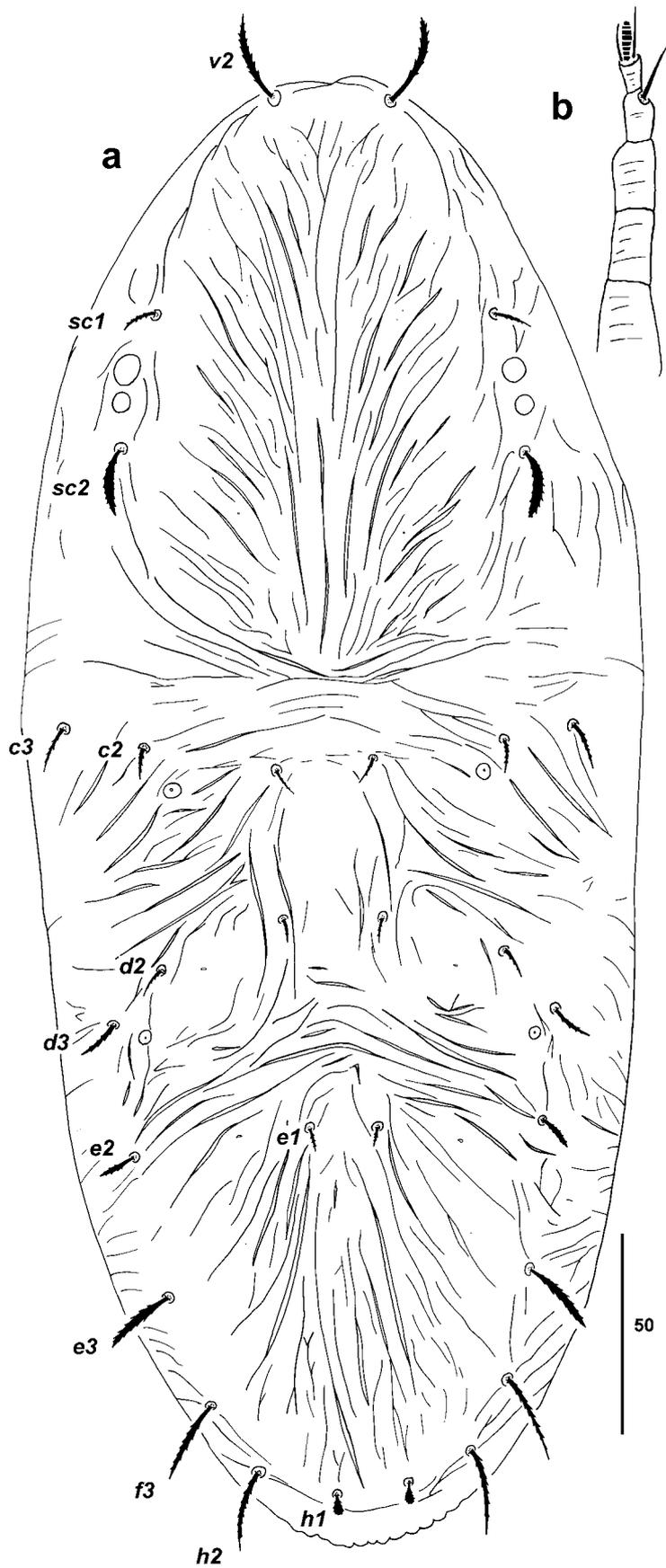


FIGURE 13. *Crossipalpus muellerianae* Smiley, Frost and Gerson, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

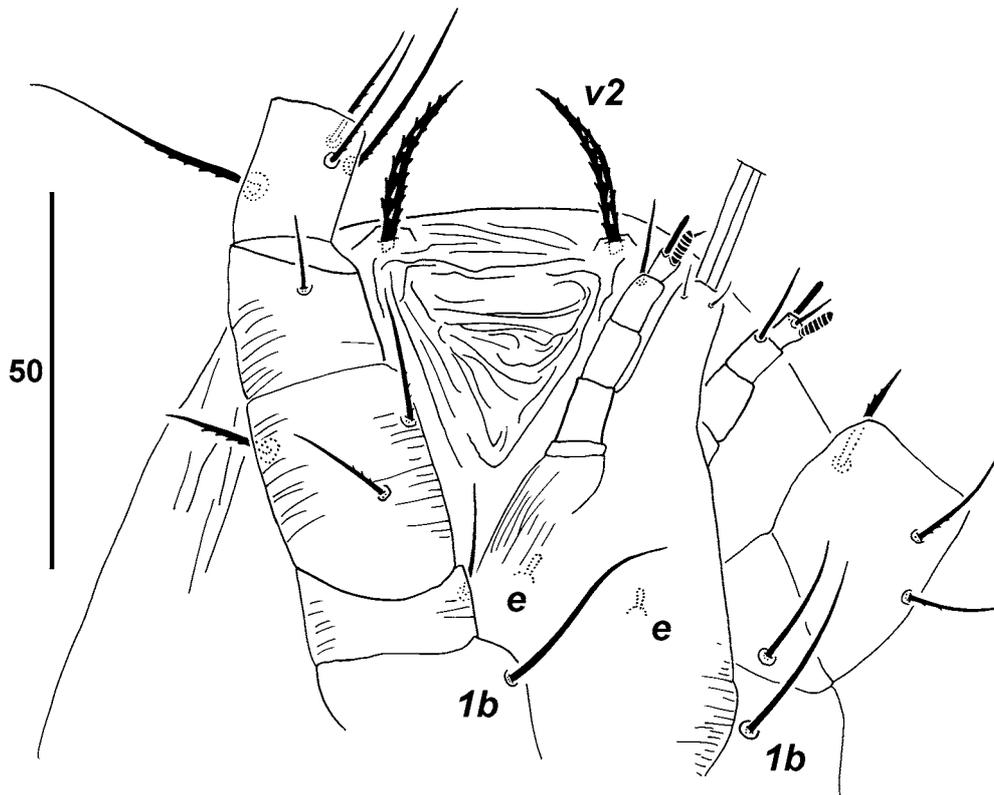


FIGURE 14. *Crossipalpus muellerianae* Smiley, Frost and Gerson, adult female, ventral view of anterior margin of prodorsum, with detail of palps.

Venter. (Figs 14, 15a) Ventral cuticle of anterior prodorsal margin with coarse striae forming triangular pattern (Fig. 14); cuticle between setae *1a-3a* with broadly separated transverse striae; fine longitudinal striae between setae *3a* to just posterior setae *4a*; narrow band of transverse striae ca. 10 wide posterior *4a*, then fine longitudinal striae to *ag*; oblique striae between *ag-ag* forming inverted “v” shape; coarse striae laterad genital region, longitudinal to oblique. Genital setae widely separated, inserted on posterior corners of genital flap in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital shield weakly developed, cuticle on genital flap between *g* setae with mixed oblique striae (*g1-g1* 33–36) anal setae *ps1-2* inserted in longitudinal line along inner edge of anal plates; seta *ps3* absent (Fig. 15a). Coxal, genital and anal setae fine, except *2c* thicker, weakly barbed; setae *1a, 3a, 4a* long, finely tapered, often broken and difficult to determine full length. Setal lengths: *1a* 48–82 [48, 57], *1b* 19–32 [22, 23], *2b* 17–29 [21, 26], *2c* 18–24 [18, 19], *3a* 38–81 [38], *3b* 17–25 [22], *4a* 40–78 [54], *4b* 17–28 [25, 28], *ag1* 10–16 [11], *g1* 19–26 [24], *g2* 18–25 [23], *ps1* 9–14 [14], *ps2* 9–14 [13]. *Spermatheca.* (Fig. 15b) Spermathecal tube long, distinctly broad near external opening, becoming narrow and convoluted distally, maximum 2 wide, ca. 110 long. Spermatheca vesicle 10–13 long, 2–3 wide proximally, 3–5 wide distally. Genital opening between setae *ps2* and posterior margin of genital flap. *Legs.* (Fig. 16) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-1-4-9(1), 2-1-3-1-4-9(1), 1-2-2-0-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 5–7 [6] long, ta II 4–6 [6] long) and 2 eupathidia $p\zeta'-p\zeta''$ (6–7 [6] long). Leg setation as in Table 1 except: coxae I without *1c*; genua I–II with *1''*, without *d*; tarsi I–IV with *tc''*. Setae *v'* added to tr IV.

MALE. Unknown.

DEUTONYMPH (n = 3). *Dorsum.* (Fig. 17) Body measurements: distance between setae *v2-h1* 285–305, *sc2-sc2* 83–91; other measurements: *v2-v2* 18–21, *sc1-sc1* 66–75, *c1-c1* 14–16, *c2-c2* 72–89, *c3-c3* 107–109, *d1-d1* 16–18, *d2-d2* 64–78, *d3-d3* 86–99, *e1-e1* 8–11, *e2-e2* 72–92, *e3-e3* 71–78, *f3-f3* 59–62, *h1-h1* 12–15, *h2-h2* 42–46. Prodorsal shield similar to female, but with fewer folds, with central longitudinal folds and sublateral oblique folds. Opisthosoma with widely separated transverse folds between *c1* and *e1*, and distinct oblique folds between *c2-c3*; paired minute pores present between *c1-c2*, *d1-d2* and laterad *e1*. Setal lengths: *v2* 29–35, *sc1* 6–10, *sc2* 13–20, *c1* 3–7, *c2* 4–7, *c3* 8–12, *d1* 3–5, *d2* 4–7, *d3* 9–11, *e1* 3–6, *e2* 9–15, *e3* 20–24, *f3* 22–26, *h1* 4–6, *h2* 22–25. *Palps.* Palps same as adult. Tibial seta 8–9 long; tarsal eupathidia 3–5 long (thin, blunt), 5–6 long (thick, blunt);

solenidion 3–5 long. *Venter*. Cuticle with striae similar to adult female. Coxal, genital and anal setae fine. Setal lengths: *1a* 35–49, *1b* 16–19, *2b* 12–18, *2c* 17–20, *3a* 34–40, *3b* 13–20, *4a* 35–41, *4b* 14–17, *agl* 8–11, *gl* 10–17, *ps1* 7–8, *ps2* 7–10. *Legs*. Setal formula for legs I–IV (coxae to tarsi) same as adult female except tr IV nude: 1-1-3-1-4-9(1), 2-1-3-1-4-9(1), 1-2-2-0-3-5, 1-0-1-0-3-5. Tarsi I and II each with 1 bulbous antiaxial solenidion ω'' (3-4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5–6 long). Leg setation as in adult except: tr IV without seta *v'*. Setae *v'* added to tr I–III.

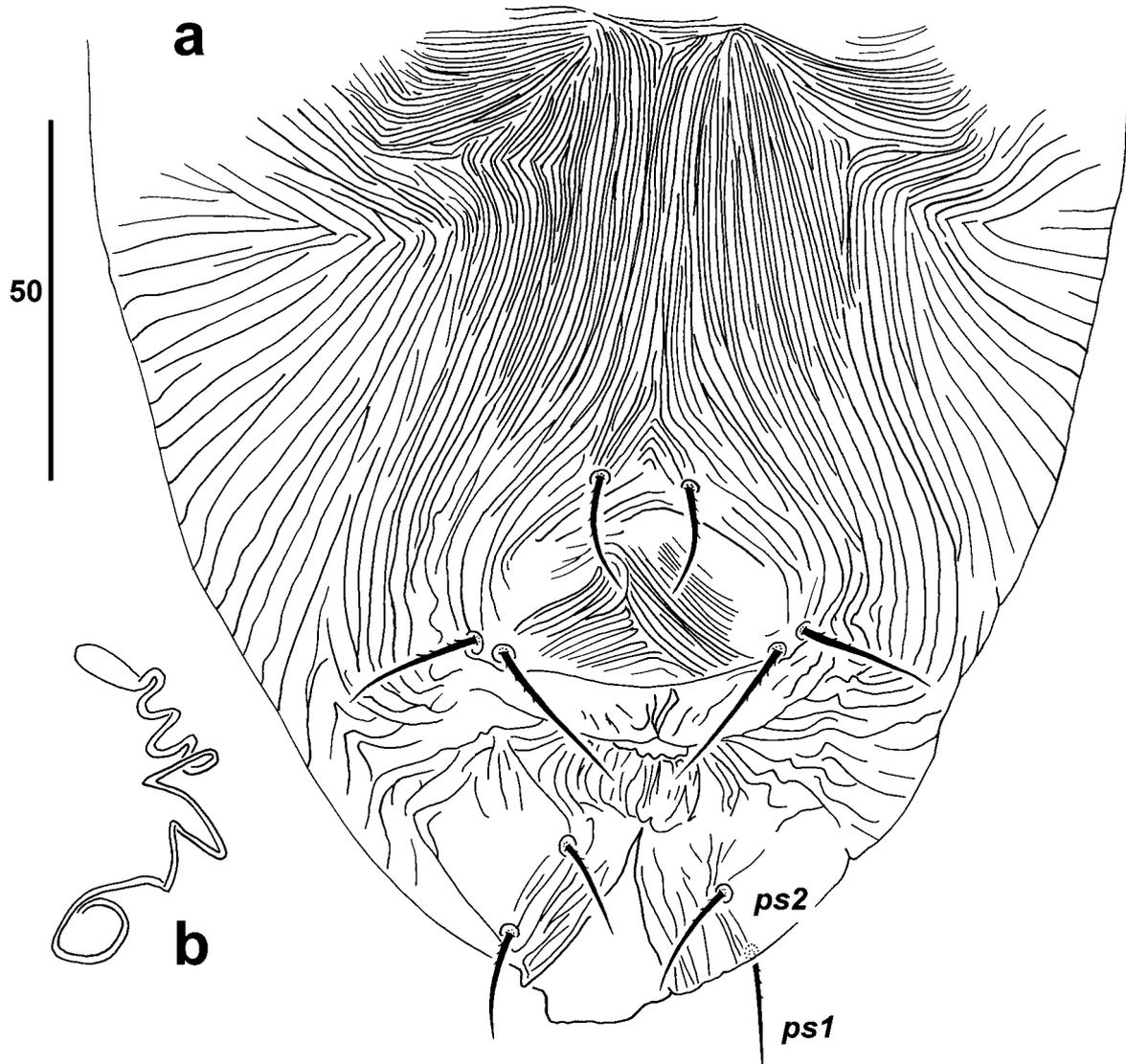


FIGURE 15. *Crossipalpus muellerianae* Smiley, Frost and Gerson, adult female, a. posterior venter; b. spermatheca.

PROTONYMPH (*n* = 3). *Dorsum*. Body measurements: distance between setae *v2-h1* 195–200, *sc2-sc2* 73–75; other measurements: *v2-v2* 18–19, *sc1-sc1* 57–60, *c1-c1* 11–13, *c2-c2* 62–64, *c3-c3* 93–100, *d1-d1* 12–14, *d2-d2* 56–58, *d3-d3* 74–77, *e1-e1* 6–8, *e2-e2* 65–68, *e3-e3* 51–55, *f3-f3* 41–43, *h1-h1* 9–11, *h2-h2* 23–25. Prodorsal shield similar to female, but with fewer and much weaker folds. Setal lengths: *v2* 24–25, *sc1* 6–7, *sc2* 11–14, *c1* 11–13, *c2* 5–7, *c3* 9–11, *d1* 4–5, *d2* 5–6, *d3* 7–10, *e1* 2–4, *e2* 10–12, *e3* 14–17, *f3* 16–18, *h1* 4–5, *h2* 18–21. *Palps*. Palps same as adult. Tibial seta 8 long; tarsal eupathidia both blunt 4, 5; solenidion 3–4 long. *Venter*. Cuticle with striae similar to adult. Coxal, genital and anal setae fine. Setal lengths: *1a* 28–39, *1b* 16–18, *2b* 15–16, *3a* 17–26, *3b* 11–14, *agl* 8, *ps1* 6–7, *ps2* 7–8. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-9(1), 1-0-3-0-4-9(1), 1-1-2-0-3-5, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 3–4 long, ta II 3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long). Leg setation as in deutonymph except: seta *2c* absent; seta *4b* absent; tr I–II without seta *v'*; ge I–II without seta *l''*; ta IV without setae *tc'*, *tc''*. Setae *l'* added to tr III.

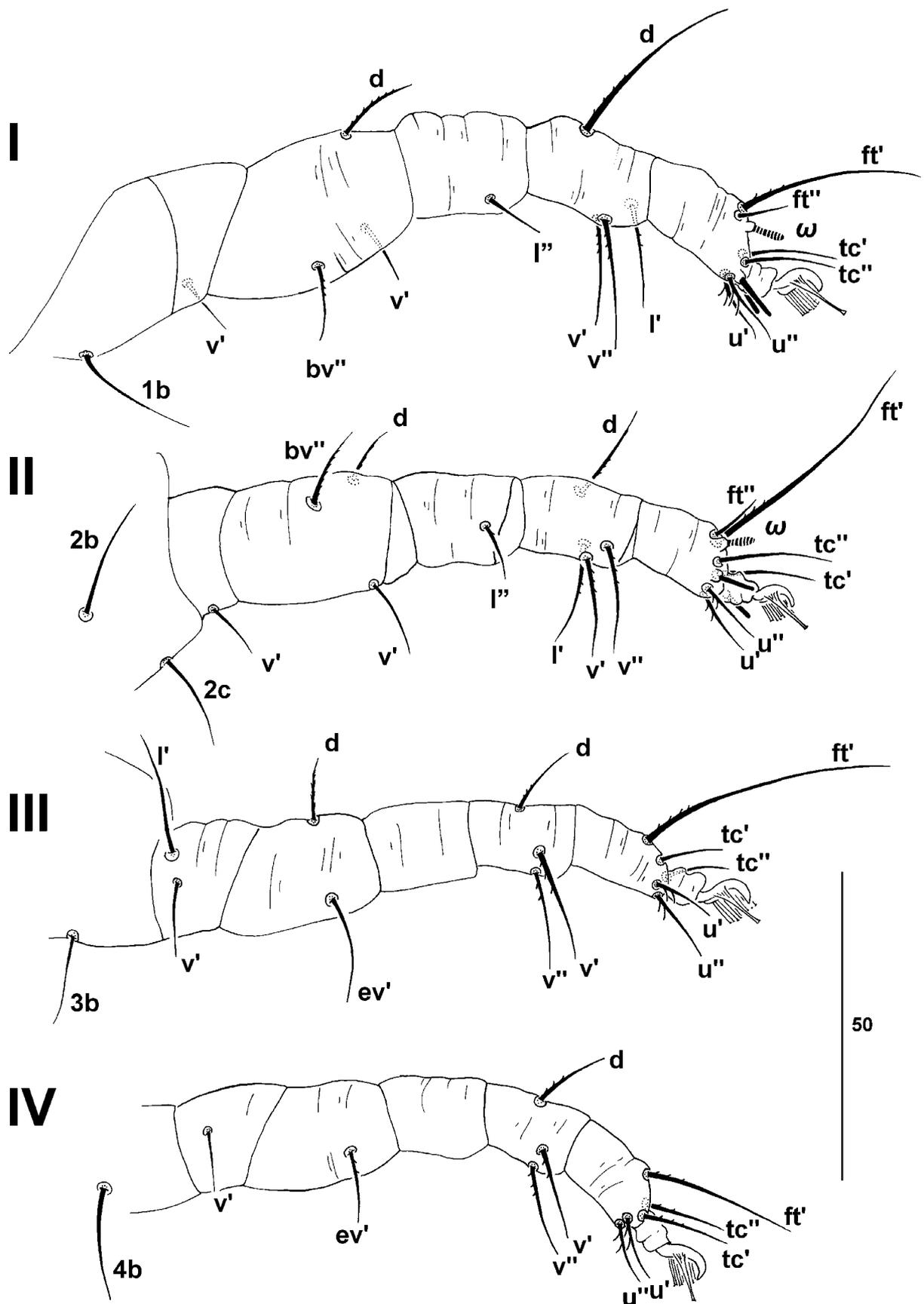


FIGURE 16. *Crossipalpus muellerianae* Smiley, Frost and Gerson, adult female, legs (left side, ventral view), eupathidia ($p\zeta'$ - $p\zeta''$) not labelled on legs I-II.

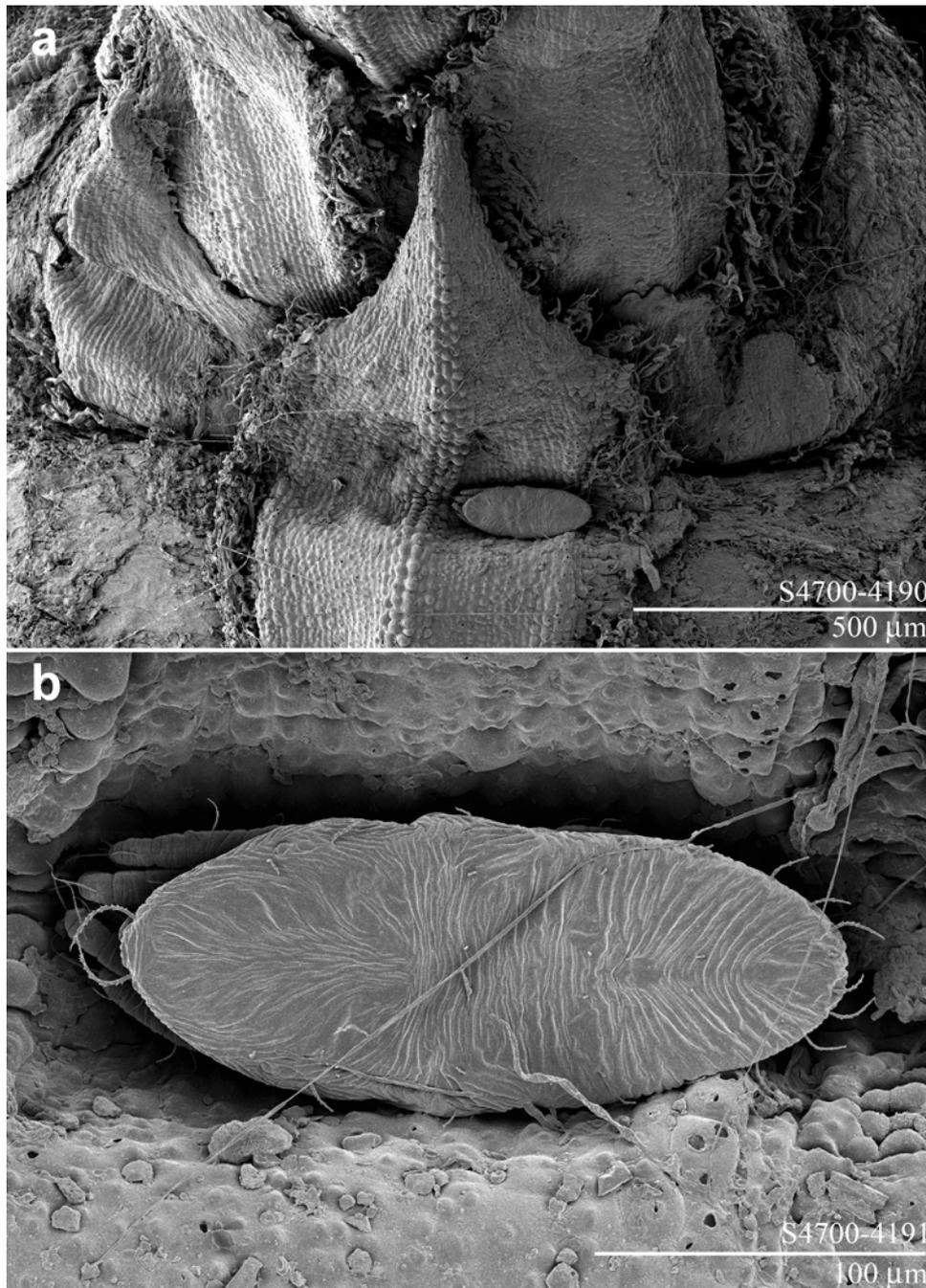


FIGURE 17. *Crossipalpus muellerianae* Smiley, Frost and Gerson, a. deutonymph in habitat; b. detail deutonymph dorsum.

LARVA (n = 2). *Dorsum*. (Fig. 18) Body measurements: distance between setae v2-h1 140–160, sc2-sc2 61–71; other measurements: v2-v2 11–15, sc1-sc1 47–55, c1-c1 10–11, c2-c2 55–58, c3-c3 82–90, d1-d1 13–15, d2-d2 43–49, d3-d3 59–61, e1-e1 7–9, e2-e2 49–57, e3-e3 36–50, f3-f3 21–28, h1-h1 5–9, h2-h2 10–15. Prodorsum with central area smooth to finely striate; lateral cuticle with coarse longitudinal to oblique striae. Opisthosomal cuticle with mostly transverse striae, with some longitudinal striae posteriorly. Setal lengths: v2 15–24, sc1 5–7, sc2 9–13, c1 4–5, c2 4–6, c3 7–8, d1 3–5, d2 4–8, d3 6–7, e1 3–4, e2 6–8, e3 10–13, f3 11–13, h1 4–5, h2 15–17. *Palps*. (Fig. 18) Palps same as adult. Tibial seta length 6–8; tarsal eupathidia 3–4 long (blunt), 4–5 long (blunt); solenidion 2–3 long. *Venter*: Striae transverse to anal area, becoming longitudinal and coarse around anal area. All setae fine. Setal lengths: 1a 21–37, 1b 10–18, 3a 22–33, ps1 6–7, ps2 5–8. *Legs*. (Fig. 18) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 bulbous antiaxial solenidion ω'' (2–3 long) and 2 eupathidia $p\zeta'$ - $p\zeta'''$ (4–5 long). Leg setation as in protonymph except: seta 2b absent; seta 3b absent; tr I–III nude; ta I–III without seta tc' , tc'' .

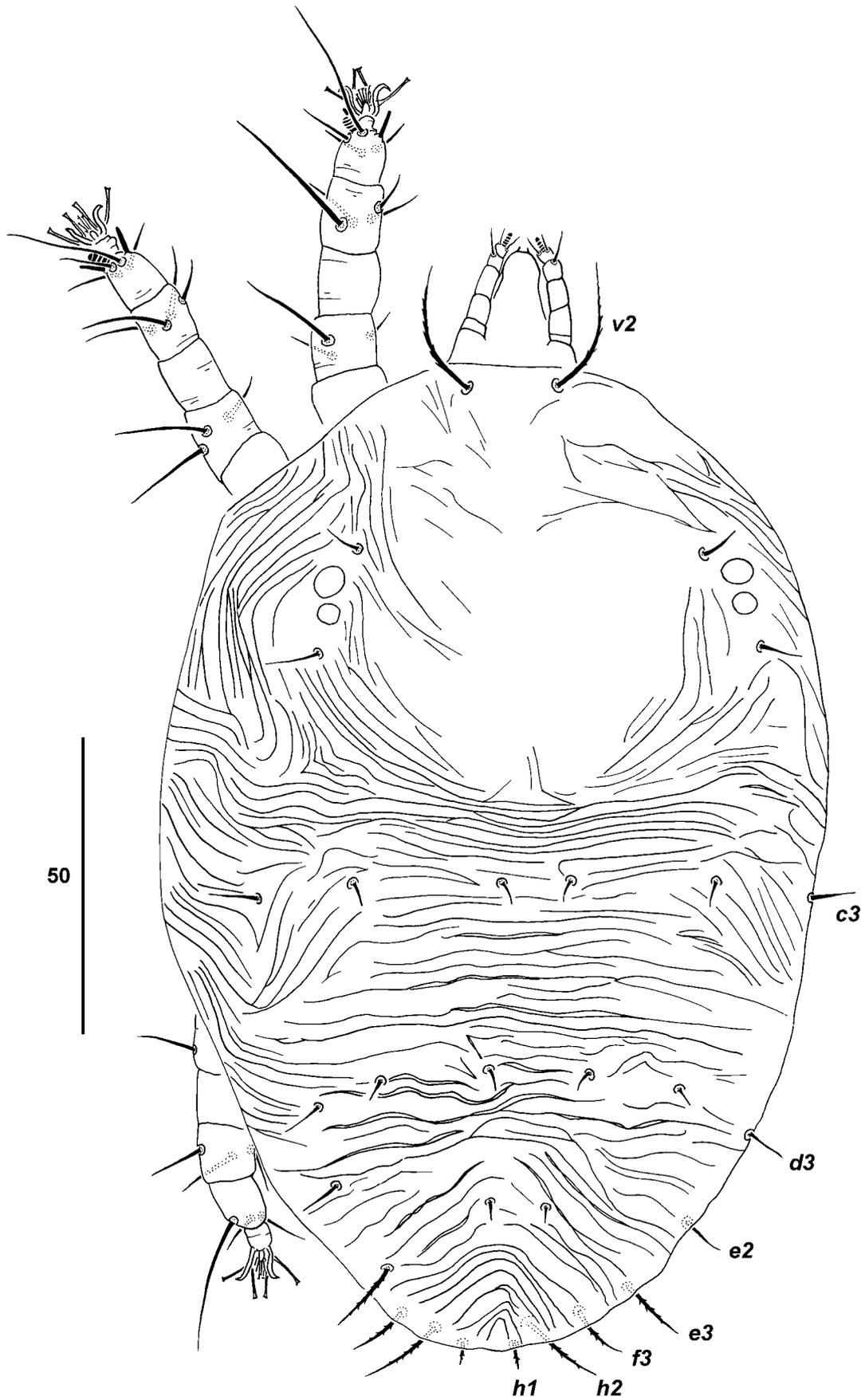


FIGURE 18. *Crossipalpus muellerianae* Smiley, Frost and Gerson, larva, dorsum with detail of legs and palp.

Remarks. Smiley *et al.* (1996) remarked that this species was unique with the adult female having tarsi I–IV 6(1)–6(1)–6–5. This is incorrect and the true count is 9(1)–9(1)–5–5. Individuals were found wedged within pits and crevices on the bark of stems of the host (Fig. 17).

This species is very similar to *Cr. verticillatae* but can be readily distinguished from it by the presence of setae *tc''* on tarsi I–IV (absent in *Cr. verticillatae*), the finer palpal segments (stout in *Cr. verticillatae*), palmate setae *h1* (lanceolate setae *h1* in *Cr. verticillatae*), and irregular dorsal reticulation (linear in *Cr. verticillatae*).

***Crossipalpus verticillatae* Smiley, Frost and Gerson, 1996**

(Figs 19–24)

Crossipalpus verticillatae Smiley, Frost and Gerson, 1996: 174, figs 16–18.

Type material examined. Holotype female ex. Drooping She-Oak *Allocasuarina verticillata* (Casuarinaceae), **AUSTRALIA:** South Australia, 10 km WNW Nairne, 09 September 1995, coll. W.E. Frost (WINC; 1 male paratype, deutonymph on same slide). Paratypes. 1 male, 1 deutonymph, same slide as holotype (WINC); 1 female, same data as holotype (WINC); 3 females, 1 male, and 1 deutonymph, ex. same host (tree #258) [feeding on bark of branchlets], **AUSTRALIA:** South Australia, Glen Osmond, Waite Institute Arboretum, 11 January 1996, coll. W.E. Frost (WINC; 1 slide); 1 female, 1 deutonymph, 4 protonymphs, and 3 larvae ex. same host [feeding on bark of branchlets], **AUSTRALIA:** South Australia, 8 km south of Harrogate, 34.57S 139.01E, 10 November 1995, W.E. Frost (WINC; one slide); 1 pharate female, 1 male, 3 deutonymphs, and 1 protonymph, same data (except 5 km south of Harrogate) (WINC; one slide).

Non-type material examined. 12 females, 1 male, 1 pharate male, 1 deutonymph, and 1 protonymph ex. *A. verticillata*, **AUSTRALIA:** South Australia, Adelaide, Athelston, Maryvale Road, Wadmore Park, 34°52'51"S 138°42'09"E, 21 April 2009, coll. J.J. Beard and C.J. Burwell (QM, USNM) (BRI voucher BRI [AQ818801]).

Diagnosis. Dorsal setae all broadly lanceolate, strongly barbed and subequal in length except *c1*, *d1*, *e1*, *h1* distinctly short; prodorsal setae *v2* subequal in length with *sc1*. Palpal segments as wide as long. Genua I–II with seta *l''*, without *d*; tarsi I–IV without seta *tc''*.

FEMALE (n = 18). *Dorsum*. (Fig. 19a) Body measurements: distance between setae *v2-h1* 310–330 [330]; *sc2-sc2* 105–110 [110]; other measurements: *v2-v2* 20–25 [20], *sc1-sc1* 87–93 [90], *c1-c1* 15–25 [19], *c2-c2* 120–130 [125], *c3-c3* 140–150 [140], *d1-d1* 17–19 [19], *d2-d2* 95–105 [95], *d3-d3* 120–130 [120], *e1-e1* 13–25 [21], *e2-e2* 110–115 [110], *e3-e3* 98–105 [98], *f3-f3* 78–89 [78], *h1-h1* 12–19 [12], *h2-h2* 52–61 [52]. Gnathosoma completely concealed beneath prodorsum; anterior margin of prodorsum rounded; setae *v2* often inserted ventrally under anterior margin of prodorsum (similar to Fig. 14). Prodorsal shield weakly developed with broadly separated longitudinal central folds and oblique lateral folds; cuticle with fine network of folds laterally. Narrow band of fine transverse striae anterior to *c1-c1*. Opisthosoma with pair of weakly developed mesonotal shields capturing setae *c1*, *c2*, *d1*, *d2*; weakly developed pygidial shield capturing *e1*, *e3*, *f2-3* and *h1-2* setae, with weak oblique folds; band of transverse folds between *d1-d1* and *e1-e1*; paired minute pores present between *c1-c2*, *d1-d2*, laterad *e1*. Lateral cuticle surrounding shields wrinkled. Most dorsal setae broadly lanceolate and barbed; setae *c1*, *d1*, *e1*, *h1* much shorter than other dorsal setae. Setal lengths: *v2* 15–20 [15, 19], *sc1* 17–20 [19, 20], *sc2* 19–22 [21, 22], *c1* 6–7 [6, 7], *c2* 13–17 [13, 16], *c3* 19–21 [19, 21], *d1* 6–8 [7, 8], *d2* 14–18 [14, 15], *d3* 19–24 [20, 21], *e1* 6–8 [6, 7], *e2* 17–22 [20, 21], *e3* 20–23 [20, 21], *f3* 20–22 [20, 22], *h1* 7–10 [7, 8], *h2* 19–22 [19, 22]. *Palps*. (Fig. 19b) Setal formula 0, 0, 0, 1, 3 (1s+2e). Tibial seta 8–10 [10] long; tarsal eupathidia 4–5 [5] long (thin, tapered), 5–6 [6] long (blunt); solenidion 5–6 [5]. *Venter*. (Fig. 20) Ventral cuticle of gnathosoma to setae *1a* transverse; striae longitudinal between *1a-1a*; striae between *1a-3a* transverse, between *3a-4a* longitudinal; transverse striae *4a* to just posterior *4a*, becoming longitudinal to *g1-2*; longitudinal striae laterad genital region. Genital setae not widely separated (25), inserted in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital shield weakly developed, cuticle on genital flap between *g* setae with longitudinal to oblique striae; anal setae *ps1-2* inserted in longitudinal line along inner edge of anal plates; seta *ps3* absent. Coxal, genital and anal setae fine and weakly barbed, except *2c* thicker and more strongly barbed; setae *1a*, *3a*, *4a* long, finely tapered, often broken and difficult to determine full length. Setal lengths: *1a* 52–59 [54, 58], *1b* 22–25 [22, 24], *2b* 21–25 [22, 24], *2c* 15–19 [15, 16], *3a* 45–68 [65, 68], *3b* 21–24 [21, 23], *4a* 46–52 [48, 51], *4b* 20–24 [22, 24], *ag1* 14–17 [14, 16], *g1* 21–25 [22, 23], *g2* 18–22 [20, 21], *ps1* 12–13 [12, 13], *ps2* 11–14 [11, 14]. *Spermatheca*. Spermatheca with a long coiled

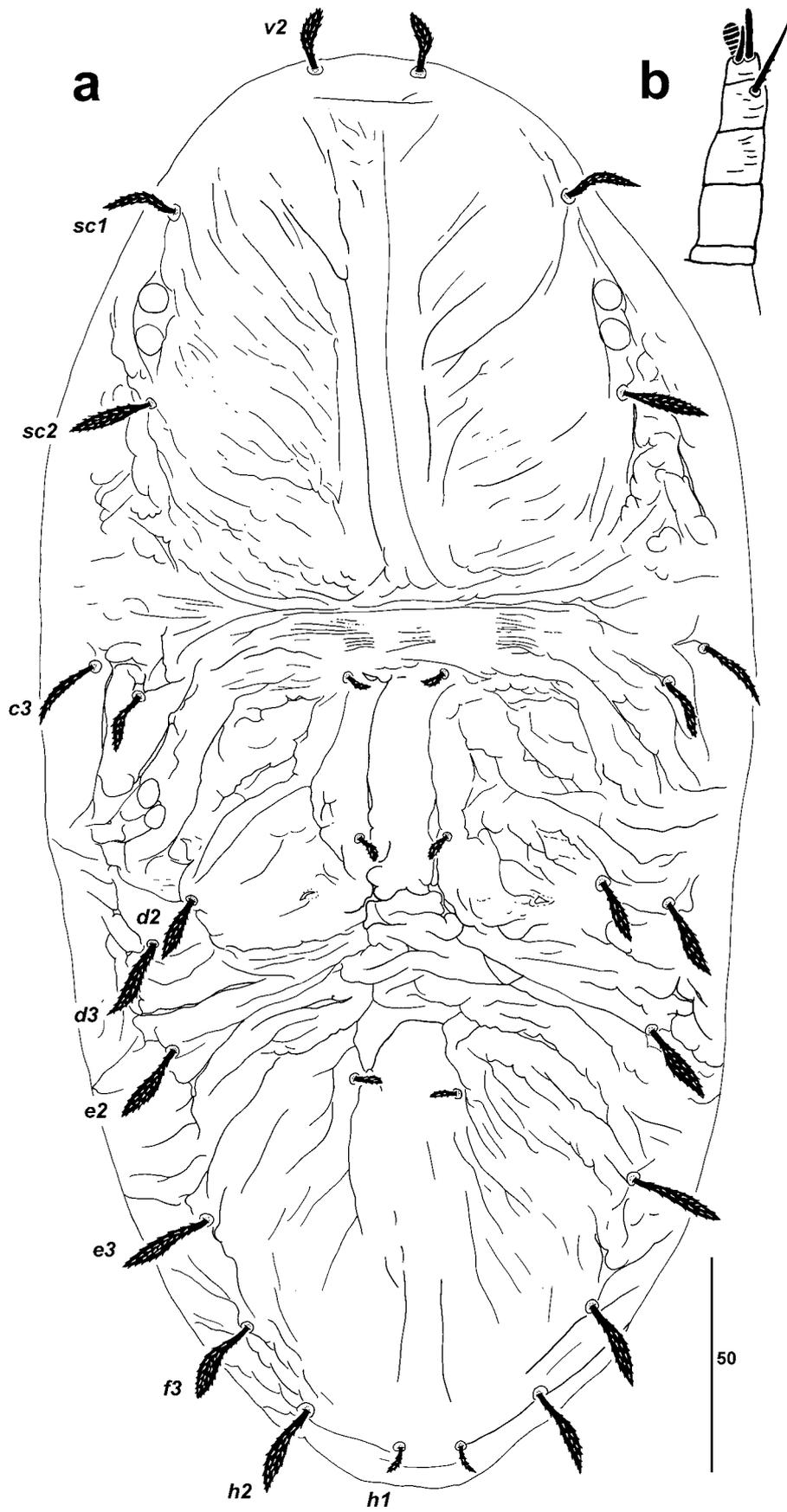


FIGURE 19. *Crossipalpus verticillatae* Smiley, Frost and Gerson, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

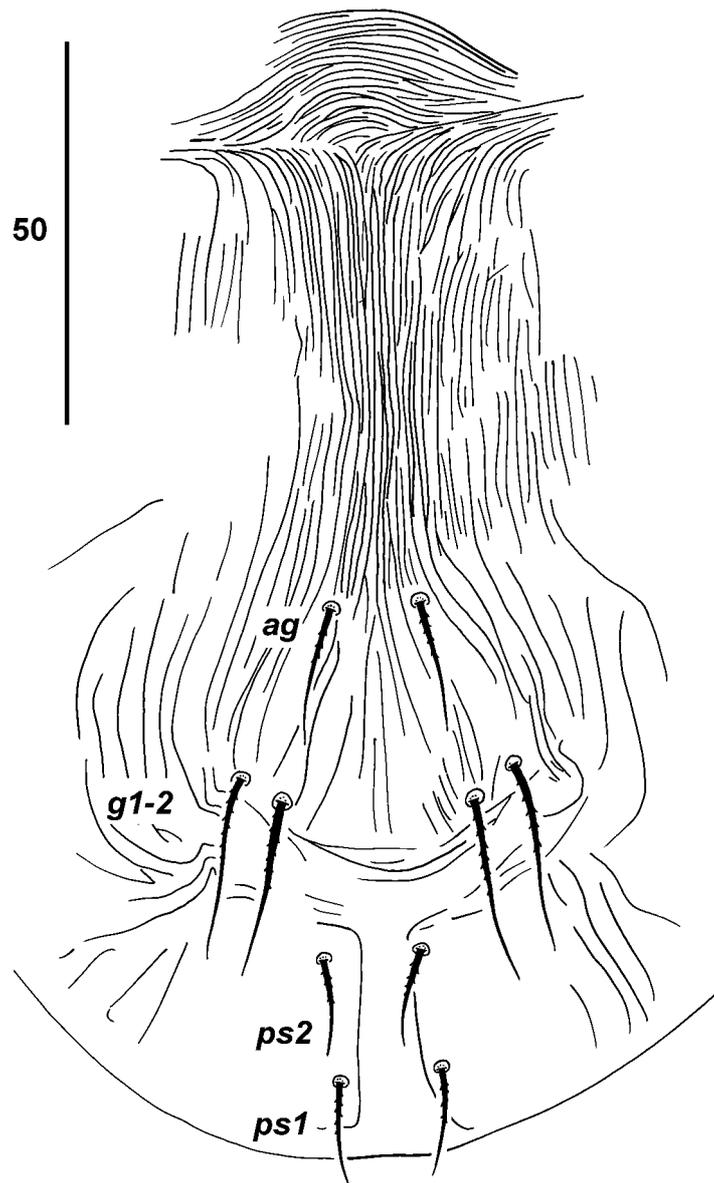


FIGURE 20. *Crossipalpus verticillatae* Smiley, Frost and Gerson, adult female, posterior venter.

tube, with some granular texture along its length; tightly coiled and multi-branched distally. Distal vesicle not visible. *Legs.* (Fig. 21) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-1-4-8(1), 2-1-3-1-4-8(1), 1-2-2-0-3-4, 1-1-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (6–7 [6] long) and 2 eupathidia $p\zeta'-p\zeta''$ (7–8 long). Leg setation as in Table 1 except: coxae I without *lc*; genua I–II with *l'*, without *d*; tarsi I–IV without *tc''*. Setae *v'* added to tr IV.

MALE (n = 5). *Dorsum.* (Fig. 22) Body measurements: distance between setae *v2-h1* 230–250, *sc2-sc2* 87–91; other measurements: *v2-v2* 12–18, *sc1-sc1* 61–66, *c1-c1* 14–21, *c2-c2* 96–105, *c3-c3* 110–117, *d1-d1* 8–12, *d2-d2* 74–79, *d3-d3* 90–96, *e1-e1* 11–13, *e2-e2* 77–80, *e3-e3* 74–77, *f3-f3* 61–67, *h1-h1* 6–10, *h2-h2* 38–42. Gnathosoma fully exposed, not concealed by anterior margin of prodorsum (Fig. 22). Four weak dorsal shields developed, separated by bands of transversely striate soft cuticle. Prodorsal shield similar to female. Mesonotal shield with 2 weak shields, weakly wrinkled or folded. Pygidial shield with weak longitudinal-oblique wrinkles or folds. Lateral cuticle surrounding shields with some weak papillae. Most dorsal setae short, lanceolate, barbed; setae *c1*, *d1* and *e1* much smaller than other setae. Setal lengths: *v2* 14–18, *sc1* 13–15, *sc2* 16–20, *c1* 5–6, *c2* 9–12, *c3* 12–14, *d1* 5–7, *d2* 9–13, *d3* 13–15, *e1* 5–8, *e2* 10–15, *e3* 14–16, *f3* 14–16, *h1* 7, *h2* 14–15. *Palps.* (Fig. 22) Palps similar to female, except solenidion greatly swollen; solenidion 7–8 long, eupathidia 6–8 long (blunt), 5–6 long (thin, tapered). *Venter.* (Fig. 23a) Cuticle with mostly transverse striae, with band of broadly separated transverse folds

just posterior to leg IV; broadly separated transverse folds between *ag* and *g1-2*. Pair of large rounded, weakly developed shields laterad setae *ag*. Coxal setae fine. Setae *1a*, *3a*, *4a* elongate, finely tapered, often broken. Setae *ag1*, *g1-2*, *ps2* weakly barbed; setae *ps1* modified, obviously thicker and stronger than *ps2*. Setal lengths: *1a* 37–49, *1b* 16–22, *2b* 15–22, *2c* 15–20, *3a* 34–68, *3b* 16–23, *4a* 31–63, *4b* 13–21, *ag1* 11–13, *g1* 11–14, *g2* 12–17, *ps1* 15–17, *ps2* 7–10. *Aedeagus*. (Fig. 23a) Narrow, sclerotised, finely tapered distally, 81–92. Membranous duct runs from inside aedeagus for about 40 then disappearing. *Legs*. (Fig. 23b) Legs similar to female, except solenidia obviously swollen. Tarsi I and II each with 1 antiaxial solenidion ω'' (10–11 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (7–9, 7–8 long).

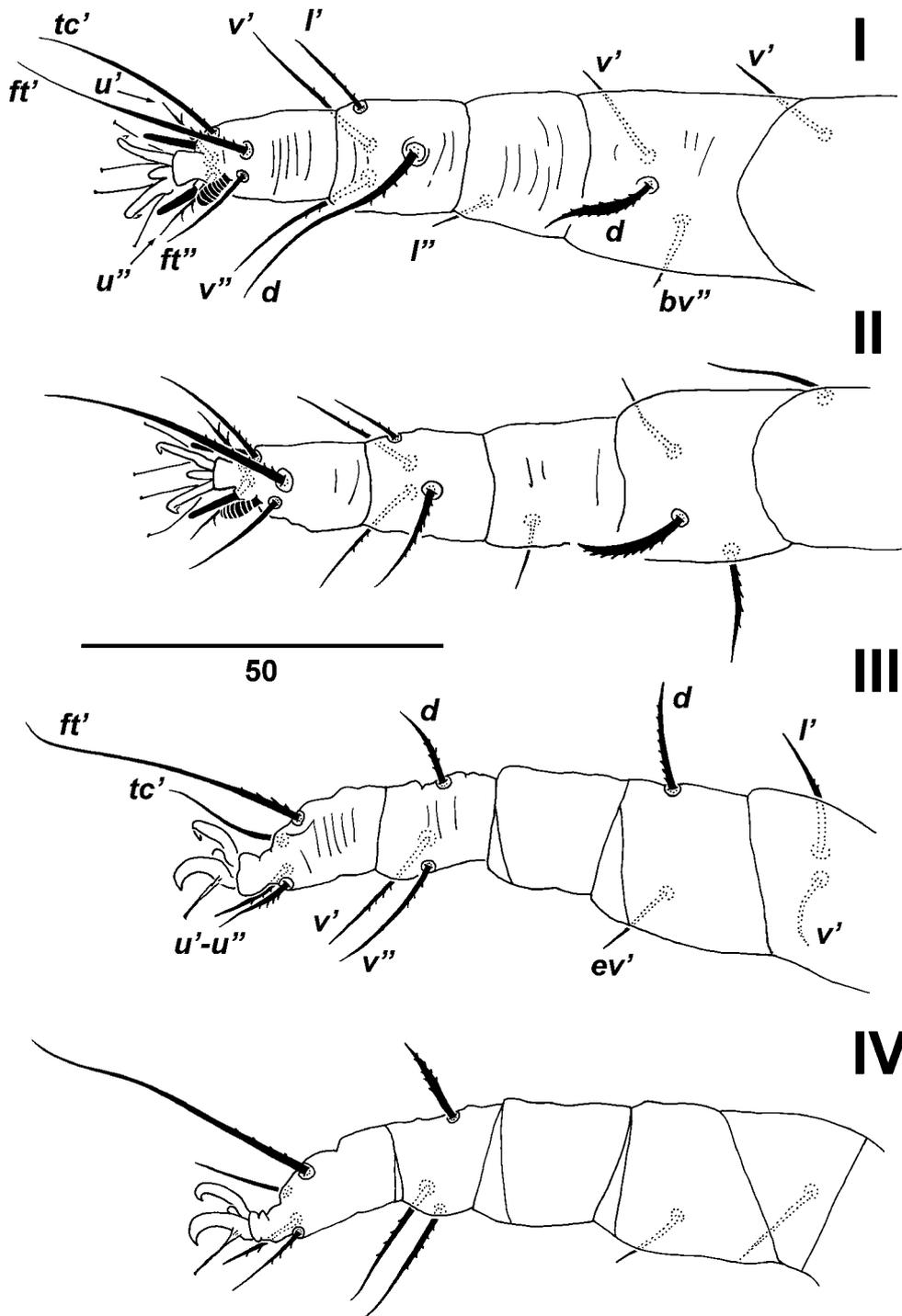


FIGURE 21. *Crossipalpus verticillatae* Smiley, Frost and Gerson, adult female, legs (left side), solenidion ω'' and eupathidia ($p\zeta''-p\zeta'''$) not labelled on leg I.

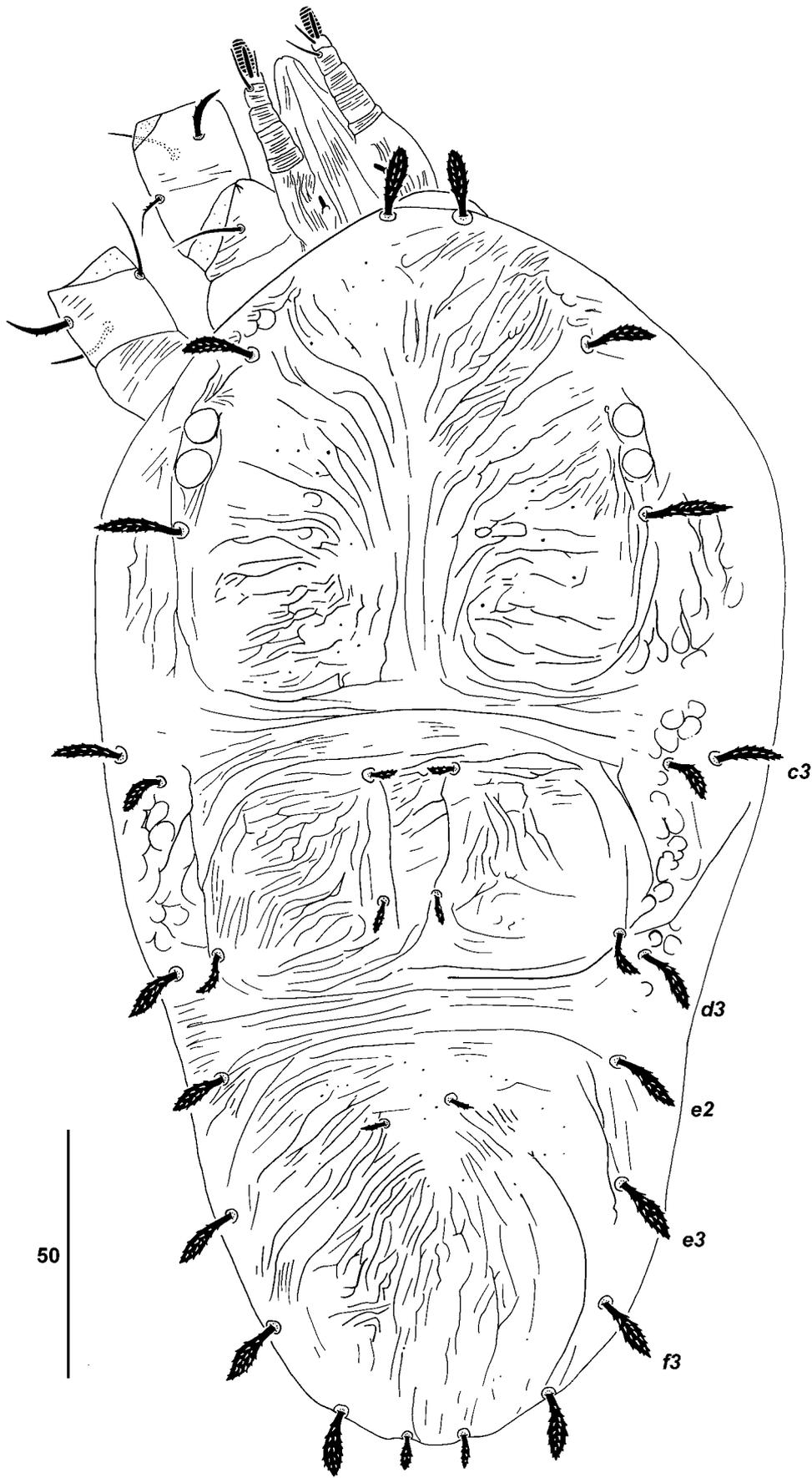


FIGURE 22. *Crossipalpus verticillatae* Smiley, Frost and Gerson, adult male dorsum, with detail of palps.

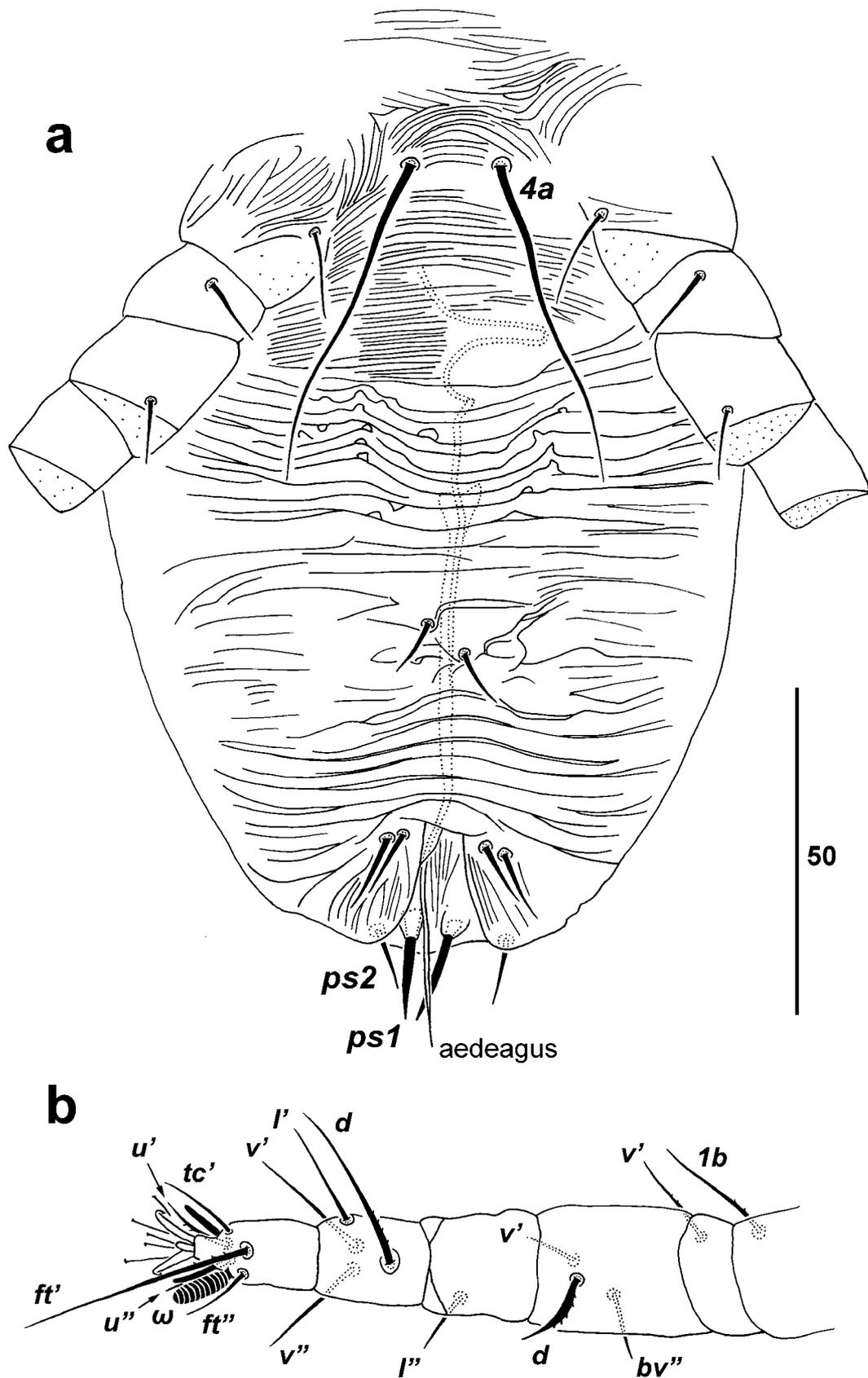


FIGURE 23. *Crossipalpus verticillatae* Smiley, Frost and Gerson, adult male, a. posterior venter, with detail of aedeagus; b. leg I (left side); eupathidia ($p\zeta^7$ - $p\zeta''$) not labelled.

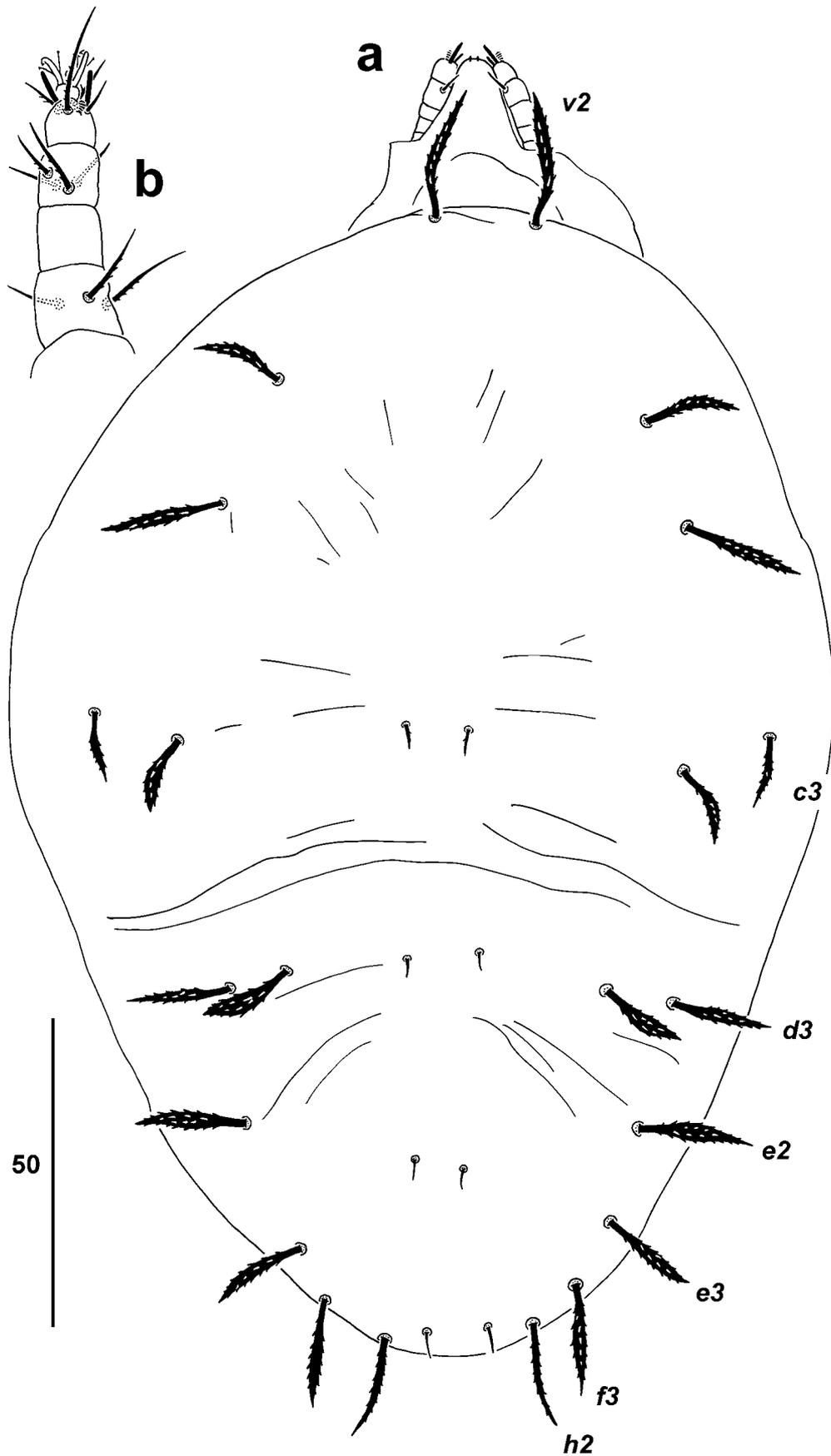


FIGURE 24. *Crossipalpus verticillatae* Smiley, Frost and Gerson, larva, a. dorsum, with details of palps; b. leg I.

DEUTONYMPH (n = 8). *Dorsum*. Body measurements: distance between setae *v2-h1* 250–295, *sc2-sc2* 84–100; other measurements: *v2-v2* 17–23, *sc1-sc1* 70–87, *c1-c1* 17–23, *c2-c2* 91–112, *c3-c3* 119–136, *d1-d1* 15–22, *d2-d2* 70–93, *d3-d3* 86–106, *e1-e1* 12–14, *e2-e2* 79–99, *e3-e3* 72–90, *f3-f3* 65–76, *h1-h1* 14–16, *h2-h2* 41–52. Dorsal shields with patterns similar to adult female. Setal lengths: *v2* 21–26, *sc1* 17–22, *sc2* 19–24, *c1* 5–7, *c2* 14–19, *c3* 16–22, *d1* 5–6, *d2* 16–21, *d3* 18–22, *e1* 5–7, *e2* 19–25, *e3* 20–24, *f3* 19–24, *h1* 6–8, *h2* 16–23. *Palps*. Palps same as adult. Tibial seta 8–9 long; tarsal eupathidia 4–5 long (thin, tapered), 5–7 long (thick, blunt); solenidion 3–4 long. *Venter*. Cuticle with longitudinal striae between *1a-1a*; transverse striae between *1a-4a*, with mixed striae *4a-4a*; transverse striae just posterior to *4a* becoming longitudinal to setae *g1*; transverse striae between *g1-ps1*, with longitudinal striae laterad genital region. Coxal setae fine and finely barbed, except setae *2c* thicker and more heavily barbed. Setal lengths: *1a* 31–52, *1b* 12–22, *2b* 12–21, *2c* 19–22, *3a* 32–57, *3b* 13–16, *4a* 20–42, *4b* 12–18, *ag1* 13–16, *g1* 12–19, *ps1* 9–13, *ps2* 10–15. *Legs*. Setal formula for legs I–IV (coxae to tarsi) same as adult female except tr IV nude: 1-1-3-1-4-8(1), 2-1-3-1-4-8(1), 1-2-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 6, 6 long; ta II 5–6, 5–6 long). Leg setation as in adult except: tr IV without seta *v'*. Setae *v'* added to tr I–III.

PROTONYMPH (n = 6). *Dorsum*. Body measurements: distance between setae *v2-h1* 190–250, *sc2-sc2* 75–91; other measurements: *v2-v2* 13–17, *sc1-sc1* 60–76, *c1-c1* 5–15, *c2-c2* 85–105, *c3-c3* 101–130, *d1-d1* 10–12, *d2-d2* 61–77, *d3-d3* 66–97, *e1-e1* 7–12, *e2-e2* 68–88, *e3-e3* 51–71, *f3-f3* 41–54, *h1-h1* 8–12, *h2-h2* 22–30. Prodorsal shield weakly developed, with similar cuticle pattern to female. Anterior opisthosoma with 2 pairs of weakly developed platelets, between *c1-c2* and *d1-d2*; platelets with few transverse folds. Setae in rows E, F, H inserted on weakly formed pygidial shield, with few oblique folds. Striae of idiosoma similar to deutonymph. Setal lengths: *v2* 22–24, *sc1* 14–18, *sc2* 17–20, *c1* 5–6, *c2* 12–17, *c3* 13–16, *d1* 4–5, *d2* 17–18, *d3* 15–19, *e1* 4–7, *e2* 19–22, *e3* 16–19, *f3* 16–19, *h1* 5–7, *h2* 17–18. *Palps*. Palps similar to deutonymph except tibial seta 6–8 long; tarsal eupathidia 3–4 long (thin, tapered), 4–5 long (thick, blunt); solenidion 3–4 long. *Venter*. Cuticle between *1a-1a* with longitudinal striae; striae *1a* and leg III with transverse striae; cuticle between leg III to IV with longitudinal striae; cuticle between legs IV transverse to oblique near *ag*; cuticle between *ag-ag* mixed; cuticle laterad genital-anal region longitudinal. Setal lengths: *1a* 25–54, *1b* 13–24, *2b* 15–16, *3a* 22–49, *3b* 10–14, *ag1* 9–13, *ps1* 7–9, *ps2* 7–9. Setae *2c*, *4a*, *4b*, *g1*, *g2* absent. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3–4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I with both 5–6 long; ta II 5–6, 4–6 long). Leg setation as in deutonymph except: seta *2c* absent; seta *4b* absent; tr I–III without seta *v'*; ge I–II without seta *l''*; ta IV without setae *tc'*. Setae *l'* added to tr III.

LARVA (n = 3). *Dorsum*. (Fig. 24a) Body measurements: distance between setae *v2-h1* 135–180, *sc2-sc2* 74–79; other measurements: *v2-v2* 13–15, *sc1-sc1* 56–60, *c1-c1* 8–10, *c2-c2* 72–80, *c3-c3* 104–108, *d1-d1* 9–10, *d2-d2* 49–51, *d3-d3* 70–71, *e1-e1* 7–8, *e2-e2* 62–65, *e3-e3* 49–65, *f3-f3* 33–41, *h1-h1* 6–9, *h2-h2* 18–28. Dorsal shields not developed; dorsal cuticle with few weak transverse folds. Lateral setae lanceolate, obviously barbed; central setae short, weakly barbed. Setal lengths: *v2* 22–25, *sc1* 14–16, *sc2* 19–21, *c1* 4–6, *c2* 12–14, *c3* 13–14, *d1* 4–7, *d2* 14–16, *d3* 15–19, *e1* 5, *e2* 13–19, *e3* 15–18, *f3* 16–19, *h1* 5–6, *h2* 15–20. *Palps*. (Fig. 24a) Palps same as deutonymph. Tibial seta 5–6 long; tarsal eupathidia 3, 4 long; solenidion 2–3 long. *Venter*. All setae fine. Setal lengths: *1a* 23–33, *1b* 11–19, *3a* 20–26, *ps1* 4–7, *ps2* 4–6. *Legs*. (Fig. 24b) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (2–3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*.

Remarks. This species is very similar to *Cr. muellerianae* but can be readily distinguished by lacking setae *tc'* on tarsi I–IV (present in *Cr. muellerianae*), the stouter palpal segments (finer in *Cr. muellerianae*), lanceolate setae *h1* (more palmate in *Cr. muellerianae*), and irregular dorsal reticulation (linear in *Cr. muellerianae*).

Crossipalpus gersoni Beard and Seeman sp. nov.

(Figs 25–31)

Type material examined. Holotype female ex. stems of *Allocasuarina luehmannii* (Casuarinaceae), AUSTRALIA: Queensland, near Mount Slopeaway, on the old Marlborough-Sarina Road, 22°52'16"S 149°50'28"E, 19 March 2005, coll. J.J. Beard and P.I. Forster (QM). Paratypes. 14 females, 6 males, 4 deutonymphs, 3 protonymphs, and 4 larvae, same data as holotype (QM, ANIC, USNM).

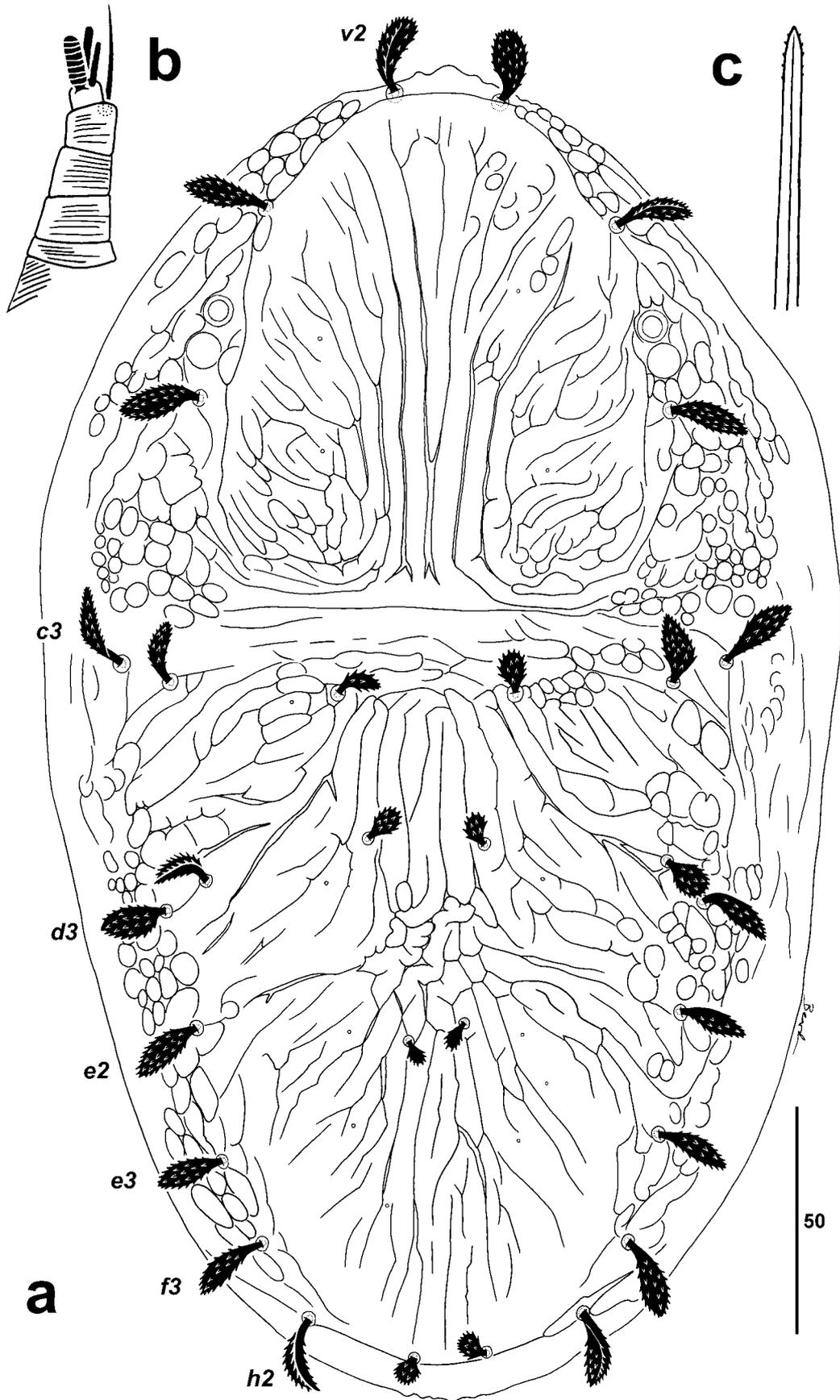


FIGURE 25. *Crossipalpus gersoni* Beard and Seeman, adult female, a. dorsum; b. detail of palp; c. detail of tips of combined stylets. Scale bar for b. and c. = 25 μ m.

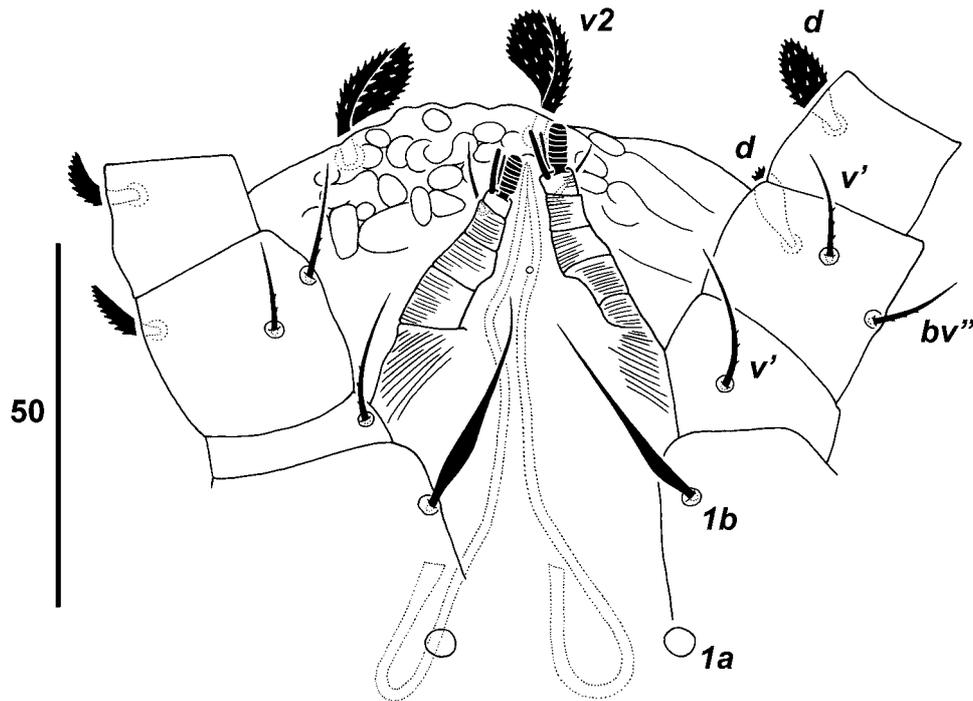


FIGURE 26. *Crossipalpus gersoni* Beard and Seeman, adult female, ventral view of anterior margin of prodorsum, with detail of palps.

Diagnosis. Dorsal setae short, broadly lanceolate, strongly barbed; dorsal setae subequal in length except *c1*, *d1*, *e1*, *h1* obviously shorter. Palpal segments as wide as long. Genua I–II with seta *d*, without *l''*; tarsi I–IV without seta *tc''*. Solenidia of male much thicker and longer than in female.

Female (n = 15). *Dorsum.* (Fig. 25a) Body measurements: distance between setae *v2-h1* 275–325 [325]; *sc2-sc2* 88–110 [110]; other measurements: *v2-v2* 19–22 [22], *sc1-sc1* 69–89 [89], *c1-c1* 29–37 [37], *c2-c2* 105–125 [125], *c3-c3* 125–145 [145], *d1-d1* 23–28 [28], *d2-d2* 89–110 [110], *d3-d3* 105–130 [130], *e1-e1* 6–17 [6], *e2-e2* 92–120 [120], *e3-e3* 83–100 [100], *f3-f3* 71–89 [89], *h1-h1* 14–18 [17], *h2-h2* 49–58 [58]. Gnathosoma completely concealed beneath prodorsum (Fig. 26). Anterior margin of prodorsum rounded. Seta *v2* inserted dorsally, though its setal base is sometimes partially concealed by an anterior fold (Fig. 25a). Prodorsal shield weakly developed with papillate-rugose sculpturing laterally, longitudinal grooves medially. Opisthosomal shield weakly developed with rugose to lineate pattern, becoming weakly rugose medially between setae *d1-e1*. Lateral cuticle surrounding shields rugose-papillate. Most dorsal setae broadly lanceolate, barbed; medial opisthosomal setae shorter than lateral setae, palmate. Setal lengths: *v2* 13–17 [17], *sc1* 15–19 [19], *sc2* 15–21 [21], *c1* 8–11 [11], *c2* 13–15 [15], *c3* 15–22 [22], *d1* 5–9 [9], *d2* 12–14 [14], *d3* 13–18 [18], *e1* 4–7 [7], *e2* 14–17 [17], *e3* 14–17 [17], *f3* 15–18 [18], *h1* 5–7 [7], *h2* 13–17 [17]. *Palps.* (Figs 25b, 26) Setal formula 0, 0, 0, 1, 3 (1s+2e). Tibial seta 6–8 [6] long; tarsal eupathidia 6 long, 5–6 [5] long; solenidium 5–6 [6] long. *Venter.* (Figs 26, 27a) Cuticle with fine transverse striae between setae *1a-3a*, longitudinal between setae *3a-4a*, then convex for 20–30, striae longitudinal posterior to setae *4a*; fine striae become coarse lateral to genital area. Genital setae inserted in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital shield smooth, poorly developed, ca. 15–20 [16] long, 35–40 [38] wide; anal setae *ps1-2* inserted medially on anal plates in longitudinal line; seta *ps3* absent. Coxal setae fine, except *2c* heavily barbed; setae *ag1*, *g1-2*, *ps1-2* lanceolate. Setal lengths: *1a* 44–55 [44], *1b* 20–26 [25], *2b* 13–19 [19], *2c* 14–17 [17], *3a* 35–50 [50], *3b* 12–22 [22], *4a* 40–46 [45], *4b* 13–17 [17], *ag1* 9–11 [11], *g1* 12–15 [15], *g2* 12–14 [13], *ps1* 7–11 [11], *ps2* 8–10 [10]. *Spermatheca.* (Fig. 27b) Spermathecal tube long, distinctly broad near external opening, becoming narrow and convoluted distally, maximum 2 wide, ca. 100 long. Thickened part of tube 52–56 long. Spermatheca vesicle not visible. Genital opening between setae *ps2*. *Legs.* (Fig. 28) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-1-4-8(1), 2-1-3-1-4-8(1), 1-2-2-0-3-4, 1-1-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidium ω'' (7–8 [8] long) and 2 eupathidia $p\zeta'-p\zeta''$ (6–7 [7] long, 6–8 [8] long). Leg setation as in Table 1 except: coxae I without *lc*; genua I–II with *d*, without *l'* and *l''*; tarsi I–IV without *tc''*. Setae *v'* added to tr IV.

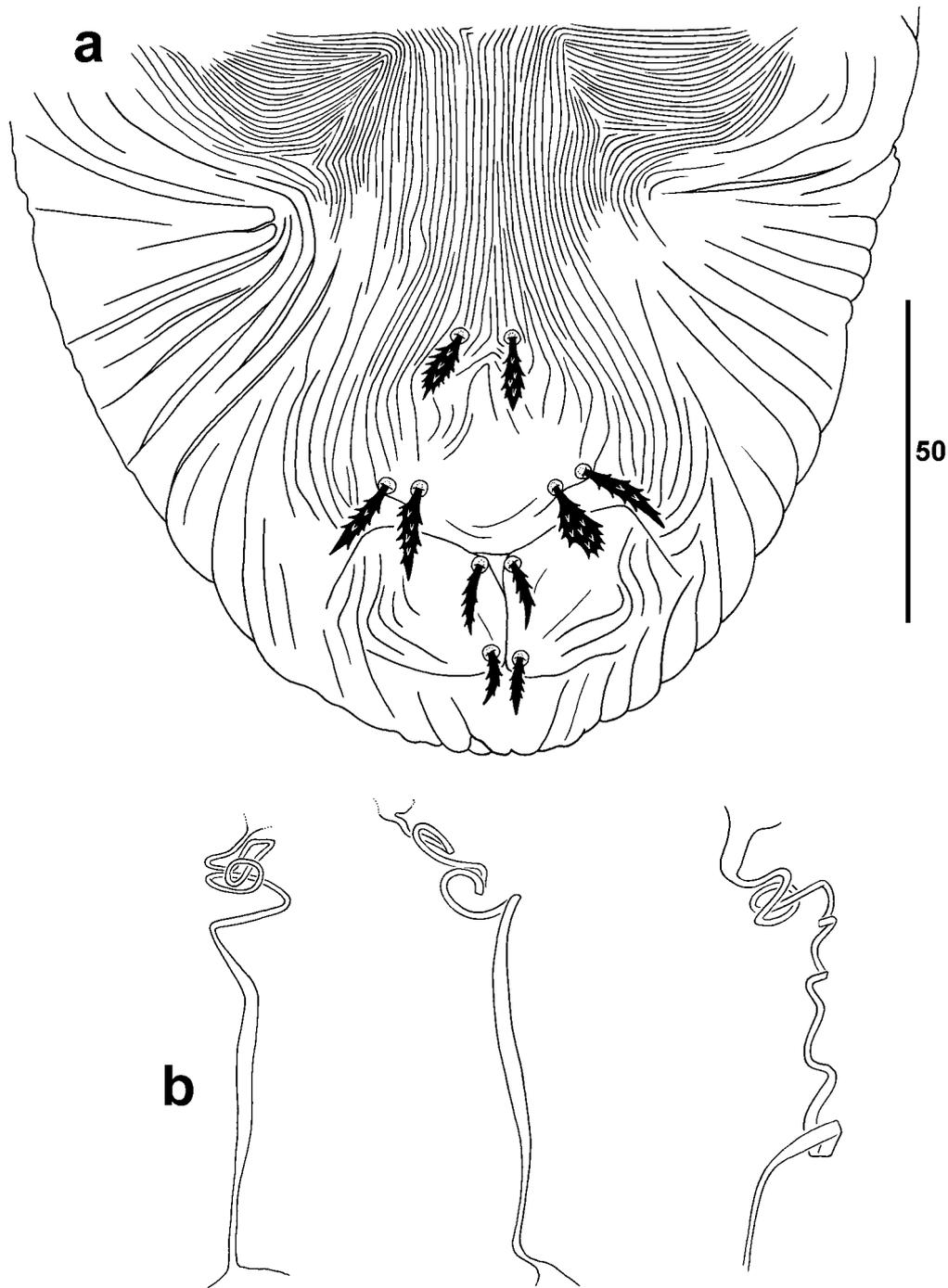


FIGURE 27. *Crossipalpus gersoni* Beard and Seeman, adult female, a. posterior venter; b. spermatheca.

MALE (6 paratypes). *Dorsum*. (Figs 29, 30a) Body measurements: distance between setae *v2-h1* 195–225, *sc2-sc2* 76–81; other measurements: *v2-v2* 11–13, *sc1-sc1* 56–63, *c1-c1* 25–28, *c2-c2* 78–87, *c3-c3* 99–110, *d1-d1* 10–14, *d2-d2* 68–71, *d3-d3* 79–87, *e1-e1* 7–8, *e2-e2* 67–71, *e3-e3* 61–65, *f3-f3* 52–58, *h1-h1* 8–10, *h2-h2* 30–40. Gnathosoma not concealed beneath prodorsum. Anterior margin of prodorsum smooth, weakly convex. Prodorsal shield weakly developed. Opisthosoma with mesonotal shield (appearing as a pair of shields) on which at least setae *c1*, *d1* and *d2* inserted, with weak rugose-lineate pattern; and pygidial shield with at least setae *e1*, *e3*, *f3*, *h2* inserted, with oblique-longitudinal weakly lineate pattern; setae *h1* often under posterior extension of pygidial shield (Fig. 30a); shields separated by transverse striae; cuticle laterad mesonotal shield papillate; several minute pores visible on shields. Setal lengths: *v2* 13–15, *sc1* 13–17, *sc2* 15–18, *c1* 9–11, *c2* 10–12, *c3* 12–17, *d1* 8–9, *d2* 10–12, *d3* 12–16, *e1* 5, *e2* 13–15, *e3* 12–16, *f3* 13–14, *h1* 6–7, *h2* 12–14. *Palps*. (Fig. 29) Palps similar to female.

Tibial seta 8 long; tarsal eupathidia 5–6, 6 long; solenidion 7 long. *Venter*. (Figs 30b, c) All striae transverse, becoming coarse on opisthogaster and weak around setae *agl*. Coxal setae fine, except *2c* narrowly lanceolate. Setae *agl*, *g2* thick, barbed; *g1*, *ps2* thin, barbed; setae *ps1* modified to form thick blades (sexually dimorphic) (Figs 29; 30a, b). Setal lengths: *1a* 33–40, *1b* 23–25, *2b* 18–20, *2c* 10–15, *3a* 42–45, *3b* 10–12, *4a* 36–45, *4b* 10–14, *agl* 7–10, *g1* 7–10, *g2* 10–11, *ps1* 13–16, *ps2* 6. *Aedeagus*. (Figs 30c, d) Narrow, sclerotised, tapering to a point, 55–61 long. Membranous duct runs from inside aedeagus, becoming indistinguishable. *Legs*. (Fig. 29) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 9–10 long, ta II 9 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 5–6, 6 long; ta II 6, 6 long). Solenidia much thicker and longer than in female.

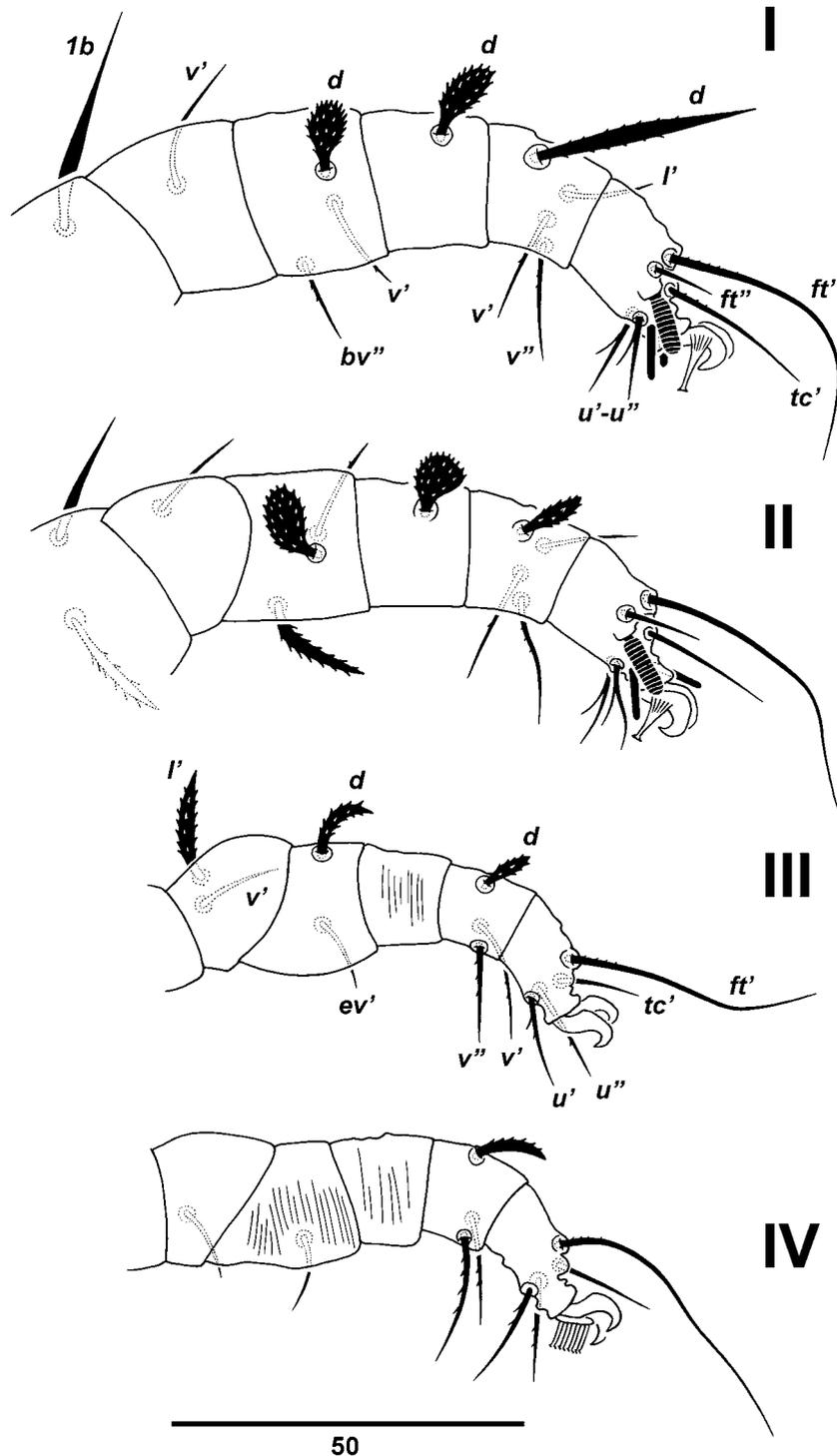


FIGURE 28. *Crossipalpus gersoni* Beard and Seeman, adult female, legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

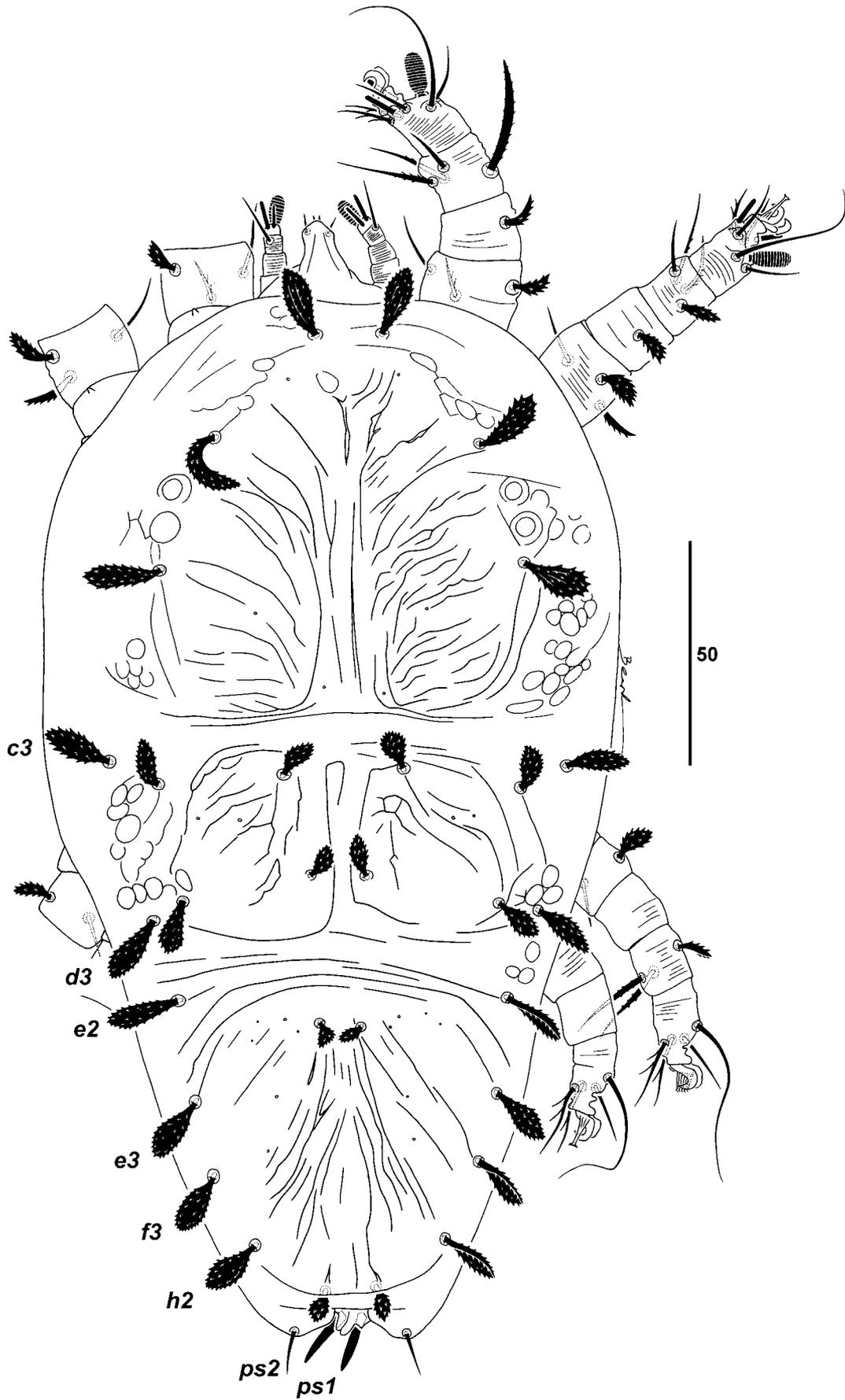


FIGURE 29. *Crossipalpus gersoni* Beard and Seeman, adult male, dorsum, with details of legs and palp.

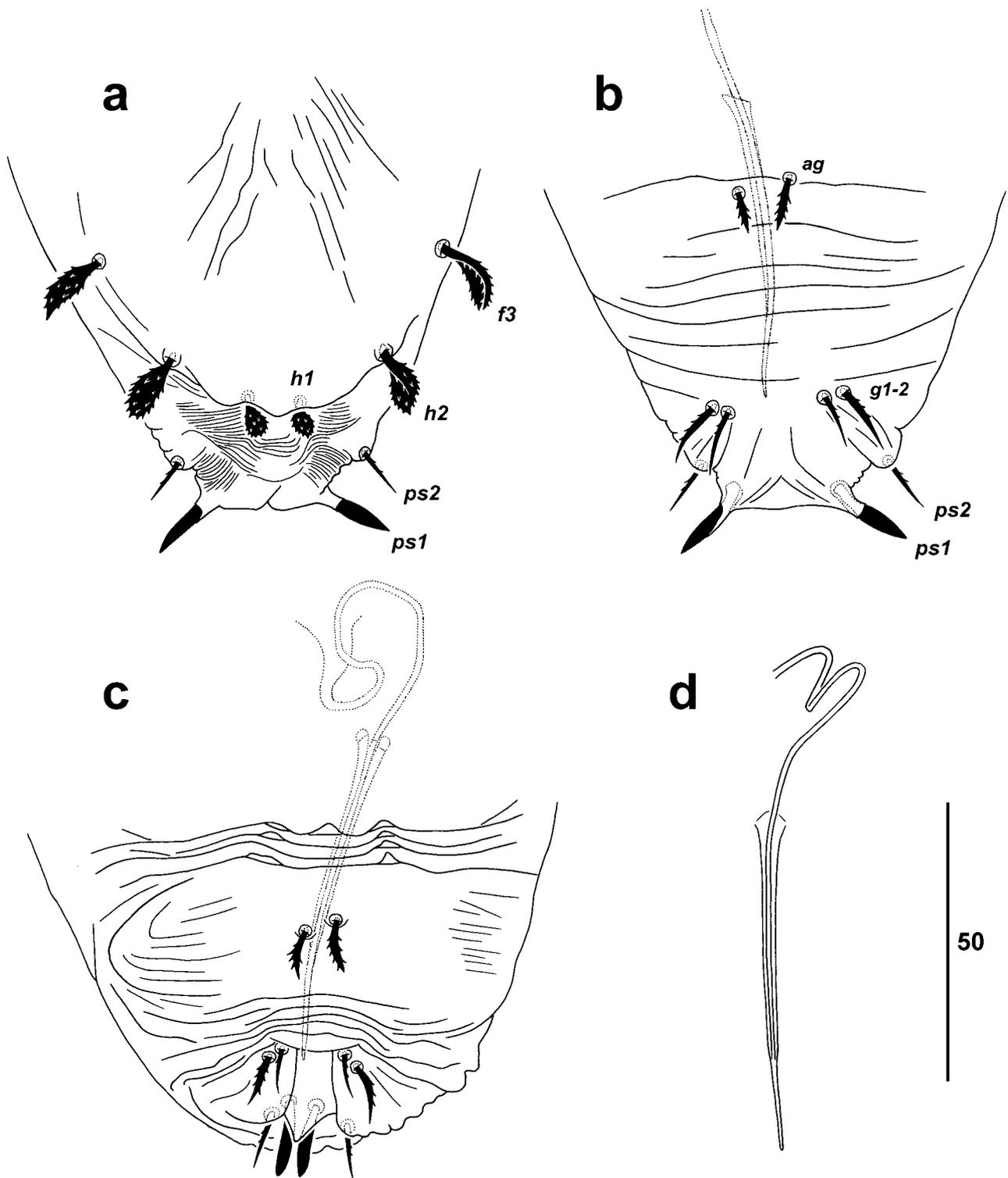


FIGURE 30. *Crossipalpus gersoni* Beard and Seeman, adult male, a. posterior dorsal opisthosoma with expanded genital opening; b. posterior venter with expanded genital opening (same individual as a.); c. posterior venter with retracted genital opening, and details of aedeagus; d. aedeagus.

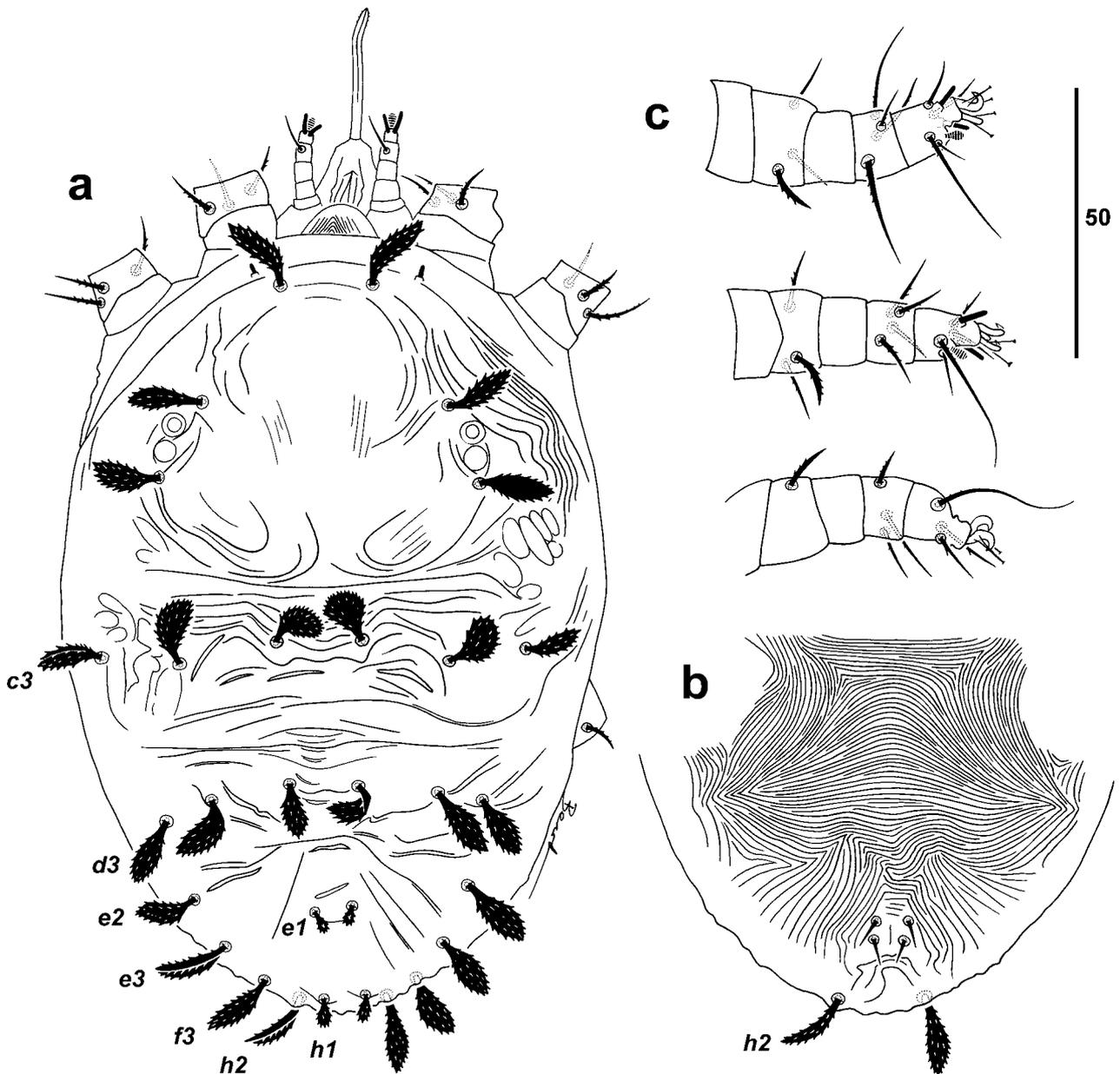


FIGURE 31. *Crossipalpus gersoni* Beard and Seeman, larva, a. dorsum, with details of palps; b. posterior venter; c. legs (right side).

DEUTONYMPH (4 paratypes). *Dorsum*. Body measurements: distance between setae $v2-h1$ 215–250, $sc2-sc2$ 71–87; other measurements: $v2-v2$ 18–22, $sc1-sc1$ 57–67, $c1-c1$ 22, $c2-c2$ 76–90, $c3-c3$ 97–113, $d1-d1$ 15–20, $d2-d2$ 56–68, $d3-d3$ 77–94, $e1-e1$ 7–11, $e2-e2$ 68–81, $e3-e3$ 62–78, $f3-f3$ 52–62, $h1-h1$ 11–13, $h2-h2$ 35–39. Prodorsal shield weakly developed with oblique-longitudinal striations. Opisthosoma with setae $c1$, $d1$ and $d2$ on paired, weak platelets. Striae transverse, becoming convex posteriorly. Setal lengths: $v2$ 12–18, $sc1$ 16–17, $sc2$ 16–20, $c1$ 11–13, $c2$ 14–17, $c3$ 13–16, $d1$ 8–11, $d2$ 13–17, $d3$ 14–17, $e1$ 5, $e2$ 14–17, $e3$ 14–15, $f3$ 13–15, $h1$ 6–8, $h2$ 13–16. *Palps*. Palps similar to adult. Tibial seta 6 long; tarsal eupathidia 3, 4 long, solenidion 4 long. *Venter*: Cuticle with transverse striae anteriorly, longitudinal between setae $3a-4a$, then transverse, becoming concave, to $ag1$, then transverse and coarse to posterior margin. Coxal setae fine, except $2c$ barbed; setae $ag1$ narrowly lanceolate, $g1$ barbed. Setal lengths: $1a$ 35–40, $1b$ 12–16, $2b$ 11–17, $2c$ 12–14, $3a$ 26–36, $3b$ 10–15, $4a$ 27–30, $4b$ 10–15, $ag1$ 8–10, $g1$ 8–12, $ps1$ 6–8, $ps2$ 6–8. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-1-3-1-4-8(1), 2-1-3-1-4-8(1), 1-2-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 4–6 long, ta II 4–5 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (5, 5–6 long). Leg setation as in adult except: tr IV without seta v' . Setae v' added to tr I–III.

PROTONYMPH (3 paratypes). *Dorsum*. Body measurements: distance between setae *v2-h1* 158–181, *sc2-sc2* 64–70; other measurements: *v2-v2* 16–19, *sc1-sc1* 52–57, *c1-c1* 16–24, *c2-c2* 63–76, *c3-c3* 97–99, *d1-d1* 16–17, *d2-d2* 49–51, *d3-d3* 67–73, *e1-e1* 6, *e2-e2* 64–67, *e3-e3* 57–61, *f3-f3* 43–44, *h1-h1* 22–24, *h2-h2* 7–9. Prodorsal shield weakly developed. Opisthosoma with setae *c1*, *d1* and *d2* on paired, weak platelets. Striae of idiosoma similar to deutonymph. Setal lengths: *v2* 13–15, *sc1* 14–15, *sc2* 14–15, *c1* 12–13, *c2* 14–16, *c3* 13–14, *d1* 11, *d2* 13–14, *d3* 14, *e1* 4–5, *e2* 12, *e3* 14–15, *f3* 9–13, *h1* 4–5, *h2* 9–15. *Palps*. Palps similar to deutonymph except solenidion 3 long. *Venter*. Same as deutonymph. Coxal setae fine, except *2b*, *agl* barbed. Setal lengths: *1a* 36, *1b* 11–13, *2b* 13–16, *3a* 30, *3b* 9, *agl* 7, *ps1* 5, *ps2* 5–6. Setae *2c*, *4a*, *4b*, *g1*, *g2* absent. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5, 4–5 long). Leg setation as in deutonymph except: seta *2c* absent; seta *4b* absent; tr I–III without seta *v'*; ge I–II without seta *d*; ta IV without setae *tc'*. Setae *l'* added to tr III.

LARVA (4 paratypes). *Dorsum*. (Fig. 31) Body measurements: distance between setae *v2-h1* 130–150, *sc2-sc2* 55–60; other measurements: *v2-v2* 13–15, *sc1-sc1* 43–49, *c1-c1* 12–16, *c2-c2* 51–55, *c3-c3* 84–85, *d1-d1* 13–15, *e1-e1* 4–5, *e2-e2* 57–62, *e3-e3* 38–44, *f3-f3* 11–13, *h1-h1* 5–7, *h2-h2* 10–13. Prodorsal shield weakly formed, 58–60 long, 61–66 wide, with few irregular striations. Opisthosomal shields absent; coarse, irregular transverse striae becoming oblique posteriorly. Setal lengths: *v2* 11–14, *sc1* 12–13, *sc2* 14–15, *c1* 10, *c2* 12–14, *c3* 11, *d1* 9–11, *d2* 11–14, *d3* 11–13, *e1* 3–4, *e2* 11–15, *e3* 11–12, *f3* 11–13, *h1* 4–5, *h2* 11–14. *Palps*. (Fig. 31a) Palps same as deutonymph. Tibial seta 5–6 long; tarsal eupathidia 2, 3 long, solenidion 2–3 long. *Venter*. (Fig. 31b) Striation same as deutonymph. All setae fine. Setal lengths: *1a* 17–27, *1b* 9–13, *3a* 25–33, *ps1* 4–5, *ps2* 4–5. *Legs*. (Fig. 31c) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 4, 4 long; ta II 5, 5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*.

Etymology. It is with great pleasure that we name this species for our colleague and friend Prof. Uri Gerson, in recognition of his acarological works, especially those on the Tegopalpinae.

Remarks. *Crossipalpus gersoni* **sp. nov.** was found on Bull-Oak *Allocasuarina luehmannii* in *Eucalyptus fibrosa* woodland on red soil, with vine thicket in small patches.

This species is similar to *Cr. raveni* **sp. nov.**, as they both have seta *d* present on ge I–II, but *Cr. gersoni* has spatulate setae *d* on femora and genua I–II (lanceolate in *Cr. raveni*), and posterior ventral setae are thick, broadly lanceolate and strongly barbed (thin, setiform and weakly barbed in *Cr. raveni*).

***Crossipalpus raveni* Beard and Seeman sp. nov.**

(Figs 32–37)

Type material examined. Holotype female ex. Woolly Oak *Allocasuarina inophloia* (Casuarinaceae), AUSTRALIA: Queensland, Moonie Highway, 90 km W Moonie, 27°56'57"S 149°31'19"E, 05 May 2007, coll. J.J. Beard and P.I. Forster (QM; BRI voucher PIF32483). Paratypes. 9 females, 5 males, and 4 larvae, same data as holotype (QM, ANIC, USNM).

Diagnosis. Dorsal setae lanceolate, strongly barbed; setae *e1* shortest. Palpal segments as wide as long. Genua I–II with seta *d*, without *l''*; tarsi I–IV without *tc''*. Solenidia of male much thicker and longer than in female.

FEMALE (n = 10). *Dorsum*. (Fig. 32a) Body measurements: distance between setae *v2-h1* 310–365 in 9 paratypes [355]; *sc2-sc2* 100–110 [110]; other measurements: *v2-v2* 22–24 [24], *sc1-sc1* 86–98 [98], *c1-c1* 15–22 [22], *c2-c2* 100–115 [115], *c3-c3* 125–145 [135], *d1-d1* 14–21 [21], *d2-d2* 85–95 [94], *d3-d3* 110–120 [120], *e1-e1* 14–18 [16], *e2-e2* 100–110 [110], *e3-e3* 89–100 [95], *f3-f3* 70–80 [73], *h1-h1* 12–17 [13], *h2-h2* 35–54 [48]. Gnathosoma completely concealed beneath prodorsum. Anterior margin of prodorsum rounded. Prodorsal shield weakly developed with oblique grooves laterally, longitudinal grooves medially. Opisthosomal shield weakly developed with oblique-longitudinal lineate grooves, becoming transverse between setae *d1-e1*. Lateral cuticle surrounding shields smooth. Dorsal setae lanceolate, barbed; setae *e1* shorter than other setae. Setal lengths: *v2* 21–25 [22], *sc1* 20–25 [20], *sc2* 20–22 [20], *c1* 15–19 [15], *c2* 14–20 [16], *c3* 17–21 [18], *d1* 12–19 [15], *d2* 14–21 [18], *d3* 17–21 [18], *e1* 7–9 [8], *e2* 17–24 [19], *e3* 17–24 [20], *f3* 18–23 [21], *h1* 9–12 [11], *h2* 21–24 [21]. *Palps*. (Fig. 32b) Setal formula 0, 0, 0, 1, 3 (1s+2e). Tibial seta 9–11 [9] long; tarsal eupathidia 6 [6], 5 [5] long; solenidion 4–5 [4] long. *Venter*. (Fig. 33a) Cuticle with fine transverse striae between setae *1a-3a*, longitudinal

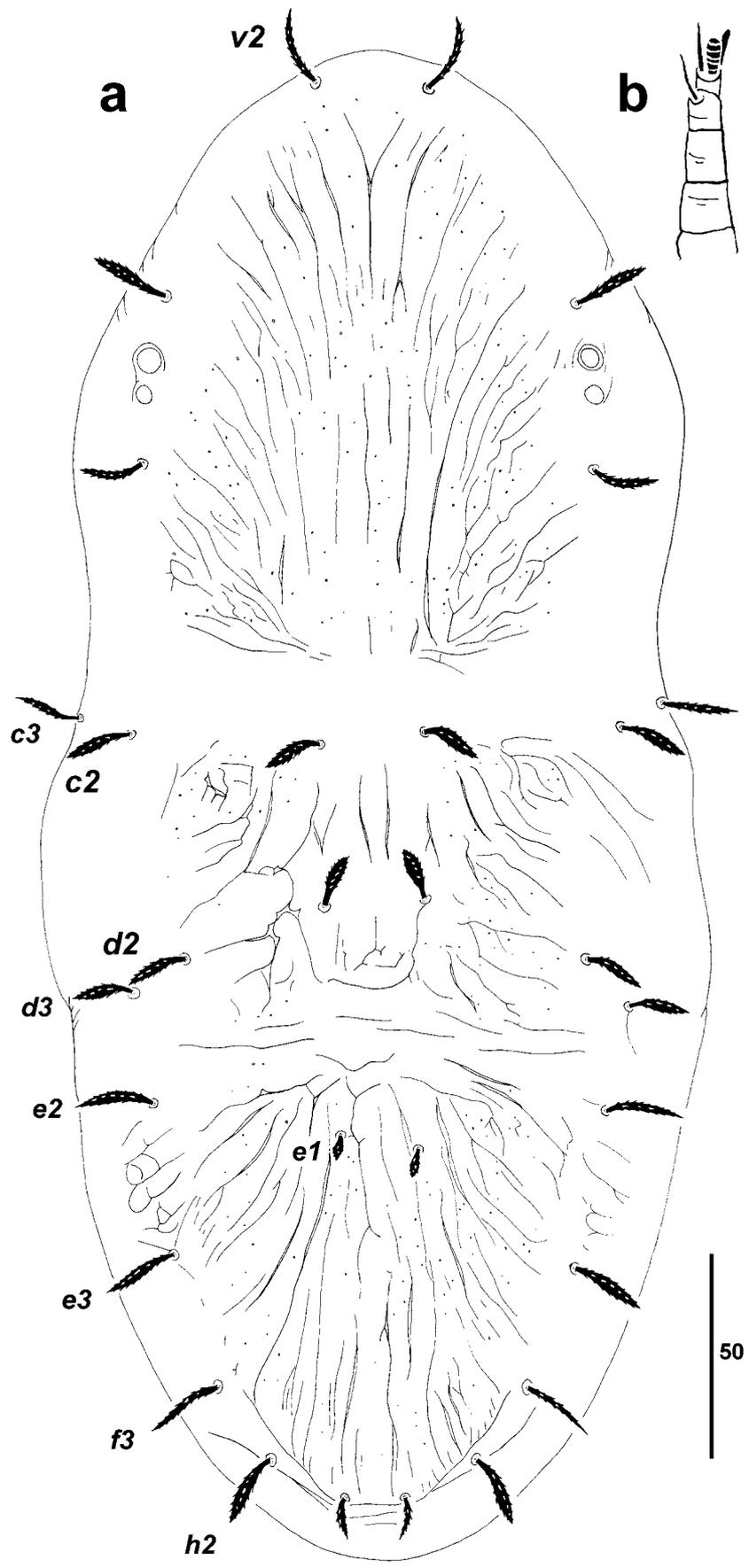


FIGURE 32. *Crossipalpus raveni* Beard and Seeman, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

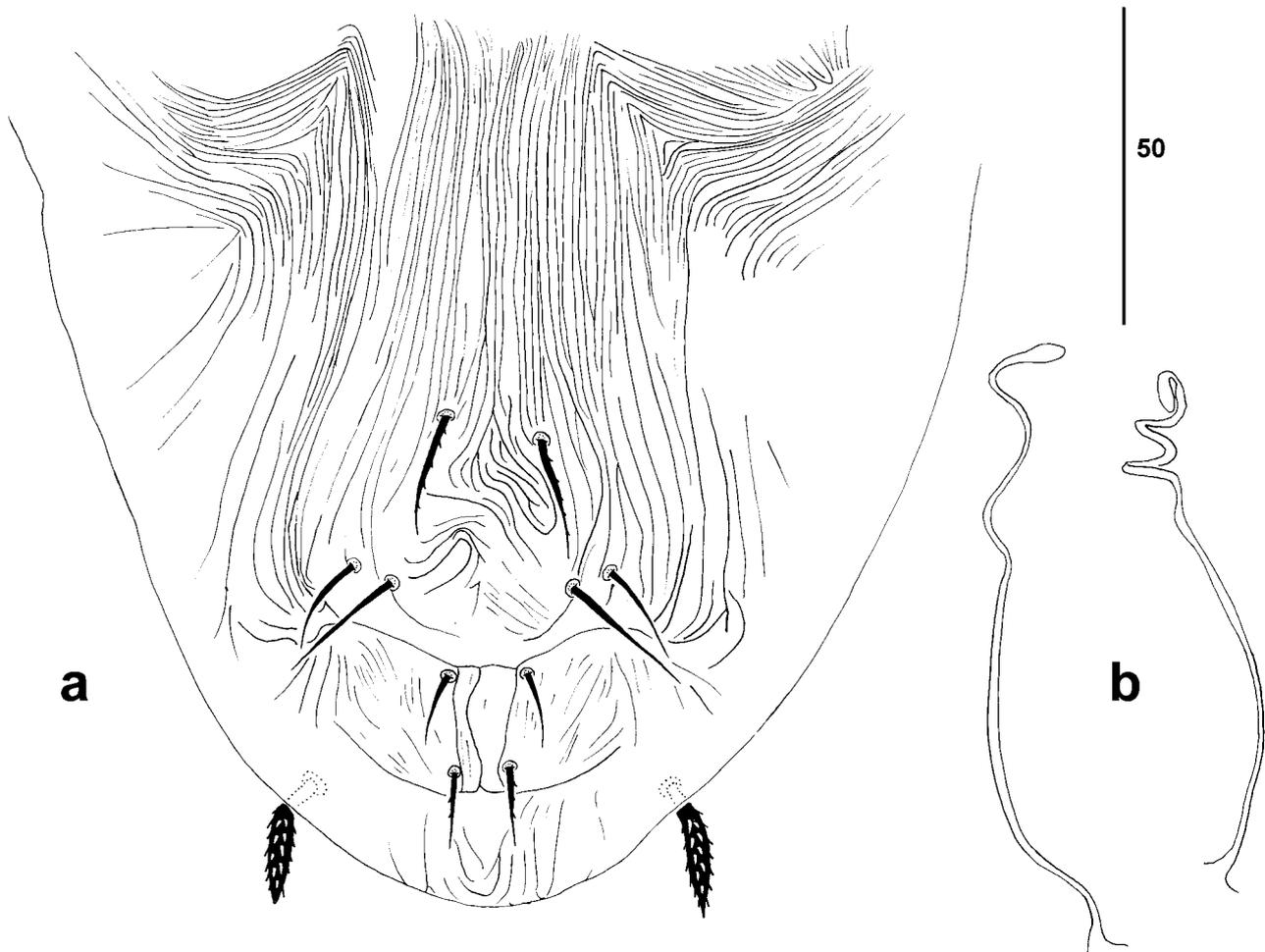


FIGURE 33. *Crossipalpus raveni* Beard and Seeman, adult female, a. posterior venter; b. spermatheca.

between setae *3a-4a*, then convex for 20–30 μm , striae longitudinal posterior to setae *4a*; fine striae become coarse lateral to genital area. Genital setae inserted in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital shield smooth, poorly developed; anal setae *ps1-2* inserted medially on anal plates in longitudinal line; seta *ps3* absent. Coxal setae fine, *2c* barbed; setae *ag1*, *g1-2*, *ps1-2* fine, with few barbs. Setal lengths: *1a* 64–83 [64], *1b* 18–30 [21], *2b* 18–25 [18], *2c* 18–21 [19], *3a* 35–66 [35], *3b* 16–22 [17], *4a* 42–92 [45], *4b* 14–26 [15], *ag1* 14–18 [14], *g1* 20–24 [21], *g2* 18–23 [19], *ps1* 11–16 [14], *ps2* 10–13 [13]. *Spermatheca*. (Fig. 33b) Spermathecal tube long, becoming narrow and sometimes convoluted distally, maximum 2 wide, ca. 80 long. Spermatheca vesicle not oval-shaped, 4 long, 2 wide. Genital opening between setae *ps2*. *Legs*. (Fig. 34) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-1-4-8(1), 2-1-3-1-4-8(1), 1-2-2-0-3-4, 1-1-1-0-3-4. Tarsi I and II each with 1 anti-axial solenidion ω'' (5–6 long) and 2 eupathidia $p\zeta'-p\zeta''$ (7–8 [7] long). Leg setation as in Table 1 except: coxae I without *1c*; genua I–II with *d*, without *l'*; tarsi I–IV without *tc''*. Setae *v'* added to tr IV.

MALE (5 paratypes). *Dorsum*. (Fig. 35) Body measurements: distance between setae *v2-h1* 245–265, *sc2-sc2* 83–91; other measurements: *v2-v2* 13–17, *sc1-sc1* 69–74, *c1-c1* 12–17, *c2-c2* 85–94, *c3-c3* 96–112, *d1-d1* 11–13, *d2-d2* 69–74, *d3-d3* 78–87, *e1-e1* 11–17, *e2-e2* 73–81, *e3-e3* 69–77, *f3-f3* 57–66, *h1-h1* 7–10, *h2-h2* 35–43. Gnathosoma not concealed beneath prodorsum. Anterior margin of prodorsum smooth, weakly convex. Prodorsal shield weakly developed. Opisthosoma with mesonotal shield (appearing as a pair of shields) on which at least setae *c1*, *d1* and *d2* inserted, with weak rugose-lineate pattern; and pygidial shield with at least setae *e1*, *e3*, *f3*, *h2* inserted, with oblique-longitudinal weakly lineate pattern; setae *h1* often under posterior overhang of pygidial shield; shields separated by transverse striae; cuticle laterad mesonotal shield smooth with few papillations; several minute pores visible on shields. Setal lengths: *v2* 19–24, *sc1* 16–19, *sc2* 15–20, *c1* 9–14, *c2* 11–16, *c3* 15–17, *d1* 7–13, *d2* 9–15, *d3* 12–18, *e1* 6–8, *e2* 14–17, *e3* 15–18, *f3* 15–19, *h1* 7–10, *h2* 15–19. *Palps*. Palps similar to female. Tibial seta 8–10 long; tarsal eupathidia 6–7, 5–6 long; solenidion 7–8 long, swollen. *Venter*. (Fig. 36a) All striae

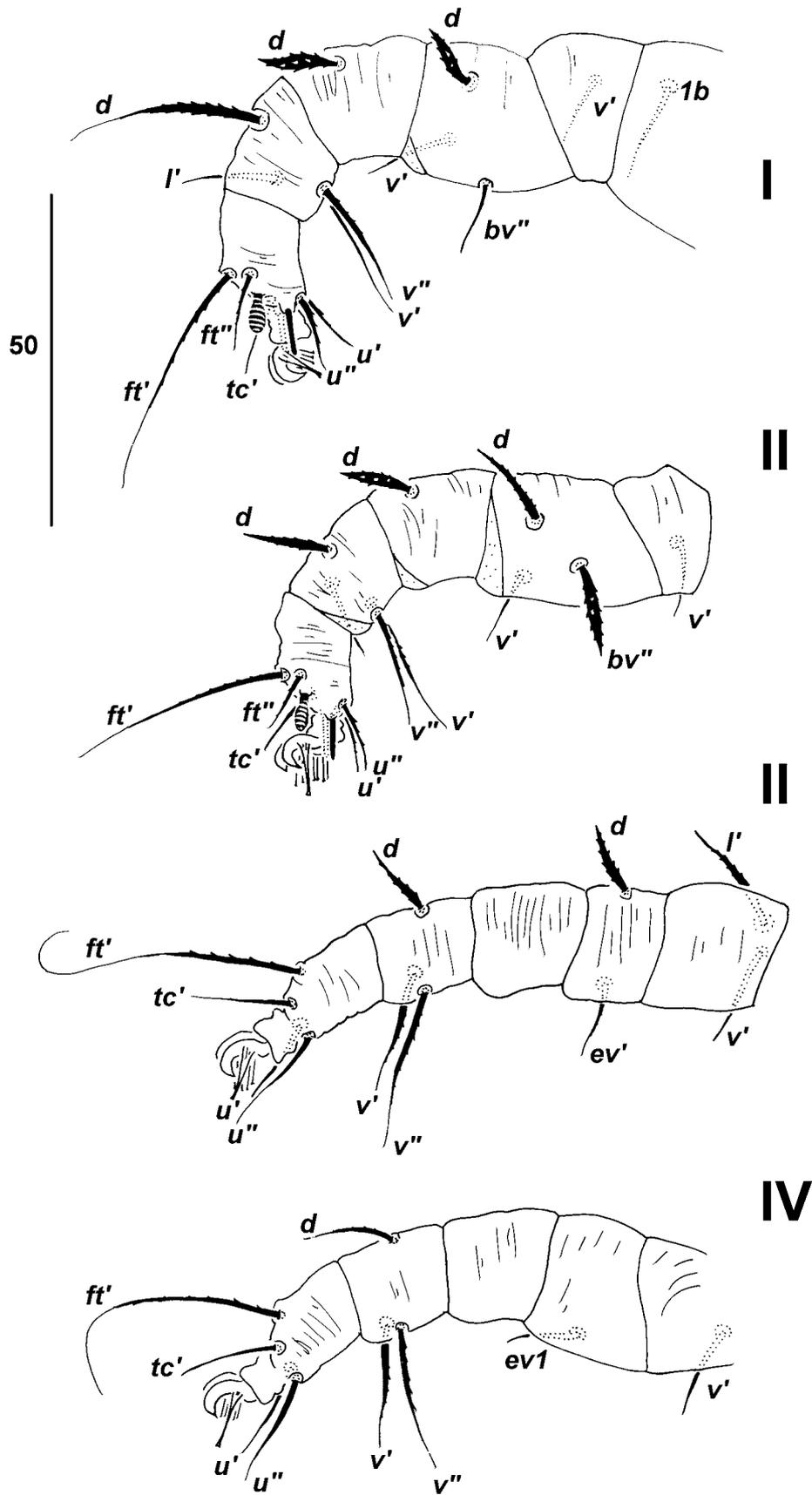


FIGURE 34. *Crossipalpus raveni* Beard and Seeman, adult female, legs (left side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on legs I–II.

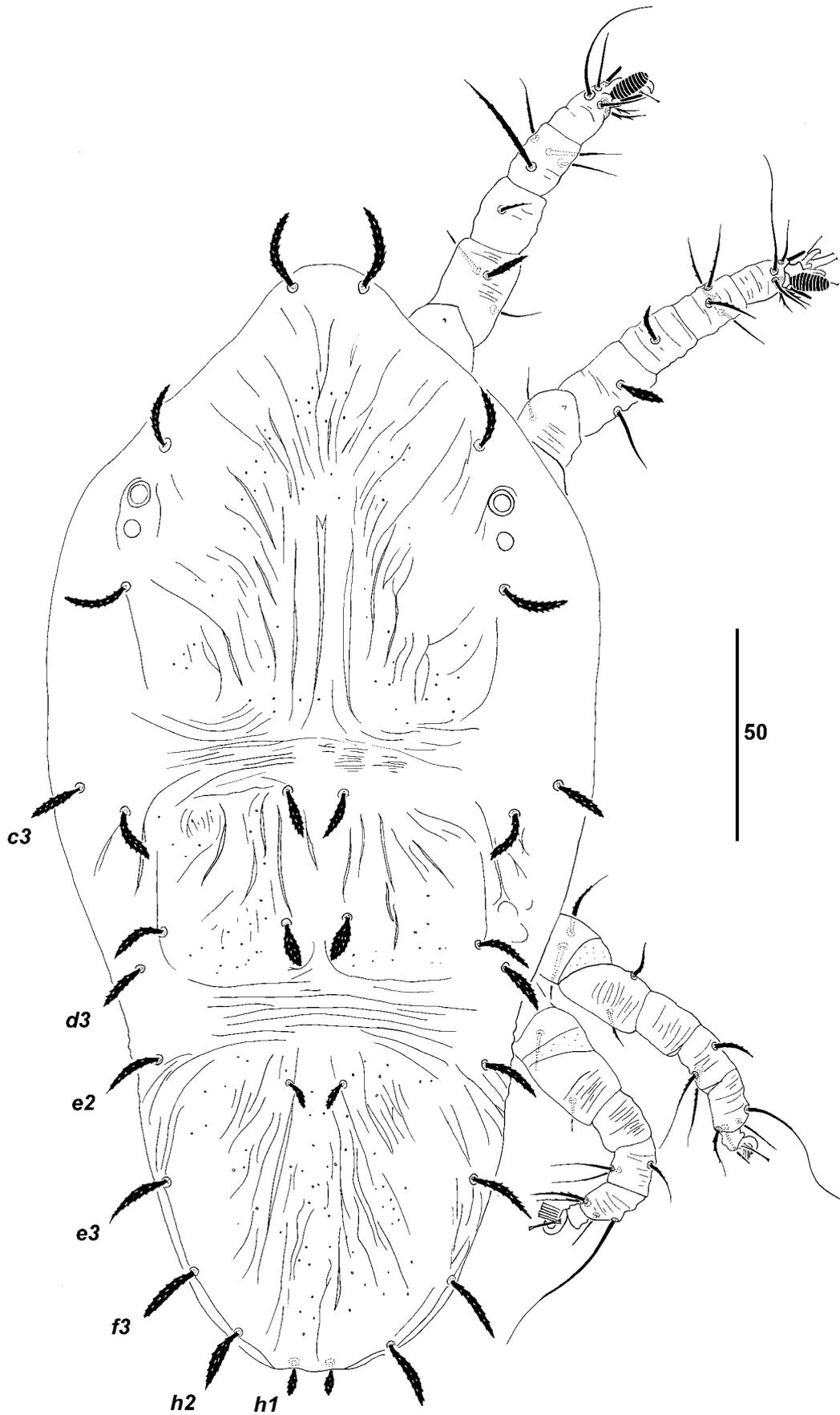


FIGURE 35. *Crossipalpus raveni* Beard and Seeman, adult male, dorsum with details of legs.

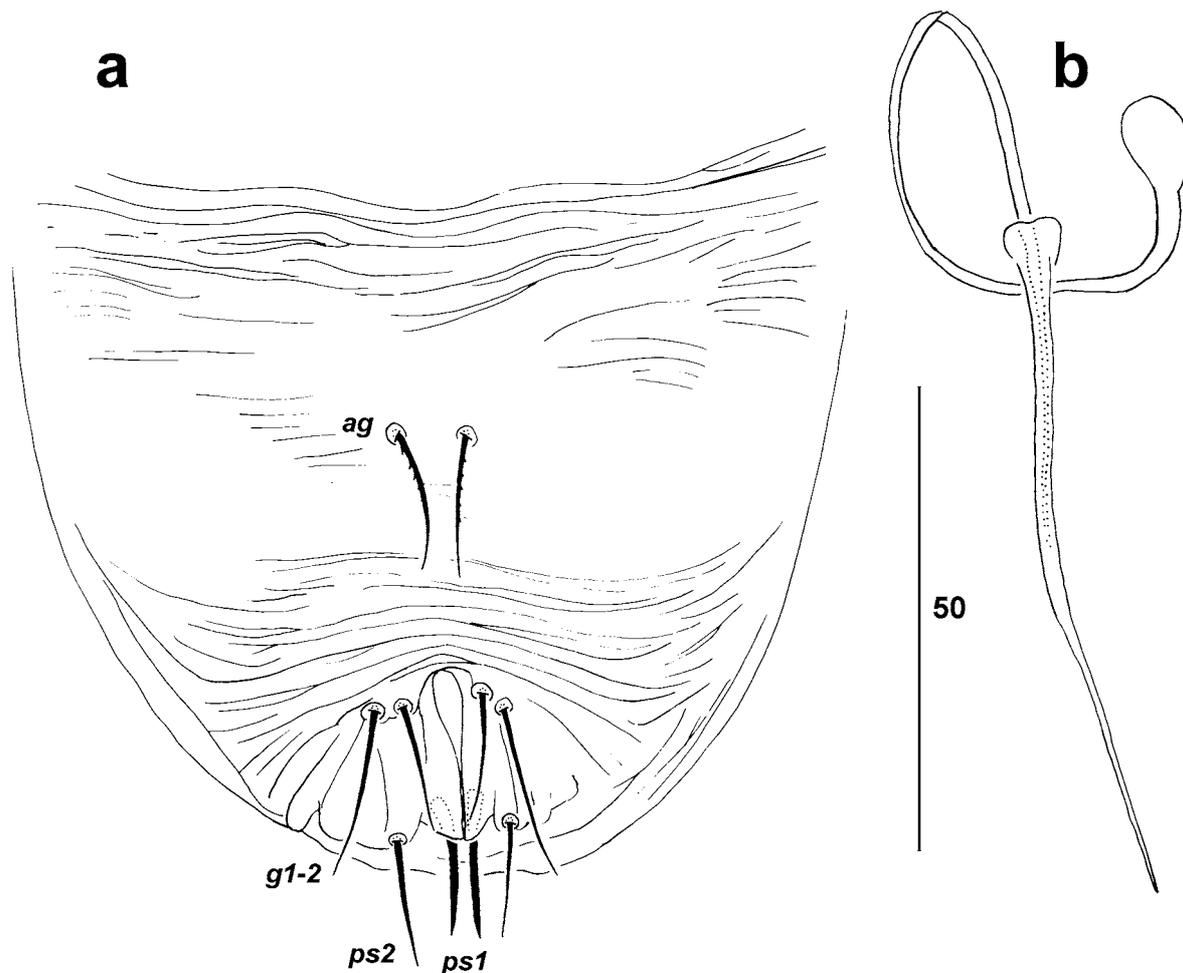


FIGURE 36. *Crossipalpus raveni* Beard and Seeman, adult male, a. posterior venter, with genital opening retracted; b. aedeagus.

transverse, becoming coarse posteriorly and weak around setae *ag1*. Coxal setae fine, except *2c* barbed. Setae *ag1* barbed; *g1*, *g2*, *ps2* fine; setae *ps1* modified to form thick blades (sexually dimorphic). Setal lengths: *1a* 47–52, *1b* 19–27, *2b* 19–24, *2c* 13–21, *3a* 46–60, *3b* 17–21, *4a* 37–48, *4b* 15–18, *ag1* 13–16, *g1* 11–15, *g2* 15–20, *ps1* 15–16, *ps2* 8–11. **Aedeagus.** (Fig. 36b) Narrow, sclerotised, tapering to a point, 67–70 long. Membranous duct runs from inside aedeagus, becoming indistinguishable. **Legs.** (Fig. 35) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 9–11 long, ta II 9–10 long) and 2 eupathidia $p\zeta'-p\zeta'''$ (ta I 6–7, 5–6; ta II 7, 7–8). Solenidia much thicker and longer than those in female.

DEUTONYMPH and PROTONYMPH. Unknown.

LARVA (4 paratypes). **Dorsum.** (Fig. 37) Body measurements: distance between setae *v2-h1* 170–180, *sc2-sc2* 61–64; other measurements: *v2-v2* 15–16, *sc1-sc1* 51–55, *c1-c1* 8–9, *c2-c2* 58–60, *c3-c3* 84–87, *d1-d1* 11–13, *e1-e1* 5–6, *e2-e2* 53–54, *e3-e3* 40–44, *f3-f3* 34–35, *h1-h1* 5–7, *h2-h2* 13–17. Prodorsal shield obsolete. Opisthosomal shields absent; sparse irregular transverse striae anteriorly. Setal lengths: *v2* 24–27, *sc1* 12–16, *sc2* 15–17, *c1* 17–22, *c2* 15–17, *c3* 10–11, *d1* 15–20, *d2* 14–18, *d3* 11–12, *e1* 4–8, *e2* 15–17, *e3* 14–17, *f3* 16–19, *h1* 5–6, *h2* 18–19. **Palps.** Palps same as adult. Tibial seta 6–7 long; tarsal eupathidia 3, 4 long, solenidion 2 long. **Venter.** Transverse striae, becoming oblique around anal region. All setae fine. Setal lengths: *1a* 21–28, *1b* 13–16, *3a* 16–30, *ps1* 4–6, *ps2* 4–6. **Legs.** (Fig. 37) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta'''$ (4–5 long). Leg setation as in Table 1 except genua I–III without *l'*. Trochanters I–III nude.

Etymology. It is with great pleasure that we name this species for our colleague and friend Dr Robert Raven, in recognition of his support for our work and his immense contribution to Arachnology.



FIGURE 37. *Crossipalpus raveni* Beard and Seeman, larva, dorsum with detail of legs.

Remarks. *Crossipalpus raveni* sp. nov. is similar to *Cr. gersoni* sp. nov., as they both have seta *d* present on ge I–II, but *Cr. raveni* has lanceolate setae *d* on femora and genua I–II (spatulate in *Cr. gersoni*), and posterior ventral setae are thin, setiform and weakly barbed (broadly lanceolate and strongly barbed in *Cr. gersoni*).

***Magdalenapalpus* Mesa, Welbourn and Evans, 2009**

Type species. *Meyeraepalpus strandtmanni* Smiley, Frost and Gerson, 1996, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 12 or 13 pairs of lanceolate setae; *c2*, *d2*, and *e2* present; seta *f2* present or absent; setae *e2* inserted in more-or-less marginal position; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, setal formula 0,0,0,2,3(1); immature stages with anterior margin of prodorsum smoothly rounded, without projections/notches, gnathosoma not concealed; ventral plate absent; 3 pairs of pseudanal setae (*ps1–3*) on weakly developed anal plates. *Adult female:* anterior margin of prodorsum deeply incised, forming 1 pair of broad fleshy lobes, each lobe bearing setae *v2* (also in male); gnathosoma partially concealed by anterior margin of prodorsum (also in male); genital plate weakly developed, membranous; metapodal plates not developed; coxae I without setae *1c*; trochanters I–IV 0-0-1-0 (*v'* absent on tr I–IV; *l'* present on tr III); femora I–IV 3-3-2-1; genua 1-1-0-0 (*d* present on ge I–II); tibiae 4-4-3-3; tarsi I–IV 8(1)-8(1)-4-4 (without *tc''*). Solenidia of male much thicker and longer than in female.

Species. Three species: *M. strandtmanni*, *M. caperatus*, *M. forsteri*.

Hosts and distribution. Casuarinaceae, Australia.

Remarks. The new species described herein differ from the type species by lacking seta *f2*. Although this is an important difference, these species share the same leg setation, a deeply incised prodorsum with setae *v2* inserted on the resultant lobes, and a partially concealed gnathosoma.

***Magdalenapalpus strandtmanni* (Smiley, Frost and Gerson, 1996)**

(Figs 38–41)

Meyeraepalpus strandtmanni Smiley, Frost and Gerson, 1996: 178, fig. 26.

Magdalenapalpus strandtmanni, Mesa *et al.* 2009: 61, fig. 35.

Type material examined. Holotype female ex. Bull-Oak *Allocasuarina luehmannii* (Casuarinaceae) [feeding on bark of branchlets], **AUSTRALIA:** South Australia, 16 km E Mt Mary, 16 December 1995, coll. W. Frost (WINC; on same slide as paratype female and 1 deutonymph). Paratypes. 1 female, 1 deutonymph, same slide as holotype (WINC); 1 female, 1 larva, same data as holotype except 28 February 1996 (1 slide); 1 deutonymph, 3 protonymphs, same data as holotype (1 slide, with 1 female *Chaudhripalpus creelae*); 2 females, 1 deutonymph, 1 pharate protonymph, same data as holotype (1 slide); 2 females, 2 deutonymphs, 1 pharate deutonymph, 2 protonymphs, 1 larva, same data as holotype (1 slide); 1 female, same data as holotype except 28 February 1996 (on slide with 1 female *Chaudhripalpus creelae*); 1 female, same data as holotype except 28 February 1996 (on slide with 1 female, 1 deutonymph *Chaudhripalpus creelae*) (WINC).

Diagnosis. Dorsal opisthosomal setae *f2* present. Dorsal setae all broadly lanceolate, strongly barbed, subequal in length. Posterior opisthosomal venter with setae fine, barbed, except setae *ps1* thickened, heavily barbed.

FEMALE (n = 9). *Dorsum.* (Fig. 38) Body measurements: distance between setae *v2-h1* 230–250 in 8 paratypes [230]; *sc2-sc2* 86–96 [86]; other measurements: *v2-v2* 36–43 [42], *sc1-sc1* 78–84 [81], *c1-c1* 31–39 [31], *c2-c2* 87–96 [87], *c3-c3* 125–140 [125], *d1-d1* 22–27 [22], *d2-d2* 73–96 [73], *d3-d3* 105–120 [105], *e1-e1* 21–26 [24], *e2-e2* 71–92 [74], *e3-e3* 93–105 [95], *f2-f2* 62–73 [65], *f3-f3* 72–86 [72], *h1-h1* 21–27 [27], *h2-h2* 49–57 [57]. Gnathosoma almost completely concealed beneath prodorsum (Fig. 38). Anterior margin of prodorsum with notch between setae *v2*, 8–15 [13] deep; setae *v2* inserted on anterior lobes formed by notch (Fig. 38). Prodorsal shield weakly developed with weak oblique folds and lines. Opisthosomal shield weakly developed, mostly with weak transverse folds and lines, becoming longitudinal between *e1-e1* and *h1-h1*. Dorsal setae broadly lanceolate and strongly barbed, subequal in length; Setal lengths: *v2* 23–30 [28], *sc1* 22–27 [25], *sc2* 24–29 [28], *c1* 26–31 [27, 31], *c2* 27–32 [29, 31], *c3* 21–24 [22, 24], *d1* 21–25 [23], *d2* 22–27 [24, 26], *d3* 19–26 [24, 26], *e1* 19–27 [24, 27],



FIGURE 38. *Magdalenapalpus strandmanni* (Smiley, Frost and Gerson), adult female, dorsum, with details of palps.

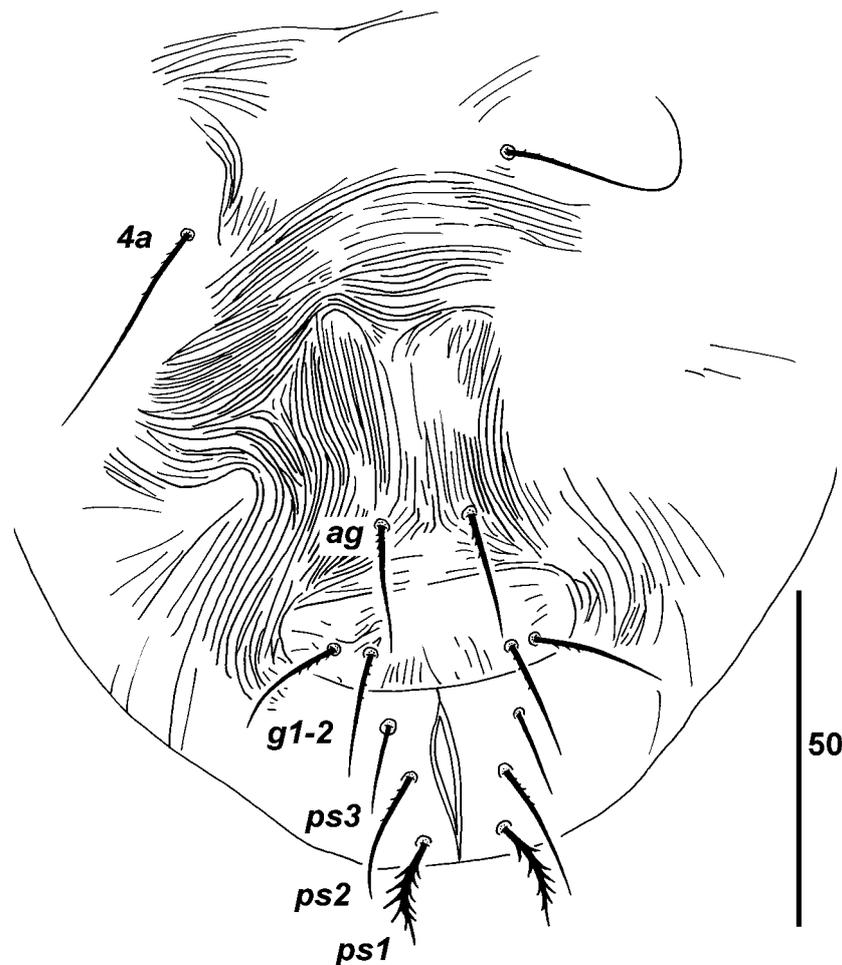


FIGURE 39. *Magdalenapalpus strandmanni* (Smiley, Frost and Gerson), adult female, posterior venter.

e2 22–28 [26, 28], *e3* 22–27 [27], *f3* 23–29 [29], *h1* 19–28 [28], *h2* 23–31 [25, 28]. *Palps.* (Fig. 38) Setal formula 0, 0, 0, 2, 3 (1s+2e). Tibial setae, dorsal 7–11 [7] long, ventral 7–10 [7] long; tarsal eupathidia 6–7 [6] long (thin, tapered), 7–8 [7] long (thick, blunt); solenidion 6–7 [6, 7] long. *Venter.* (Fig. 39) Ventral cuticle with longitudinal striae between *1a-1a*; with transverse striae between *1a* to just posterior to setae *4a*, becoming longitudinal to *ag*; striae between *ag-ag* mixed, with transverse striae on anterior of genital flap; longitudinal striae laterad genital region. Genital setae inserted on posterior corners of genital flap in more-or-less transverse row, *g1* inserted slightly posterior to level of *g2*. Genital shield not developed, cuticle on genital flap smooth; setae *ps1-2* inserted in longitudinal line along inner edge of anal plates. Coxal, genital and anal setae *ps2-3* fine; setae *ps1* heavily barbed; setae *1a*, *3a*, *4a* long, finely tapered, often broken and difficult to determine full length. Setal lengths: *1a* 30–47 [31, 38], *1b* 18–26 [19, 21], *2b* 14–22 [17], *2c* 15–27 [19], *3a* 31–45 [not visible], *3b* 16–22 [21], *4a* 30–37 [not visible], *4b* 18–21 [21], *ag1* 19–24 [19], *g1* 18–24 [21], *g2* 18–24 [22], *ps1* 15–18 [16], *ps2* 15–20 [16], *ps3* 12–20 [12]. *Spermatheca.* Not visible. *Legs.* (Fig. 40) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 9–11 [10] long, ta II 8–11 [10] long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 6–8 [7–8] long, 6–7 [7] long; ta II with both 6–7 [7] long). Leg setation as in Table 1 except: coxae I without *1c*; trochanters I–IV 0-0-1-0 (*v'* absent on tr I–IV; *l'* present on tr IV); ge I–IV 1-1-0-0 (*d* present ge I–II); ta I–IV without *tc''*.

MALE. Unknown.

DEUTONYMPH (6 paratypes). *Dorsum.* Body measurements: distance between setae *v2-h1* 198–219, *sc2-sc2* 75–82; other measurements: *v2-v2* 27–33, *sc1-sc1* 67–75, *c1-c1* 28–33, *c2-c2* 75–76, *c3-c3* 115–120, *d1-d1* 23–30, *d2-d2* 58–65, *d3-d3* 94–101, *e1-e1* 18–21, *e2-e2* 63–72, *e3-e3* 81–89, *f3-f3* 44–54, *h1-h1* 65–71, *h2-h2* 21–23. Gnathosoma not concealed by prodorsum. Prodorsal shield similar to female, but with fewer folds; opisthosomal shield weak, with some weak transverse folds. Setal lengths: *v2* 27–32, *sc1* 22–25, *sc2* 24–27, *c1* 25–28, *c2* 26–28,

c3 21–23, *d1* 20–23, *d2* 20–25, *d3* 21–24, *e1* 19–24, *e2* 21–23, *e3* 21–26, *f2* 20–27, *f3* 20–26, *h1* 18–22, *h2* 19–24. *Palps*. Palps same as adult. Tibial setae, dorsal 9–10 long, ventral 7–8 long; tarsal eupathidia 5 long (thin, tapered), 6 long (thick, blunt); solenidion 5–6 long. *Venter*. Cuticle on gnathosoma to *1a* with longitudinal striae; *1a-4a* with transverse striae; between *4a-4a* with mixed striae; immediately posterior *4a* with transverse striae, becoming longitudinal to *ag*; longitudinal striae around genital-anal region. Setal lengths: *1a* 30–38, *1b* 13–16, *2b* 13–20, *2c* 14–20, *3a* 28–31, *3b* 12–14, *4a* 23–28, *4b* 12–14, *ag1* 12–14, *g1* 12–16, *ps1* 8–10, *ps2* 10–12, *ps3* 10–12. *Legs*. Setal formula for legs I–IV same as adult female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 5 long, ta II 4–5 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (ta I 6, 5–6 long; ta II with both 5 long).

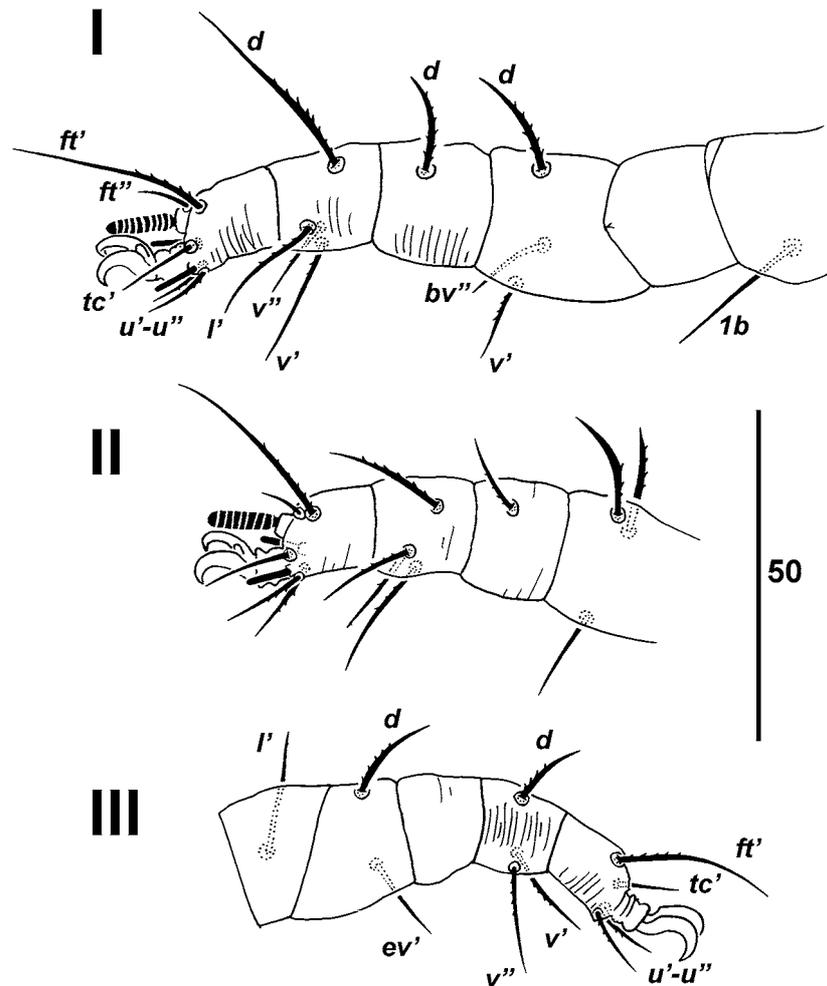


FIGURE 40. *Magdalenapalpus strandtmanni* (Smiley, Frost and Gerson), adult female, legs (right side), solenidion ω'' and eupathidia ($p\zeta''-p\zeta'''$) not labelled on leg I.

PROTONYMPH (6 paratypes). *Dorsum*. Body measurements: distance between setae *v2-h1* 145–180, *sc2-sc2* 68–73; other measurements: *v2-v2* 25–29, *sc1-sc1* 62–66, *c1-c1* 24–28, *c2-c2* 68–72, *c3-c3* 100–110, *d1-d1* 20–25, *d2-d2* 51–57, *d3-d3* 81–86, *e1-e1* 12–19, *e2-e2* 53–66, *e3-e3* 65–69, *f2-f2* 44–59, *f3-f3* 46–51, *h1-h1* 13–29, *h2-h2* 19–33. Gnathosoma not concealed by prodorsum. Setal lengths: *v2* 25–28, *sc1* 17–22, *sc2* 18–24, *c1* 21–23, *c2* 19–23, *c3* 15–18, *d1* 19–21, *d2* 16–22, *d3* 17–20, *e1* 17–21, *e2* 16–19, *e3* 17–20, *f2* 16–19, *f3* 14–19, *h1* 15–20, *h2* 15–20. *Palps*. Palps same as adult. Tibial setae, dorsal 8–9 long, ventral 6–7 long; tarsal eupathidia 4–5, 5–6 long; solenidion 3–4 long. *Venter*. Cuticle on gnathosoma to *1a* with longitudinal striae; *1a* to leg IV with transverse striae; leg IV to posterior margin with longitudinal striae. Coxal, genital and anal setae fine. Setal lengths: *1a* 24–29, *1b* 13–16, *2b* 12–18, *3b* 21–28, *ag* 12–20, *ps1* 7–8, *ps2* 7–8, *ps3* 7–8. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3–4 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (5 long). Leg setation as in deutonymph except: seta *2c*, *4b* absent; genu I–II without *d*; tarsi IV without *te'*. Setae *l'* added to tr III.

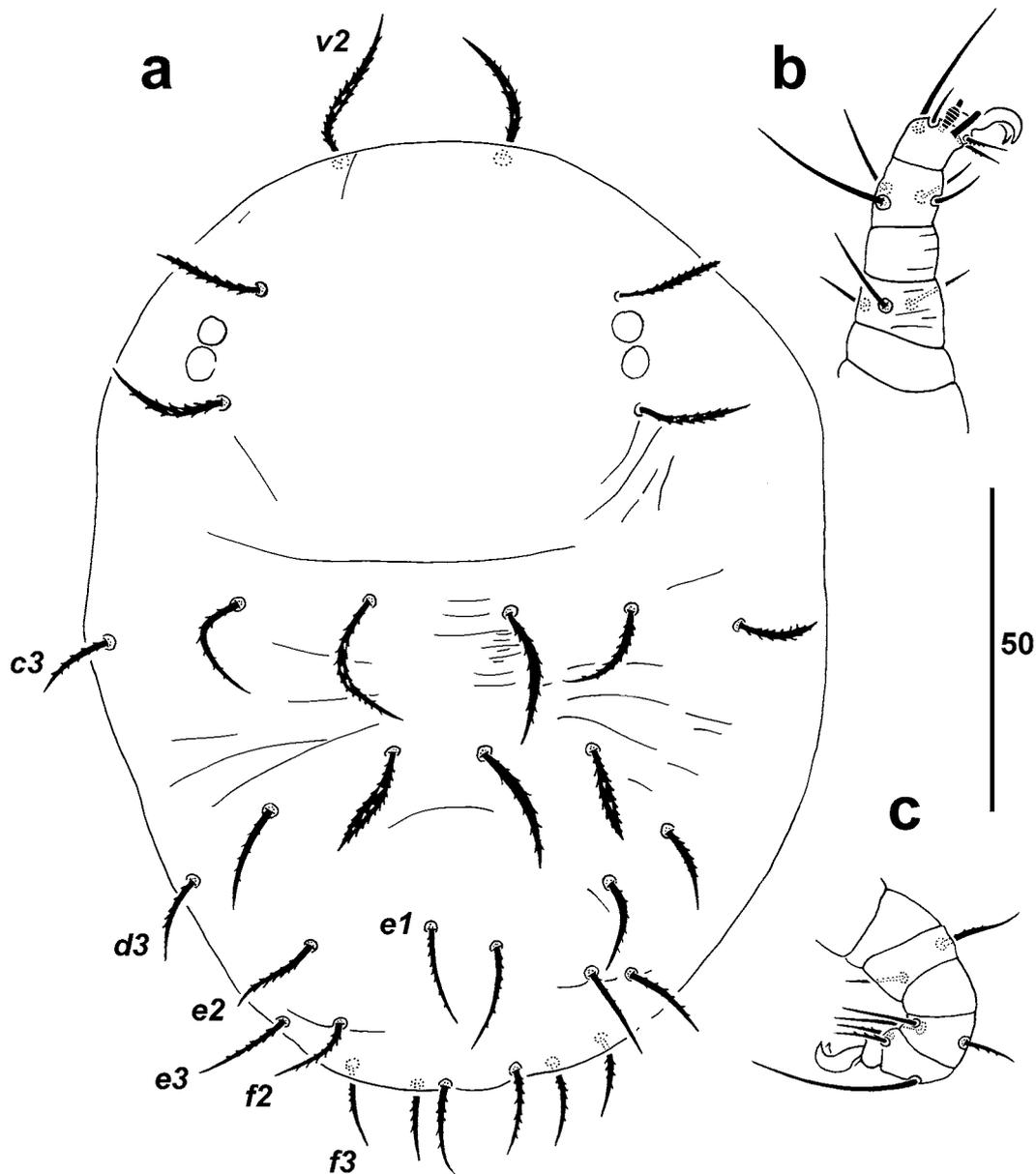


FIGURE 41. *Magdalenapalpus strandtmanni* (Smiley, Frost and Gerson), larva, a. dorsum; b. leg I; c. leg III.

LARVA (2 paratypes). *Dorsum*. (Fig. 41a) Body measurements: distance between setae *v2-h1* 130–140, *sc2-sc2* 61–63; other measurements: *v2-v2* 21–23, *sc1-sc1* 51–53, *c1-c1* 21–23, *c2-c2* 57–59, *c3-c3* 92–95, *d1-d1* 12–15, *d2-d2* 43–48, *d3-d3* 67–69, *e1-e1* 8–9, *e2-e2* 45–48, *e3-e3* 51–53, *f2-f2* 34–37, *f3-f3* 29–37, *h1-h1* 9–11, *h2-h2* 16–20. Gnathosoma not concealed by prodorsum. Setal lengths: *v2* 22–24, *sc1* 17–18, *sc2* 16–19, *c1* 19–21, *c2* 17–19, *c3* 12–14, *d1* 15–16, *d2* 14–16, *d3* 12–13, *e1* 16–17, *e2* 13–14, *e3* 12–13, *f2* 13–14, *f3* 11–14, *h1* 13–14, *h2* 13–14. *Palps*. Palps same as adult. Tibial setae, dorsal 6–8 long, ventral 7 long; tarsal eupathidia 4, 5 long; solenidion 3 long. *Venter*. Cuticle on gnathosoma to *Ia* with longitudinal striae; *Ia* to leg IV with transverse striae; leg IV to posterior margin with some longitudinal striae. All setae fine. Setal lengths: *Ia* 25–33, *Ib* 12–14, *3a* 26–27, *ps1* 5, *ps2* 5, *ps3* 5. *Legs*. (Fig. 41b, c) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 bulbous antiaxial solenidion ω'' (ta I 3 long, ta II 2–3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*.

Remarks. In our specimens, leg setae counts are markedly different to those presented by Smiley *et al.* (1996), who reported that coxa I had two setae (only one seta is present), the trochanters had 1-1-2-1 (our count 0-0-1-0, i.e. *l'* present on only tr III, *v'* absent on tr I–IV), the genua had 3-3-1-0 (our count 1-1-0-0), and the tarsi had 7(1)-

7(1)-5-5 (our count 8(1)-8(1)-4-4). They also reported that seta *4a* was absent, but it is present.

Magdalenapalpus strandtmanni differs from the new species presented here by the presence of dorsal opisthosomal setae *f2* (absent in *M. caperatus* and *M. forsteri*).

***Magdalenapalpus caperatus* Beard and Seeman sp. nov.**

(Figs 42–47)

Type material examined. Holotype female ex. Coastal She-Oak *Casuarina equisetifolia* (Casuarinaceae), AUSTRALIA: Northern Territory, Darwin, Nightcliffe Boat Ramp, 12°22'46"S 130°50'34"E, 19 May 2008, coll. J.J. Beard and R. Ochoa (MAGNT). Paratypes. Same data as holotype: 21 females, 1 pharate female, 5 deutonymphs, 7 protonymphs, 15 larvae (24 slides) (MAGNT, QM, ANIC, USNM).

Diagnosis. Dorsal opisthosomal setae *f2* absent. Dorsal setae broadly lanceolate, strongly barbed, subequal in length. Prodorsal and opisthosomal shield with extensive rugose and wrinkled sculpturing; lateral cuticle smooth. Dorsal opisthosomal setae *d1-d1* 26–30, *e1-e1* 23–25 apart. Posterior opisthosomal venter with thickened, barbed setae.

FEMALE (n = 22). *Dorsum*. (Figs 42, 43) Body measurements: distance between setae *v2-h1* 275–300 [290]; *sc2-sc2* 98–105 [105]; other measurements: *v2-v2* 32–35 [35], *sc1-sc1* 76–78 [77], *c1-c1* 31–35 [35], *c2-c2* 59–77 [59], *c3-c3* 135–145 [145], *d1-d1* 26–30 [28], *d2-d2* 91–105 [105], *d3-d3* 115–130 [130], *e1-e1* 23–25 [25], *e2-e2* 91–105 [105], *e3-e3* 94–110 [110], *f3-f3* 80–92 [92], *h1-h1* 29–32 [31], *h2-h2* 47–58 [47]. Gnathosoma partially concealed beneath prodorsum. Anterior margin of prodorsum with medial notch (internal depth 15–16), forming pair of broad, fleshy lobes (Figs 42, 43); setae *v2* inserted under a fold on each lobe (Figs 42, 43). Prodorsal shield with rugose sculpturing. Opisthosomal shield with rugose-oblique sculpturing, becoming transverse-rugose medially. Lateral cuticle surrounding shields weakly tessellate to smooth. All dorsal setae barbed, broadly lanceolate. Setal lengths: *v2* 18–22 [18], *sc1* 17–18 [17], *sc2* 16–22 [22], *c1* 16–20 [20], *c2* 19–23 [19], *c3* 18–19 [19], *d1* 15–16 [16], *d2* 16–18 [18], *d3* 19–20 [19], *e1* 13–15 [15], *e2* 18–22 [22], *e3* 18–20 [20], *f3* 15–20 [15], *h1* 15–16 [16], *h2* 18–20 [20]. *Palps*. (Fig. 43) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 5–7 [5] long, ventral 8–9 [8] long; tarsal eupathidia 6, 8 long; solenidion 6–8 [8] long. *Venter*. (Fig. 44a) Cuticle with transverse striae, becoming longitudinal midway between *4a* and *ag*, extending to genital area; fine striae become coarse lateral to genital area. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield smooth, poorly defined, ca. 25–30 [30] long, 38–40 [40] wide; anal setae *ps1–3* inserted in longitudinal row on anal plates. Coxal setae fine, except *2c* barbed; setae *ps1–2* barbed; *ps3*, *g1-g2*, *ag* smooth or with few barbs. Setal lengths: *1a* 36–50 [50], *1b* 20–29 [29], *2b* 14–17 [14], *2c* 19–23 [23], *3a* 38–40 [40], *3b* 13–15 [15], *4a* 23–37 [37], *4b* 12–14 [14], *ag1* 18–21 [18], *g1* 20–23 [23], *g2* 18–20 [20], *ps1* 14–15 [15], *ps2* 12–14 [14], *ps3* 7–12 [12]. *Spermatheca*. (Fig. 44b) Spermathecal tube short, narrow, < 1 wide, ca. 40 long, expanded at exterior opening, and ending in membranous vesicle 8 long, 2–3 wide. Genital opening between setae *ps2–3*. *Legs*. (Fig. 45) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 10–12 [12] long, ta II 10–11 [11] long) and 2 eupathidia $p\zeta'-p\zeta''$ (6–7 [7] long). Leg setation as in Table 1 except: coxae I without *1c*; *v'* absent on tr I–IV, *l'* present on tr III; genua I–II with *d*; tarsi I–IV without *tc''*.

MALE. Unknown.

DEUTONYMPH (4 paratypes). *Dorsum*. Body measurements: distance between setae *v2-h1* 245–270, *sc2-sc2* 77–88; other measurements: *v2-v2* 25–28, *sc1-sc1* 70–74, *c1-c1* 23–25, *c2-c2* 68–69, *c3-c3* 123–128, *d1-d1* 19–20, *d2-d2* 69–73, *d3-d3* 93–99, *e1-e1* 22–40, *e2-e2* 85–88, *e3-e3* 90, *f3-f3* 65–70, *h1-h1* 14–21, *h2-h2* 34–40. Anterior margin of prodorsum with rounded protrusion lacking medial notch. Prodorsal shield smooth with few creases. Opisthosomal shield with *c1-c2* and *d1-d2* on patches of smooth cuticle, and smooth pygidial shield; all shields surrounded by coarse irregularly transverse striae medially and smooth soft cuticle laterally. All dorsal setae lanceolate, except *e3*, *f3*, *h1*, *h2* narrowly lanceolate. Setal lengths: *v2* 25–28, *sc1* 17–18, *sc2* 19–20, *c1* 18–25, *c2* 18–20, *c3* 16–19, *d1* 16, *d2* 16–19, *d3* 17–20, *e1* 13–15, *e2* 14–16, *e3* 16–17, *f3* 16–18, *h1* 11–13, *h2* 18–19. *Palps*. Palps similar to adult. Tibial setae, dorsal 6 long, ventral 7–9 long; tarsal eupathidia 5, 6 long; solenidion 4–5 long. *Venter*. (Fig. 46c) Cuticle with transverse striae to midway between *4a* and *ag*, becoming longitudinal, striae coarse

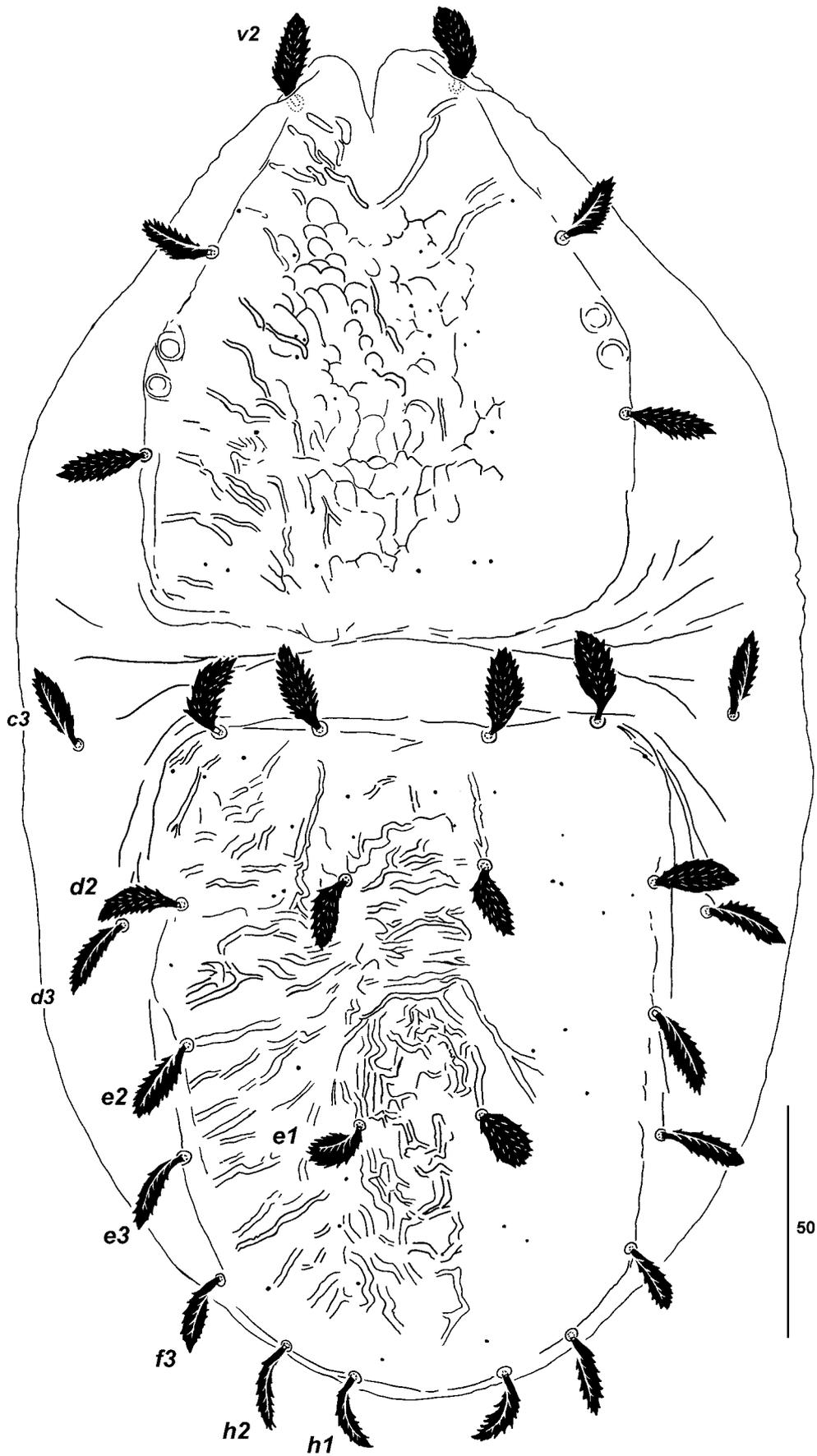


FIGURE 42. *Magdalenapalpus caperatus* Beard and Seeman, adult female, dorsum.

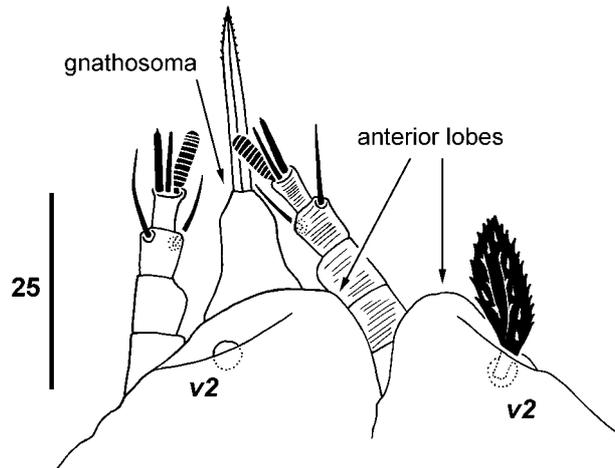


FIGURE 43. *Magdalenapalpus caperatus* Beard and Seeman, adult female, anterior margin of prodorsum, with details of palp.

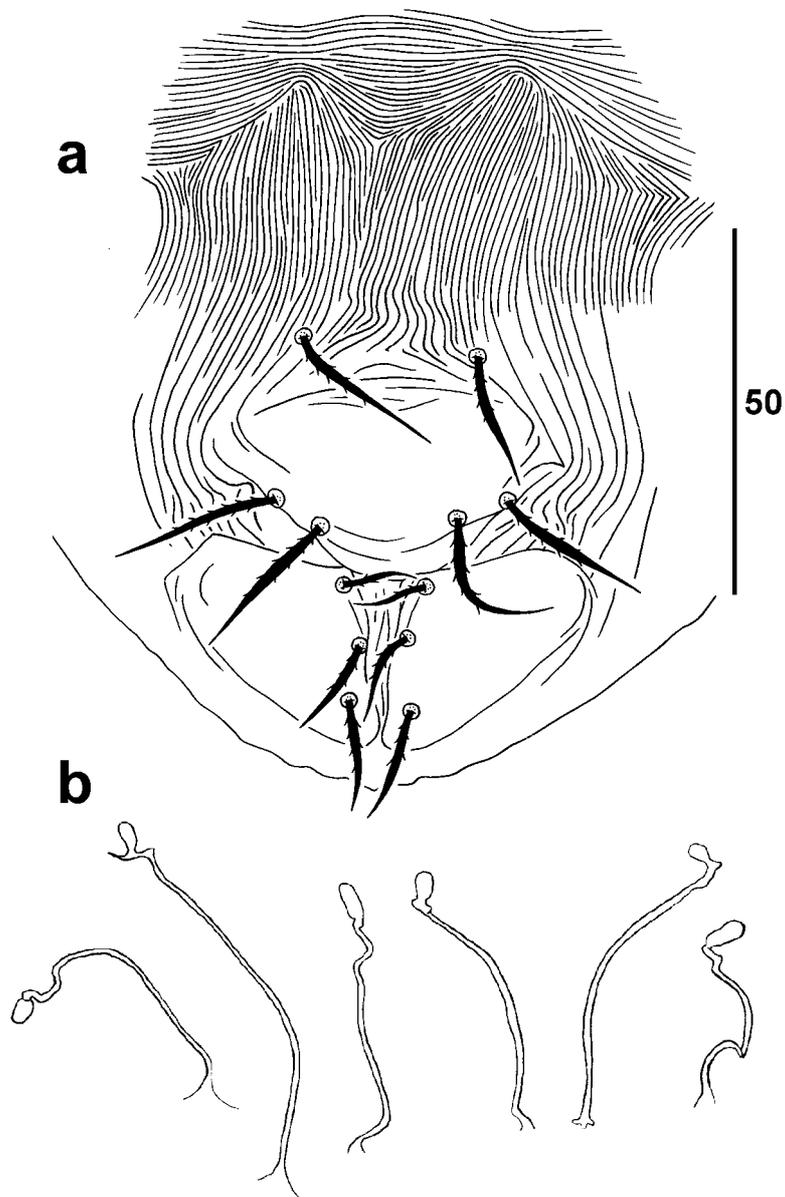


FIGURE 44. *Magdalenapalpus caperatus* Beard and Seeman, adult female, a. posterior venter; b. spermatheca.

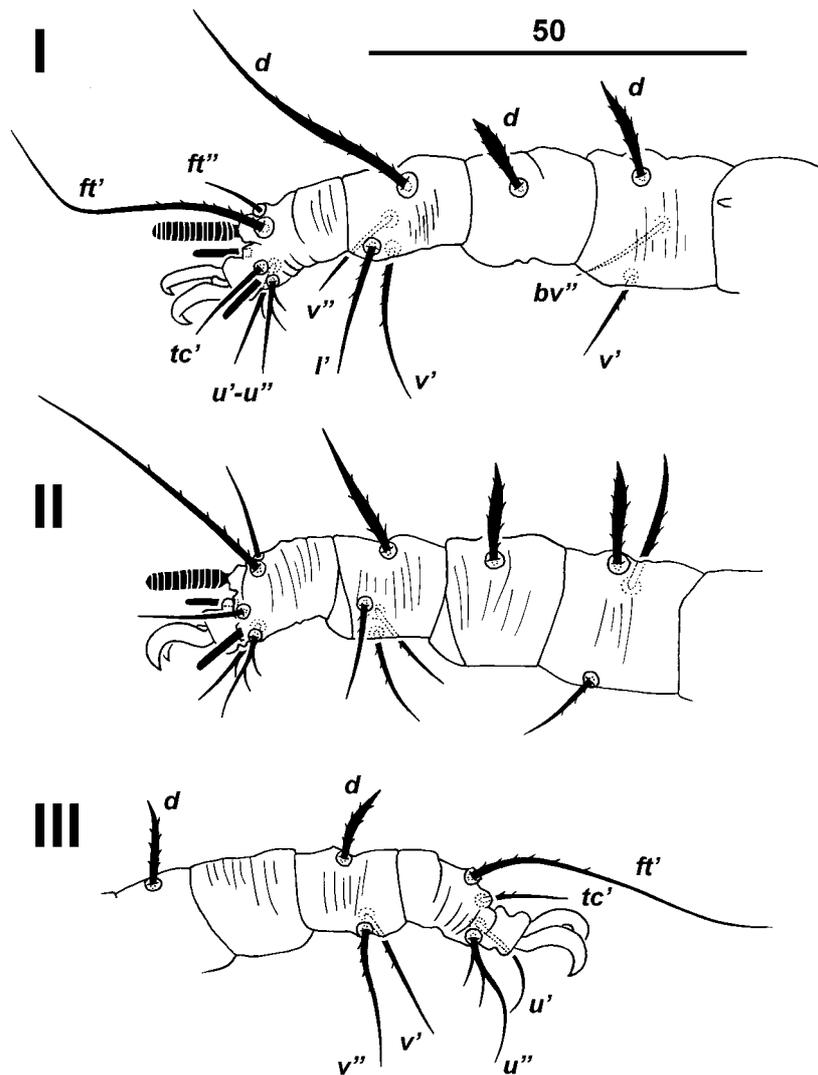


FIGURE 45. *Magdalenapalpus caperatus* Beard and Seeman, adult female, legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

around anal region. Anal setae *ps1*–*3* on weakly defined anal plates. Ventral setae fine, smooth. Setal lengths: *1a* 37–42, *1b* 14–16, *2b* 11–12, *2c* 17–20, *3a* 30–32, *3b* 10–11, *4a* 17–26, *4b* 10–14, *ag1* 10–13, *g1* 12–15, *ps1* 5–6, *ps2* 6–8, *ps3* 5–6. *Legs.* Setal formula for legs I–IV same as adult. Tarsi I and II each with 1 antiaxial solenidion ω'' (5–6 long) and 2 eupathidia $p\zeta'$ – $p\zeta''$ (5 long).

PROTONYMPH (7 paratypes). *Dorsum.* Body measurements: distance between *v2*–*h1* 190–210, *sc2*–*sc2* 71–78; other measurements: *v2*–*v2* 20–24, *sc1*–*sc1* 58–63, *c1*–*c1* 17–22, *c2*–*c2* 59–61, *e3*–*e3* 100–108, *d1*–*d1* 15–17, *d2*–*d2* 57–61, *d3*–*d3* 78–84, *e1*–*e1* 12–14, *e2*–*e2* 64–69, *e3*–*e3* 66–71, *f3*–*f3* 41–50, *h1*–*h1* 9–15, *h2*–*h2* 20–30. Anterior margin of prodorsum with rounded protrusion lacking medial notch. Prodorsal shield smooth with few creases. Opisthosomal shield with *c2* and *d1*–*d2* on patches of smooth cuticle, and smooth pygidial shield; all shields surrounded by coarse irregularly transverse striae medially and smooth soft cuticle laterally. Dorsal setae narrowly lanceolate, except setae *v2*, *c1*, *c3*, *d2*, *e1* lanceolate. Setal lengths: *v2* 20–24, *sc1* 14–15, *sc2* 17–18, *c1* 18, *c2* 16–18, *c3* 12–16, *d1* 15–16, *d2* 15–16, *d3* 14–15, *e1* 11–14, *e2* 14, *e3* 13–15, *f3* 12–13, *h1* 9–10, *h2* 12–13. *Palps.* Palps similar to adult. Tibial setae, dorsal 7 long, ventral 5 long; tarsal eupathidia 4–5, 5–6 long; solenidion 4–5 long. *Venter.* (Fig. 46b) Striation similar to deutonymph. Anal setae *ps1*–*3* on weakly defined anal plates. Ventral setae fine, smooth. Setal lengths: *1a* 28–31, *1b* 13–17, *2b* 13–16, *3a* 23–25, *3b* 9–12, *ag1* 8–9, *ps1* 4–5, *ps2* 3–4, *ps3* 3–5. *Legs.* Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-3-4, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3–4 long) and 2 eupathidia $p\zeta'$ – $p\zeta''$ (5 long). Leg setation as in deutonymph except: seta *2c*, *4b* absent; genu I–II without *d*; tarsi IV without *tc'*. Setae *l'* added to tr III.

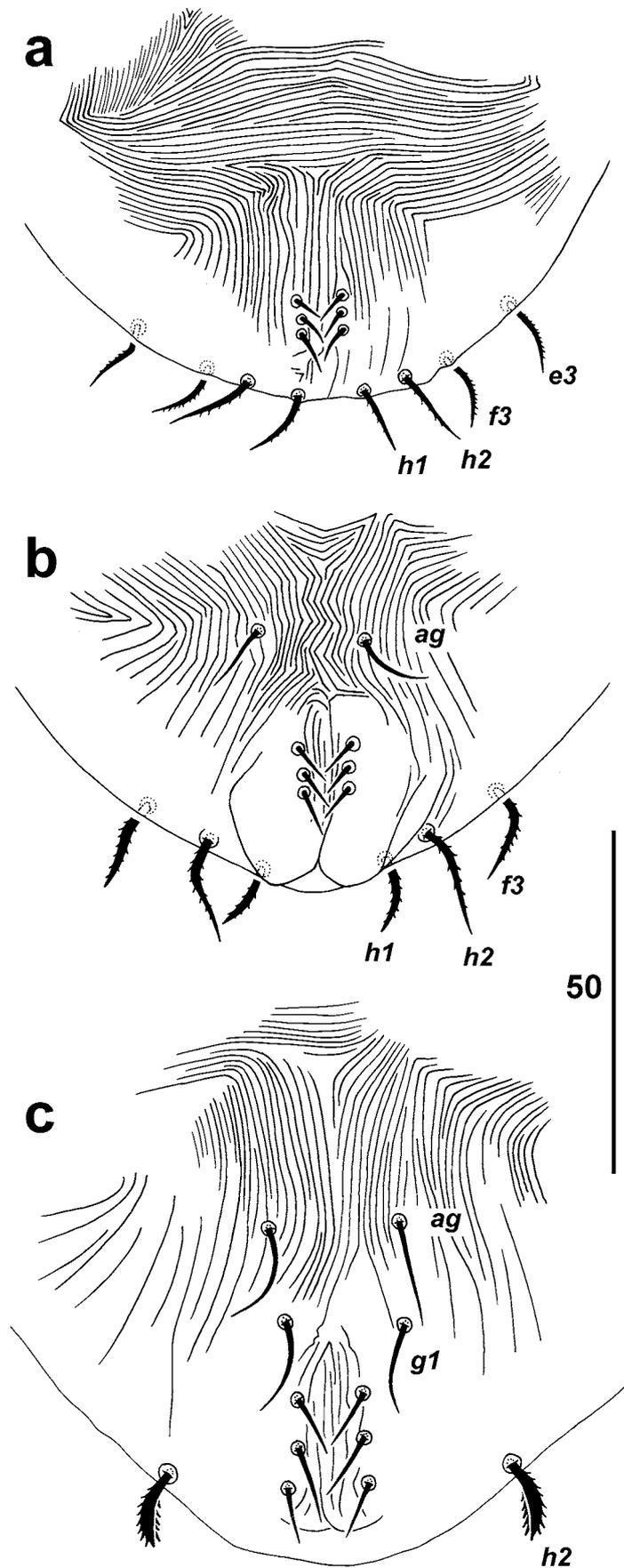


FIGURE 46. *Magdalenapalpus caperatus* Beard and Seeman, immature posterior venter, a. larva; b. protonymph; c. deutonymph.

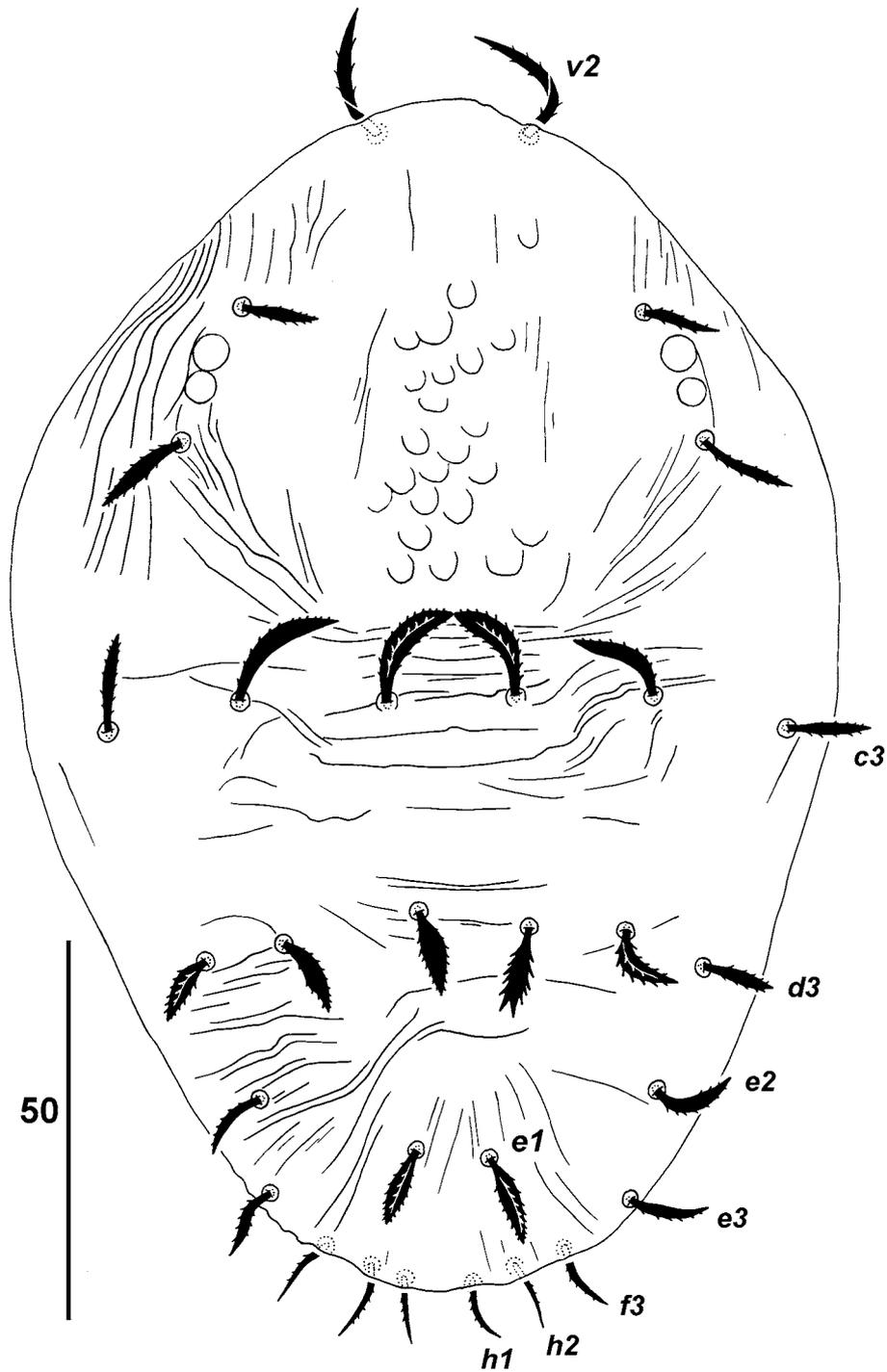


FIGURE 47. *Magdalenapalpus caperatus* Beard and Seeman, larva, dorsum.

LARVA (15 paratypes). *Dorsum*. (Fig. 47) Body measurements: distance between setae *v2-h1* 150–170, *sc2-sc2* 65–70; other measurements: *v2-v2* 17–18, *sc1-sc1* 49–51, *c1-c1* 15–16, *c2-c2* 52–54, *c3-c3* 89–94, *d1-d1* 11–13, *d2-d2* 47–50, *d3-d3* 67–72, *e1-e1* 9–10, *e2-e2* 55–59, *e3-e3* 45–53, *f3-f3* 31–34, *h1-h1* 5–7, *h2-h2* 16–18. Dorsal setae barbed; thin except for *v2*, *c3*, *d2* narrowly lanceolate and *c1*, *d1* lanceolate. Anterior margin of prodorsum without medial notch. Prodorsal shield smooth with few creases. Pygidial shield or platelets not apparent; cuticle with irregular transverse lines on soft cuticle. Setal lengths: *v2* 13–18, *sc1* 9–10, *sc2* 12–13, *c1* 13–15, *c2* 14–16, *c3* 9–10, *d1* 10–14, *d2* 10–11, *d3* 8–9, *e1* 9–10, *e2* 9, *e3* 7–10, *f3* 9–10, *h1* 8, *h2* 8–11. *Palps*. Palps similar to adult. Tibial setae, dorsal 6–7 long, ventral 5–6 long; tarsal eupathidia 4–5, 6 long; solenidion 4 long. *Venter*. (Fig. 46a) Striation similar to deutonymph. Anal setae *ps1–3* on weakly defined anal plates. Coxal

setae fine. Setal lengths: *1a* 18–23, *1b* 10–14, *3a* 20–23, *ps1* 3–4, *ps2* 3–4, *ps3* 3–4. *Legs*. Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 4 long, ta II 3–4 long) and 2 eupathidia $p\zeta''$ - $p\zeta'''$ (5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*.

Etymology. The specific name derives from *caperatus* (wrinkled), alluding to the dorsal ornamentation.

Remarks. This species was red in colour and found in cracks on bark. Our two new species of *Magdalenapalpus* have identical body and leg setation but are distinguished by the form of the dorsal setae and distance between *d1-d1* and *e1-e1*. These new species were also collected from two different genera of host plant, *Allocasuarina* and *Casuarina*.

Magdalenapalpus caperatus is similar to *M. forsteri* but can be separated by the shape of the dorsal setae which are broadly lanceolate in *M. caperatus* (narrowly lanceolate in *M. forsteri*), the distance between setae *d1-d1* 26–30 (11–16 in *M. forsteri*) and between setae *e1-e1* 23–25 (9–13 in *M. forsteri*).

***Magdalenapalpus forsteri* Seeman and Beard sp. nov.**

(Figs 48–53)

Type material examined. Holotype female ex. needles of Forest Oak *Allocasuarina torulosa* (Casuarinaceae), AUSTRALIA: SSW Mundubbera, base of Mt Lorna, “Toondahra”, 25°59'15"S 151°21'26"E, 12 May 2007, coll. J.J. Beard and P.I. Forster (QM). Paratypes. 10 females, 1 male, 1 pharate male, 3 deutonymphs, 7 larvae (QM, ANIC, USNM).

Diagnosis. Dorsal opisthosomal setae *f2* absent. Dorsal setae narrowly lanceolate, barbed. Prodorsum with irregular polygonal and folded sculpturing; opisthosomal shield with irregular folds; lateral cuticle weakly papillate. Dorsal opisthosomal setae *d1-d1* 11–16, *e1-e1* 9–13 apart. Posterior opisthosomal venter with fine barbed setae.

FEMALE (n = 11). *Dorsum*. (Fig. 48a) Body measurements: distance between setae *v2-h1* 310–325 [325]; *sc2-sc2* 105–115 [115]; other measurements: *v2-v2* 23–32 [32], *sc1-sc1* 81–89 [89], *c1-c1* 27–31 [28], *c2-c2* 85–92 [92], *c3-c3* 140–160 [160], *d1-d1* 11–16 [11], *d2-d2* 97–105 [105], *d3-d3* 120–125 [125], *e1-e1* 9–13 [11], *e2-e2* 105–115 [115], *e3-e3* 91–98 [96], *f3-f3* 72–81 [78], *h1-h1* 24–30 [27], *h2-h2* 50–58 [53]. Gnathosoma almost completely concealed beneath prodorsum. Anterior margin of prodorsum with medial notch (internal depth 21–26) forming 1 pair of broad lobes each bearing *v2*. Prodorsal shield with wrinkled ridge-like sculpturing, forming irregular polygons posteromedially. Opisthosomal shield with sparse irregular rugose sculpturing. Lateral cuticle surrounding shields papillate. All dorsal setae barbed, lanceolate. Setal lengths: *v2* 13–19 [13], *sc1* 15–19 [16], *sc2* 18–22 [22], *c1* 19–22 [28], *c2* 17–20 [20], *c3* 16–19 [17], *d1* 13–17 [13], *d2* 17–22 [19], *d3* 15–21 [20], *e1* 12–16 [12], *e2* 17–21 [19], *e3* 18–21 [21], *f3* 19–23 [21], *h1* 15–20 [20], *h2* 15–21 [16]. *Palps*. (Fig. 48b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 7–9 [7] long, ventral 10–11 [10] long; tarsal eupathidia 7–8 [7–8] long, 7–9 [8, 9] long; solenidion 7–8 [7, 8] long. *Venter*. (Fig. 49a) Cuticle with transverse striae, becoming longitudinal midway between *4a* and *ag*, extending to genital area; fine striae become coarse lateral to genital area. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield smooth, poorly defined; anal setae *ps1*–*3* inserted in longitudinal row on anal plates. Coxal setae fine; setae *ps1*–*2*, *ps3*, *g1*–*g2*, *ag* weakly barbed. Setal lengths: *1a* 62–74 [74], *1b* 21–26 [21], *2b* 16–21 [18], *2c* 20–27 [24], *3a* 44–72 [72], *3b* 18–21 [18], *4a* 46–63 [46], *4b* 15–40 [15], *ag1* 14–20 [15], *g1* 23–26 [24], *g2* 21–25 [23], *ps1* 16–18 [17], *ps2* 16–19 [18], *ps3* 10–14 [11]. *Spermatheca*. (Fig. 49b) Spermathecal tube ca. 1 wide, ca. 80 long, terminating in elongate membranous vesicle 6–8 long, 2–3 wide. Genital opening between setae *ps2*–*3*. *Legs*. (Fig. 50) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-3-4, 1-0-1-0-3-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 10–12 [12] long, ta II 9–12 [12] long) and 2 eupathidia $p\zeta''$ - $p\zeta'''$ (7–8 [7] long). Leg setation as in Table 1 except: cx I without *1c*; *v'* absent on tr I–IV, *l'* present on tr III; ge I–II with only *d* present (*l'* and *l''* absent), ge III–IV nude; ta I–IV without *tc''*.

MALE (1 paratype). *Dorsum*. (Fig. 51) Body measurements: distance between setae *v2-h1* 220, *sc2-sc2* 88; other measurements: *v2-v2* 23, *sc1-sc1* 68, *c1-c1* 23, *c2-c2* 73, *c3-c3* 107, *d1-d1* 11, *d2-d2* 74, *d3-d3* 86, *e1-e1* 12, *e2-e2* 74, *e3-e3* 64, *f3-f3* 52, *h1-h1* 12, *h2-h2* 33. Gnathosoma partially concealed beneath prodorsum. Anterior margin of prodorsum with median notch (internal depth 20–26). Prodorsal shield lightly punctate, with few striations. Opisthosoma with mesonotal shield bearing *c1*, *c2*, *d1* and *d2*, with few striations; and pygidial shield

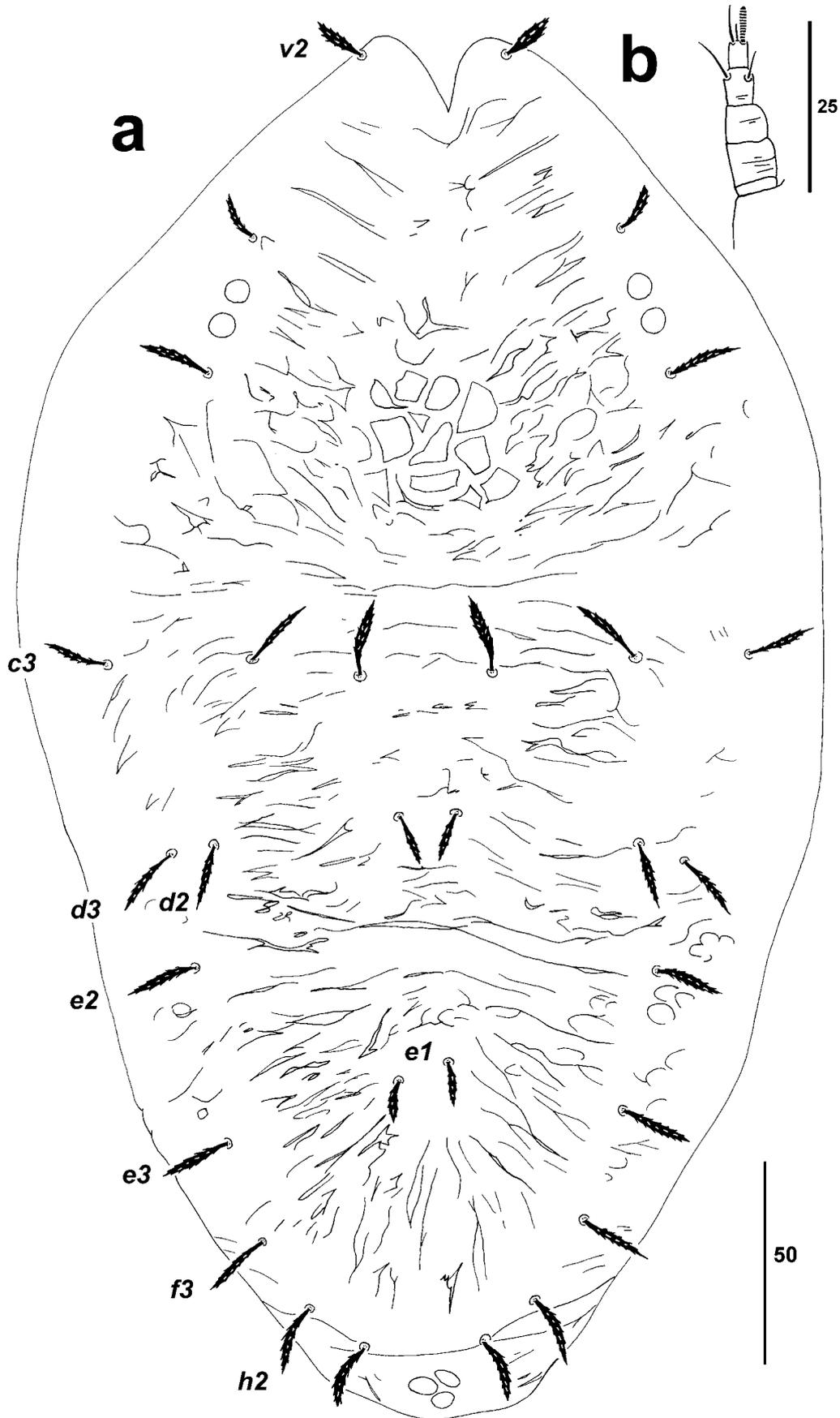


FIGURE 48. *Magdalenapalpus forsteri* Seeman and Beard, adult female, a. dorsum; b. detail of palp.

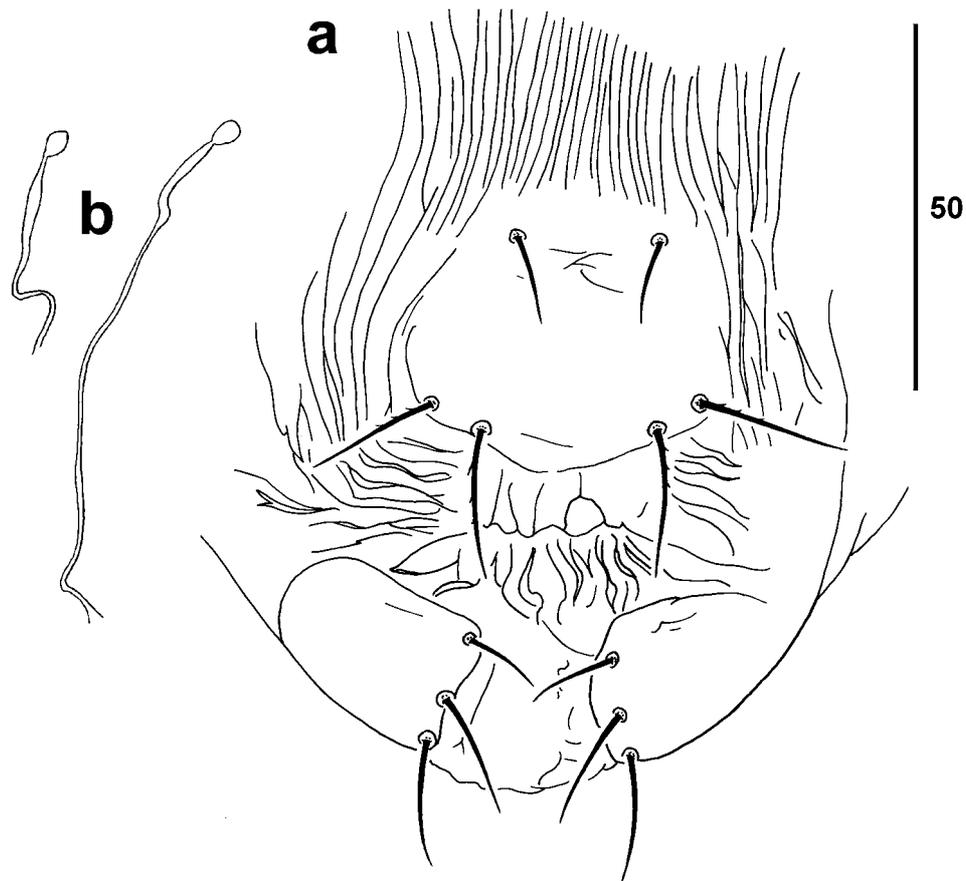


FIGURE 49. *Magdalenapalpus forsteri* Seeman and Beard, adult female, a. posterior venter; b. spermatheca.

bearing *e1*, *e3*, *f3*, *h1*, *h2*, with few striations; shields separated by transverse striae; papillate cuticle laterad prodorsal shield. Setal lengths: *v2* 17, *sc1* 14, *sc2* 17, *c1* 12, *c2* 15, *c3* 16, *d1* 10, *d2* 16, *d3* 16, *e1* 8, *e2* 17, *e3* 16, *f3* 16, *h1* 13, *h2* 16. *Palps.* (Fig. 51) Palps similar to female, except solenidia greatly swollen. Tibial setae, dorsal 8 long, ventral 10 long; tarsal eupathidia 10, 11 long; solenidion 11 long. *Venter.* (Fig. 52) All striae transverse, becoming coarse posteriorly and weak around setae *ag1*. Coxal setae fine. Setae *ag1*, *g1*, *g2* thin, barbed; *ps2*, *ps3* thin, smooth; setae *ps1* modified to form thick blades (sexually dimorphic). Setal lengths: *1a* 52, *1b* 20, *2b* 17, *2c* 17, *3a* 62, *3b* 13, *4a* 42, *4b* 17, *ag1* 11, *g1* 11, *g2* 13, *ps1* 13, *ps2* 11, *ps3* 10. *Aedeagus.* (Fig. 52) Narrow, sclerotised, tapering to a point, 56 long. Membranous duct runs from inside aedeagus, becoming indistinguishable. *Legs.* (Fig. 51) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 12 long, ta II 11 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 8, 7 long; ta II 7, 7 long). Solenidia much thicker and longer than in female.

DEUTONYMPH (3 paratypes). *Dorsum.* Body measurements: distance between setae *v2-h1* 255–275, *sc2-sc2* 85–97; other measurements: *v2-v2* 21–24, *sc1-sc1* 70–78, *c1-c1* 19–28, *c2-c2* 70–79, *c3-c3* 120–130, *d1-d1* 13–17, *d2-d2* 69–78, *d3-d3* 95–103, *e1-e1* 10–13, *e2-e2* 88–94, *e3-e3* 77–84, *f3-f3* 61–64, *h1-h1* 15–17, *h2-h2* 20–22. Gnathosoma not concealed by prodorsum. Anterior margin of prodorsum with rounded protrusion lacking medial notch. Prodorsal shield smooth, delineated by striae. Opisthosomal shield with *c1-c2* and *d1-d2* on patches of smooth cuticle, and smooth pygidial shield; all shields surrounded by coarse irregularly transverse to oblique striae. All dorsal setae lanceolate. Setal lengths: *v2* 23–26, *sc1* 16–17, *sc2* 19–26, *c1* 19–22, *c2* 21–22, *c3* 19–22, *d1* 12–16, *d2* 16–21, *d3* 19–23, *e1* 11–13, *e2* 20–22, *e3* 20–23, *f3* 19–23, *h1* 15–17, *h2* 20–22. *Palps.* Palps similar to adult. Tibial setae, dorsal 6 long, ventral 8 long; tarsal eupathidia 6–7, 5–6 long; solenidion 5 long. *Venter.* Cuticle with transverse striae to midway between *4a* and *ag*, becoming longitudinal, striae coarse around anal region. Anal setae *ps1*–*3* on weakly defined anal plates. Most ventral setae fine, smooth, except *ps1* barbed, *ps2* lightly barbed. Setal lengths: *1a* 38–51, *1b* 14–18, *2b* 12–14, *2c* 21–22, *3a* 36–44, *3b* 13–15, *4a* 33–38, *4b* 12, *ag1* 10–13, *g1* 13–17, *ps1* 9–11, *ps2* 10–12, *ps3* 6–8. *Legs.* Setal formula for legs I–IV same as adult. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 6–7 long, ta II 6 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 6 long; ta II 5–6 long).

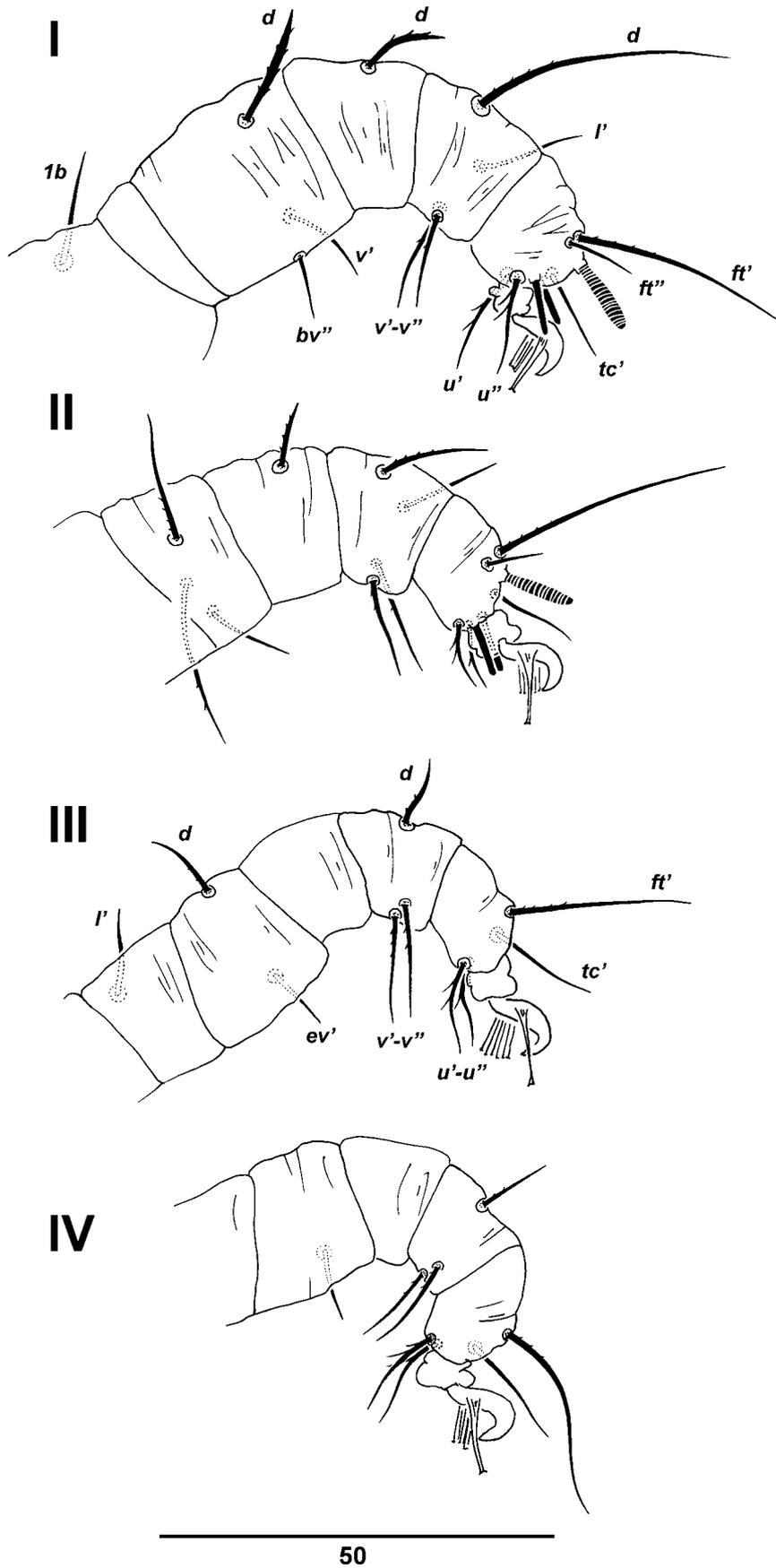


FIGURE 50. *Magdalenapalpus forsteri* Seeman and Beard, adult female, legs (right side), solenidium ω'' and eupathidia ($p\zeta'$ - $p\zeta''$) not labelled leg I.

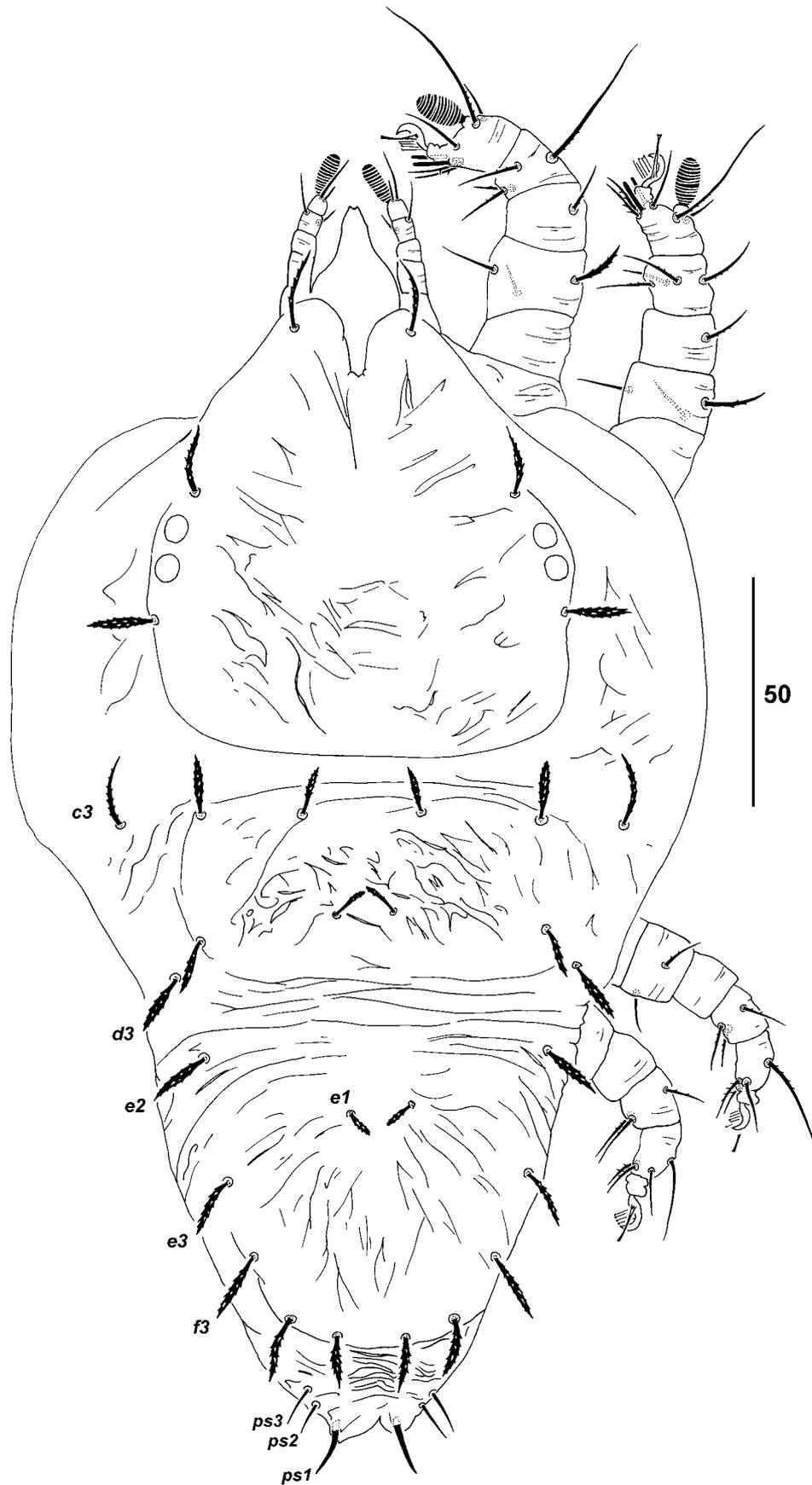


FIGURE 51. *Magdalenapalpus forsteri* Seeman and Beard, adult male, dorsum, with detail of legs and palp.

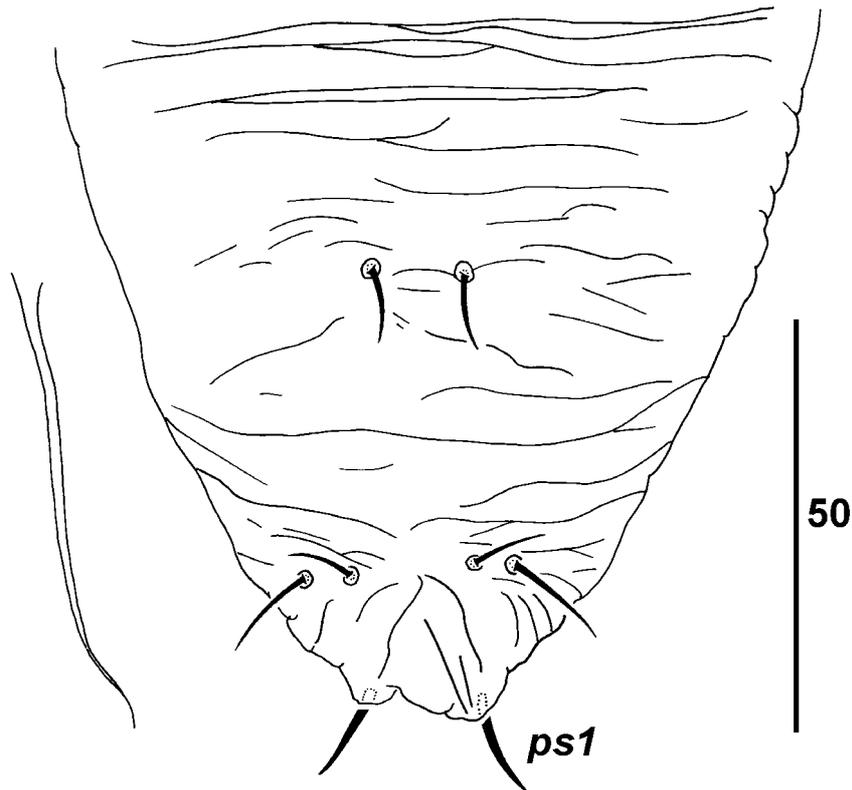


FIGURE 52. *Magdalenapalpus forsteri* Seeman and Beard, adult male, posterior venter, with detail of aedeagus.

PROTONYMPH. Unknown.

LARVA (4 paratypes). *Dorsum*. (Fig. 53) Body measurements: distance between setae *v2-h1* 145–165, *sc2-sc2* 64–69; other measurements: *v2-v2* 17–22, *sc1-sc1* 53–60, *c1-c1* 15–16, *c2-c2* 51–57, *c3-c3* 86–93, *d1-d1* 8–10, *d2-d2* 42–50, *d3-d3* 57–67, *e1-e1* 5–7, *e2-e2* 52–58, *e3-e3* 45–46, *f3-f3* 33–37, *h1-h1* 7–8, *h2-h2* 16–23. Gnathosoma not concealed by prodorsum. Anterior margin of prodorsum without medial notch. Prodorsal shield smooth, delineated by striae. Pygidial shield or platelets not apparent; cuticle with irregular transverse lines on soft cuticle. Dorsal setae barbed, thin to narrowly lanceolate. Setal lengths: *v2* 16–23, *sc1* 10–12, *sc2* 15–17, *c1* 9–14, *c2* 11–13, *c3* 13–14, *d1* 6–9, *d2* 11–17, *d3* 13–15, *e1* 6–7, *e2* 12–14, *e3* 12–14, *f3* 14–17, *h1* 9–10, *h2* 14–16. *Palps*. (Fig. 53) Palps similar to adult. Tibial setae, dorsal 7–8 long, ventral 5 long; tarsal eupathidia 5, 4 long; solenidion 4 long. *Venter*: Striation similar to deutonymph. Anal setae *ps1*–3 on weakly defined anal plates. Coxal setae fine. Setal lengths: *1a* 24–36, *1b* 10–13, *3a* 22–26, *ps1* 4–5, *ps2* 4, *ps3* 3–4. *Legs*. (Fig. 53) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 4 long, ta II 3–4 long) and 2 eupathidia $p\zeta'-p\zeta'''$ (5 long). Leg setation as in Table 1 except genua I–III nude.

Etymology. It is with great pleasure that we name this species in honour of Queensland botanist, Paul Forster, for the numerous identifications and host plant collections he has made for us over the years.

Remarks. Our two new species of *Magdalenapalpus* have identical body and leg setation but are distinguished by the form of the dorsal setae and distance between *d1-d1* and *e1-e1*. These new species were also collected from two different genera of host plant, *Allocasuarina* and *Casuarina*.

Magdalenapalpus forsteri is similar to *M. caperatus* but can be separated by the shape of the dorsal setae which are narrowly lanceolate in *M. forsteri* (broadly lanceolate in *M. caperatus*), the distance between setae *d1-d1* 11–16 (in 26–30 *M. caperatus*) and between setae *e1-e1* 9–13 (in 23–25 *M. caperatus*).

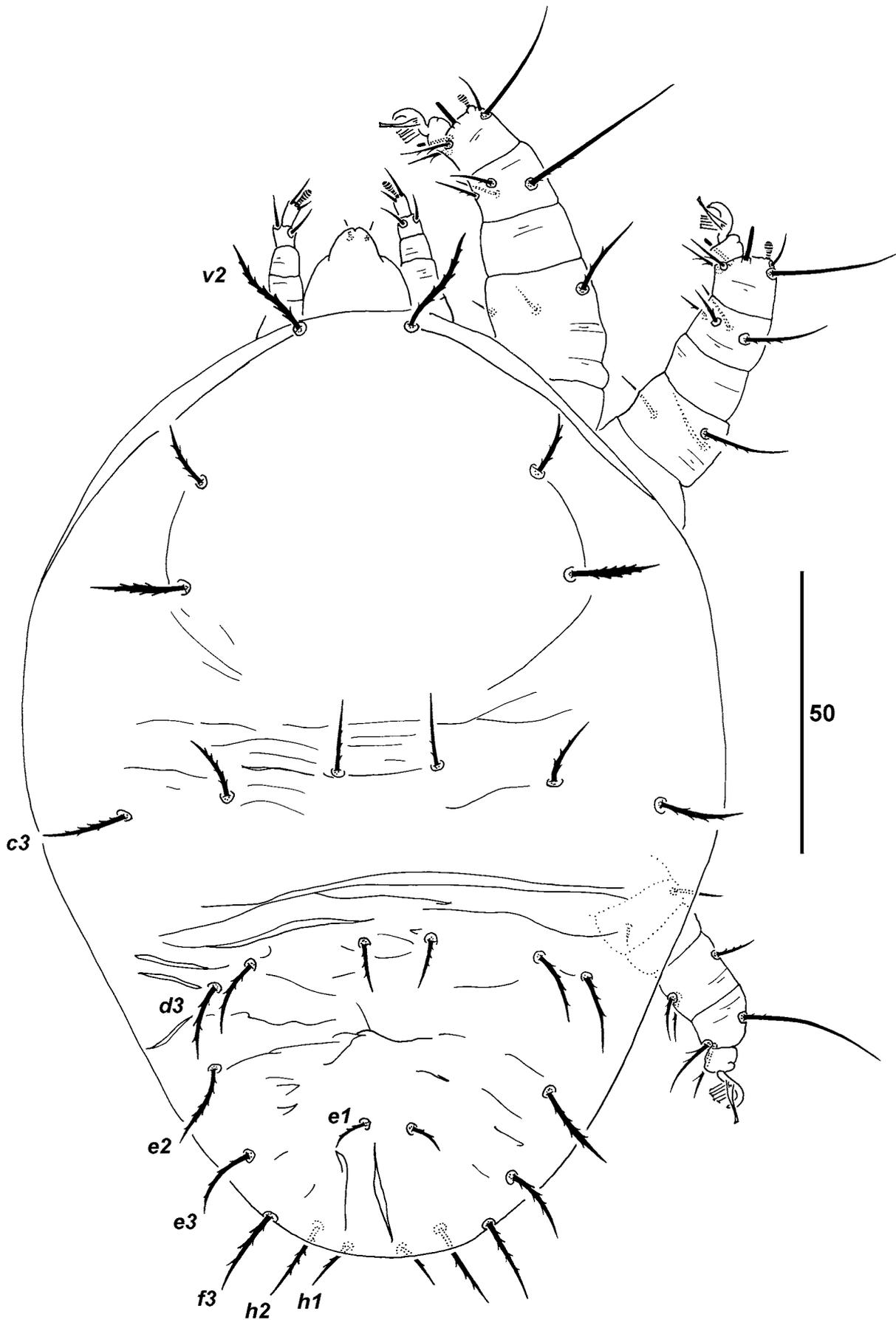


FIGURE 53. *Magdalenapalpus forsteri* Seeman and Beard, larva, dorsum with details of legs and palp.

***Meyeraepalpus* Smiley, Frost and Gerson, 1996**

Type species. *Meyeraepalpus delfinadae* Smiley, Frost and Gerson 1996, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 13 pairs of broadly lanceolate dorsal setae; *c2*, *d2* and *e2* present; setae *e2* and *f2* in sublateral position aligned with *c2* and *d2*, not on margin; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, palp setal formula 0, 0, 0, 2, 3(1); 3 pairs of pseudanal setae (*ps1–3*) on weakly developed membranous anal plates; immature stages with anterior margin of prodorsum smoothly rounded, without projections or notches. *Adult female:* Anterior margin of prodorsum with triangular lobes present, within anterior prodorsal concavity, anterior to setae *v2*; gnathosoma partially concealed by prodorsum; ventral plate weakly developed, membranous; genital plate weakly developed, membranous. Coxal seta *1c* present. Solenidia of male swollen, much larger than those of female.

Remarks. Smiley *et al.* (1996) designated *Meyeraepalpus delfinadae* as the type species for the genus, which also included *Me. strandtmanni*. Mesa *et al.* (2009) moved *Me. delfinadae* to *Aegyptobia* and erected the new genus *Magdalenapalpus* for *Me. strandtmanni*. Recently we were able to recollect *Me. delfinadae*, remount specimens studied by Smiley *et al.* (1996), study fresh specimens under the low temperature scanning electron microscope, and perform a cladistic analysis to show that *Meyeraepalpus* is in fact a valid genus, and is rediagnosed above. We agree with Mesa *et al.* (2009) that the second species originally grouped with *Me. delfinadae*, *Ma. strandtmanni*, does in fact represent a different genus and accept *Magdalenapalpus*, which we also redescribe and rediagnose.

***Meyeraepalpus delfinadae* Smiley, Frost and Gerson, 1996**

(Figs 54–66)

Meyeraepalpus delfinadae Smiley, Frost and Gerson, 1996: 178, figs. 22–25.

Aegyptobia delfinadae, Mesa *et al.* (2009): 13.

Type material examined. Holotype female ex. Slaty She-Oak *Allocasuarina muelleriana* (Casuarinaceae) [feeding on bark of branchlets], **AUSTRALIA:** South Australia, Flinders Ranges, St Mary's Peak, at 750 m, 03 October 1995, coll. W. E. Frost (WINC). Paratypes. 2 females, same data as holotype (WINC; 1 slide, with 1 *Crossipalpus muellerianae* deutonymph); 1 male, same data as holotype (WINC; same slide as holotype).

Non-type material examined. 8 females, 2 pharate females, 1 male, 5 deutonymphs, 3 protonymphs, 1 pharate protonymph, 1 larva, ex. *Allocasuarina muelleriana*, **AUSTRALIA:** South Australia, Adelaide, Athelston, Maryvale Road, Wadmore Park, 34°52'49"S 138°42'10"E, 21 April 2009, coll. J.J. Beard and C.J. Burwell (QM; USNM).

Diagnosis. All dorsal setae broadly lanceolate, barbed. Both dorsal shields with weak rugose sculpturing. Gnathosoma partially concealed by prodorsum. Anterior margin of prodorsum with fleshy triangular lobes, within deep anterior prodorsal concavity, anterior to setae *v2*. Palp setal formula 0, 0, 0, 2, 3(1). Setae *ps1–3* narrow, smooth. Coxae I–IV 2-2-1-1 (*1c* present on cx I); trochanters I–IV 1-1-2-1 (seta *v'* present on tr I–IV; *l'* present on tr III); femora I–IV 3-3-1-1 (*d* absent on fe III); genua I–IV 3-3-1-0 (*l'* and *l''* present on ge I–II; *l'* present on ge III; ge IV nude); tarsi I–IV 9(1)-9(1)-5-5 (*tc''* present ta I–IV). Empodia claw-like. Spermathecal tube narrow, ca. 110 long. Spermathecal vesicle elongate, 2–4 wide, 10 long. Male with swollen solenidia on palps and tarsus I–II.

FEMALE (n = 11). *Dorsum.* (Figs 54, 55a, 56, 57a) Body measurements: distance between setae *v2-h1* 265–300 [290]; *sc2-sc2* 140–170 [145]; other measurements: *v2-v2* 31–44 [31], *sc1-sc1* 115–135 [115], *c1-c1* 30–42 [42], *c2-c2* 140–175 [145], *c3-c3* 185–235 [195], *d1-d1* 18–31 [28], *d2-d2* 135–165 [140], *d3-d3* 170–205 [170], *e1-e1* 18–27 [18], *e2-e2* 130–145 [130], *e3-e3* 125–155 [140], *f2-f2* 91–110 [94], *f3-f3* 96–105 [105], *h1-h1* 22–31 [31], *h2-h2* 58–75 [68]. Gnathosoma partially concealed beneath anterior margin of prodorsum (Fig. 56). Anterior margin of prodorsum with medial notch anterior and ventral to setae *v2* (internal depth 14–22 [17]), forming 1 pair of three-dimensional triangular lobes originating from within apparent depression; anterior notch often appearing slightly withdrawn into prodorsum when anterior margin of prodorsum collapsing and/or folds on itself anterior to setae *v2* (Figs 56, 57a). Prodorsal and opisthosomal shields weakly developed with sparse rugose sculpturing. Lateral cuticle surrounding shields with few irregular striae. All dorsal setae short, broadly lanceolate,

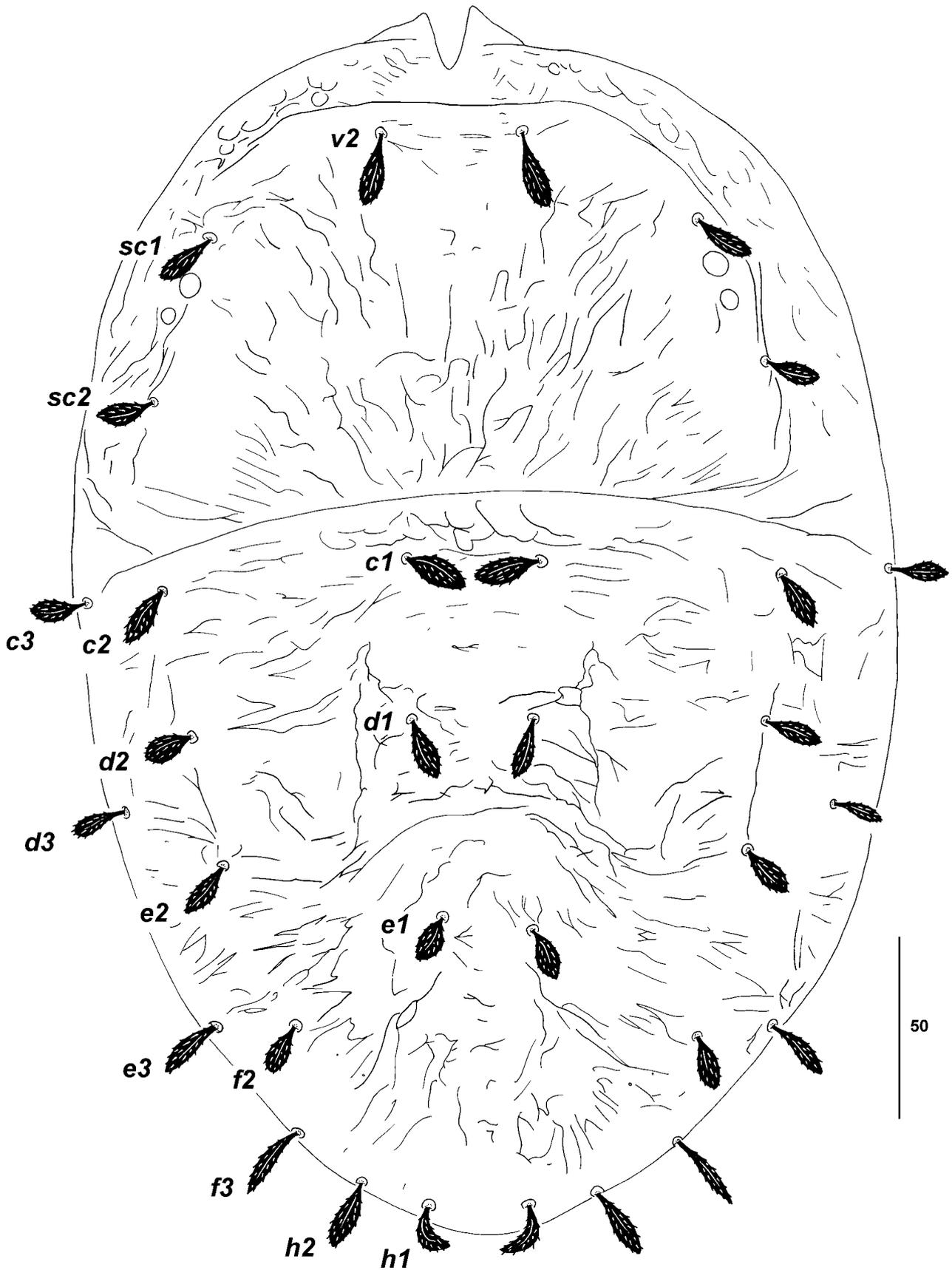


FIGURE 54. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), adult female dorsum.

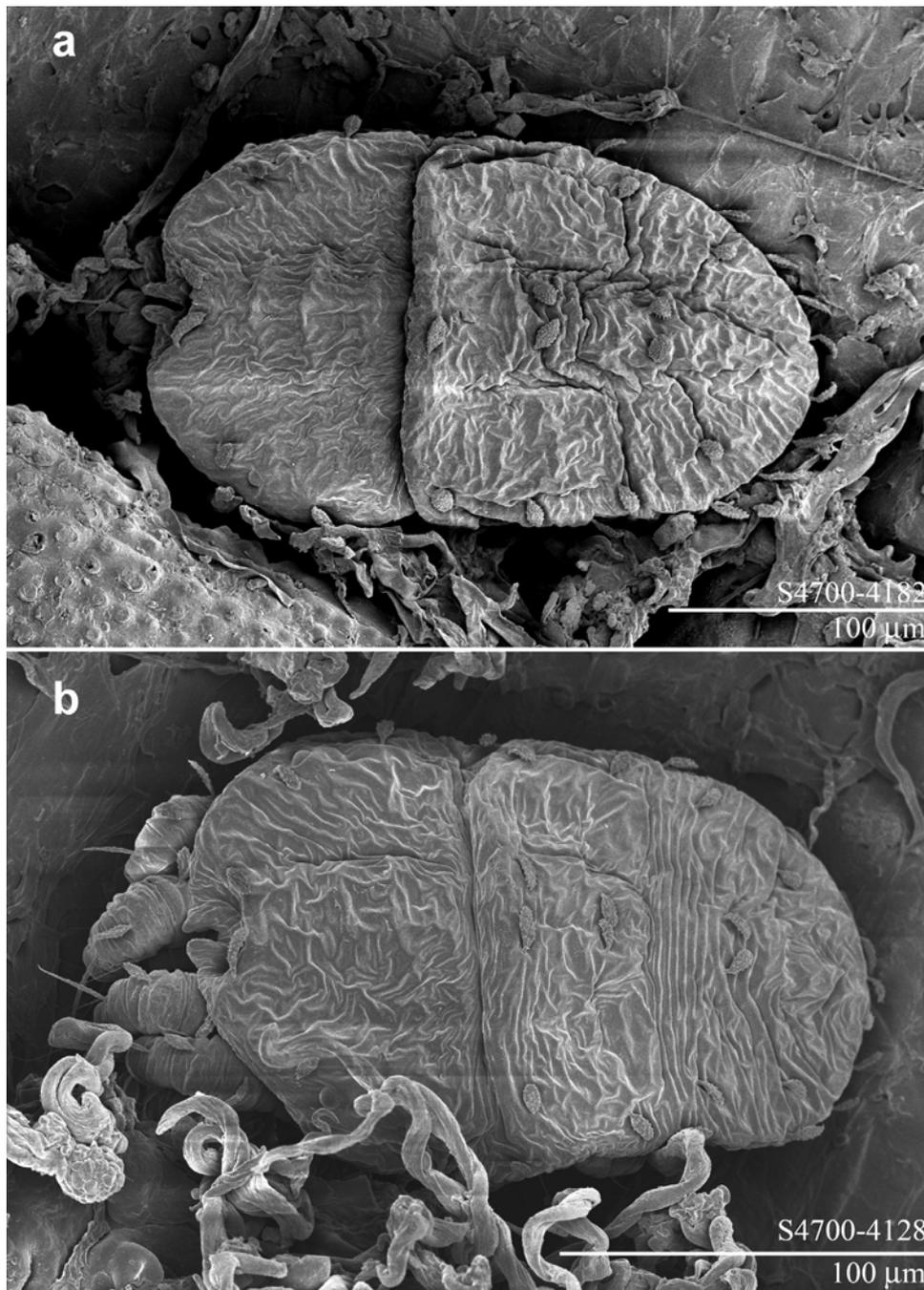


FIGURE 55. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), a. adult female in habitat; b. adult male in habitat.

barbed. Setal lengths: *v2* 18–21 [19], *sc1* 14–22 [17], *sc2* 14–19 [17], *c1* 17–23 [23], *c2* 13–19 [19], *c3* 13–17 [15], *d1* 18–21 [20, 21], *d2* 15–20 [16], *d3* 14–22 [16, 18], *e1* 15–21 [19], *e2* 13–17 [13, 17], *e3* 16–20 [18, 19], *f2* 15–18 [18], *f3* 17–27 [20], *h1* 14–17 [16], *h2* 17–22 [21, 22]. *Palps.* (Fig. 56) Setal formula 0, 0, 0, 2, 3 (1s+2e). Tibial setae, dorsal 7–10 [8] long, ventral 9–12 [10] long; tarsal eupathidia 5–6 [6], 7–8 [8] long; solenidion 5–6 [6] long. *Venter.* (Fig. 58a, b) Cuticle with fine longitudinal striae between *1a-1a*; broadly separated transverse striae between *1a-3a*; weak fine transverse striae *3a-4a*; striae posterior to *4a* fine transverse becoming oblique to longitudinal towards *ag*; *ag-ag* with mixed striae; broadly separated longitudinal striae surrounding genital flap; few weak longitudinal to oblique striae on genital flap. Genital setae inserted in more-or-less transverse row on genital flap. Anal setae *ps1-3* fine, inserted along medial margin of anal plates in more-or-less longitudinal line. Coxal, genital and anal setae fine. Setal lengths: *1a* 55–70 [64], *1b* 18–33 [31], *1c* 15–25 [25], *2b* 20–31 [27], *2c* 19–31 [24], *3a* 46–77 [72], *3b* 20–28 [24], *4a* 45–64 [63], *4b* 21–30 [25], *ag* 20–26 [23], *g1* 22–28 [24], *g2* 18–27

[23], *ps1* 12–17 [15], *ps2* 12–15 [14], *ps3* 10–17 [13]. *Spermatheca*. (Fig. 58c) Spermathecal tube narrow, ca. 110 long. Spermatheca elongate, 10 long, 2 wide basally and expanding to 3–4 wide. Genital opening between setae *ps3*. Not always clearly visible. *Legs*. (Fig. 59) Setal formula for legs I–IV (coxae to tarsi) 2-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-1-1-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 6–9 [8, 9] long, ta II 6–8 [8] long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 7–9 [8, 9] long; ta II 6–8 [7] long). Leg setation as in Table 1 except femora III without seta *d*. Setae *v'* added to tr IV.

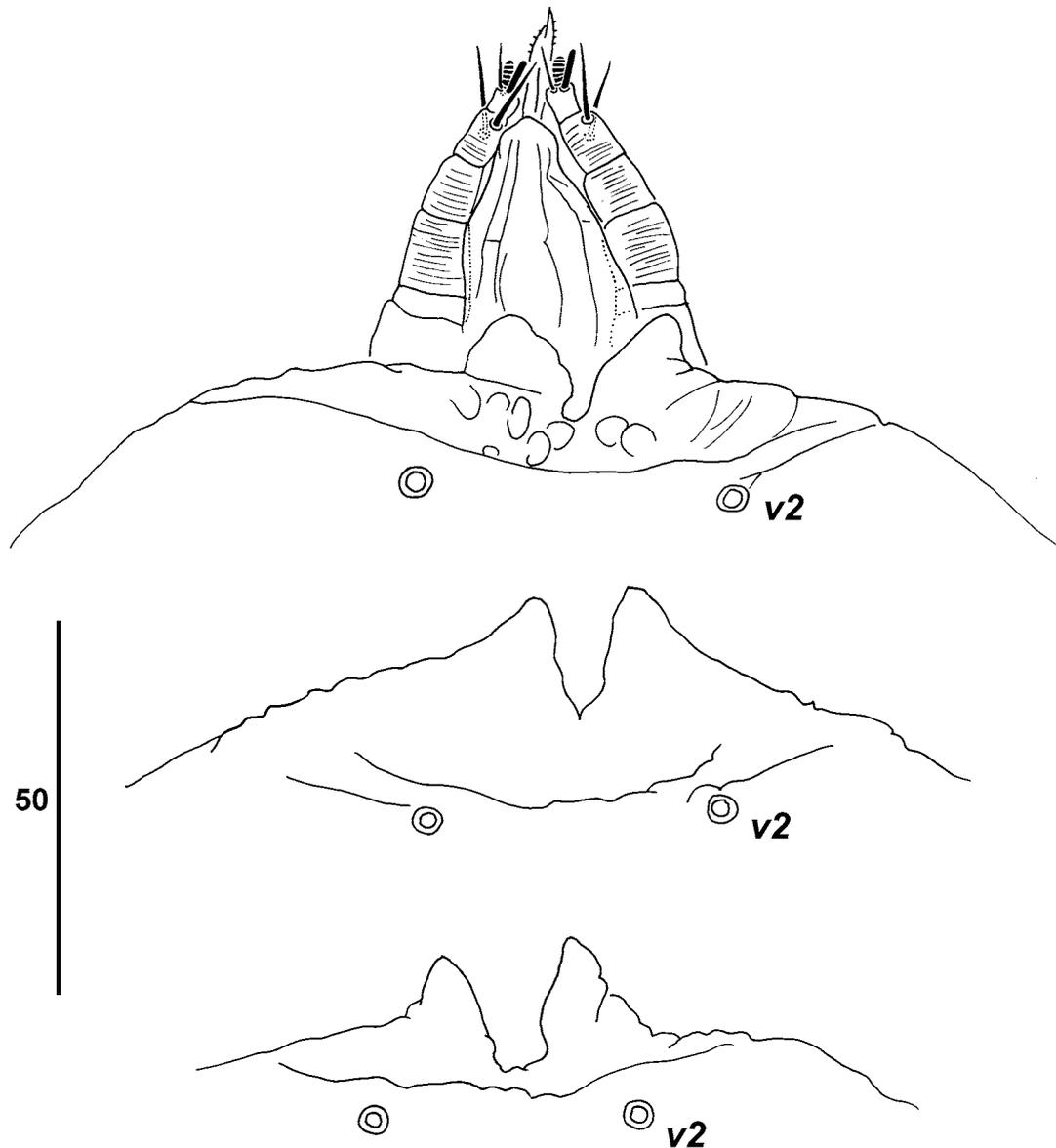


FIGURE 56. *Meyeraepalpus delphinadae* (Smiley, Frost and Gerson), adult female, anterior margin of prodorsum, with detail of palps.

MALE ($n = 2$). *Dorsum*. (Fig. 55b) Body measurements: distance between setae *v2-h1* 210–215, *sc2-sc2* 115–125; other measurements: *v2-v2* 25–30, *sc1-sc1* 93–94, *c1-c1* 28–29, *c2-c2* 106–110, *c3-c3* 136–152, *d1-d1* 18–19, *d2-d2* 92–97, *d3-d3* 107–113, *e1-e1* 15–17, *e2-e2* 82–87, *e3-e3* 92–97, *f2-f2* 63–64, *f3-f3* 72–74, *h1-h1* 12, *h2-h2* 41–43. Gnathosoma not concealed beneath anterior margin of prodorsum (Fig. 61). Anterior margin of prodorsum similar to female, with medial notch anterior to setae *v2* (internal depth 9–11) (Figs 57b, 61). Prodorsal, mesonotal and pygidial shields weakly wrinkled and finely pitted; setae *c1-2* and *d1-2* inserted on paired mesonotal shields; setae *e1*, *e3*, *f2-3*, *h1-2* inserted on pygidial shield. Setal lengths: *v2* 17, *sc1* 15, *sc2* 14, *c1* 17, *c2* 14, *c3* 15, *d1* 15, *d2* 14, *d3* 14, *e1* 15, *e2* 15, *e3* 16, *f2* 13, *f3* 17, *h1* 12, *h2* 17. *Palps*. (Figs 60a, 61) Palps similar to female. Tibial setae, dorsal 10–11 long, ventral 8–9 long; tarsal eupathidia 7, 7–8 long; solenidion significantly

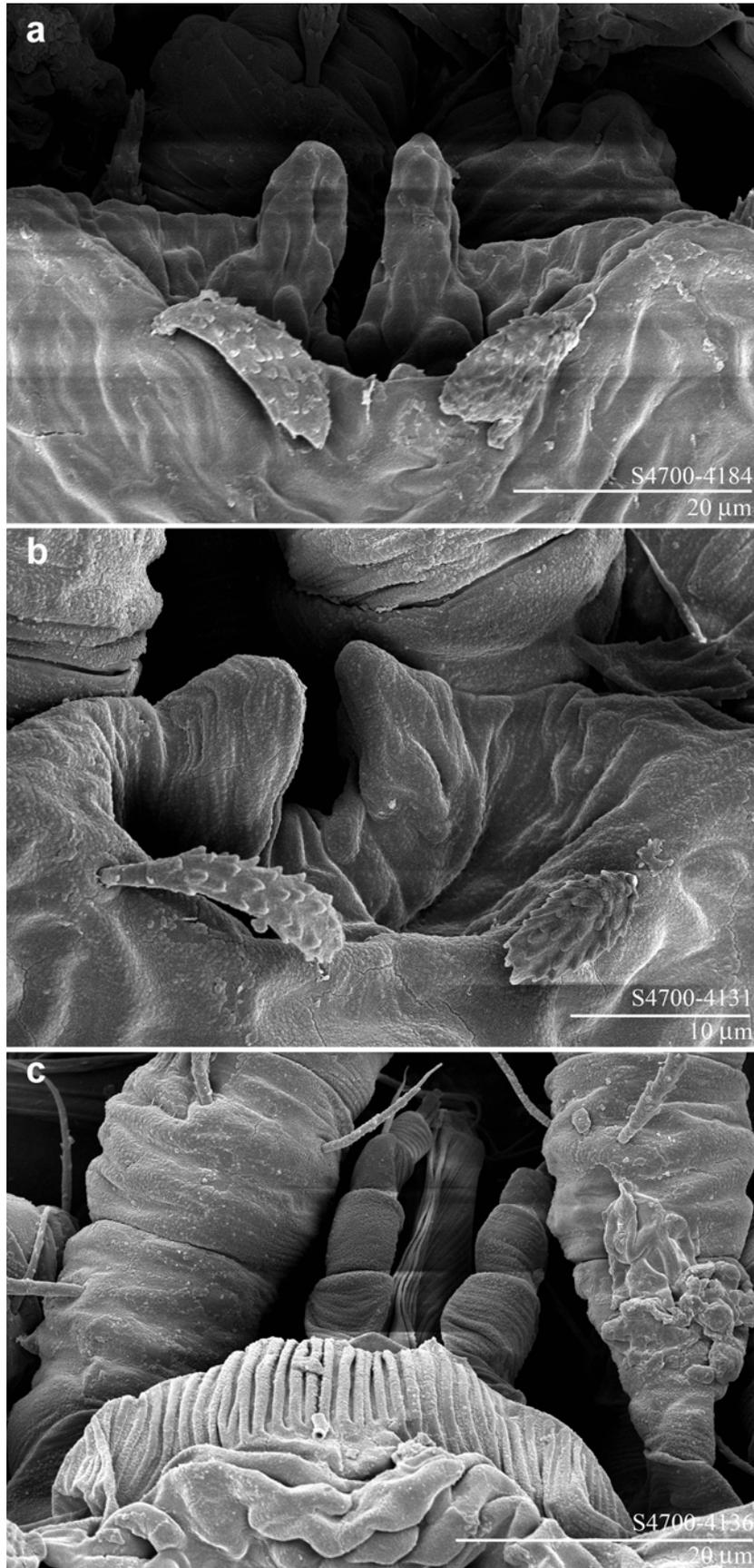


FIGURE 57. *Meyeraepalpus delphinadae* (Smiley, Frost and Gerson), anterior margin of prodorsum, with setae v2, a. adult female; b. adult male; c. deutonymph.

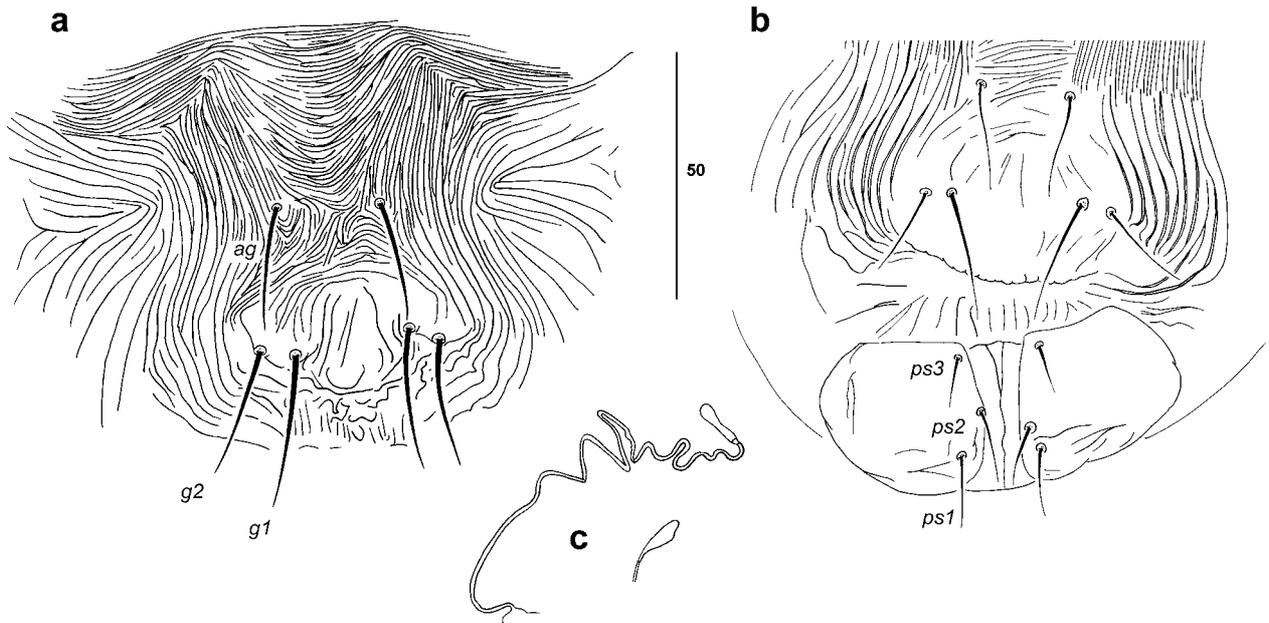


FIGURE 58. *Meyeraealpus delfinadae* (Smiley, Frost and Gerson), adult female, a. genital region; b. posterior venter; c. spermatheca.

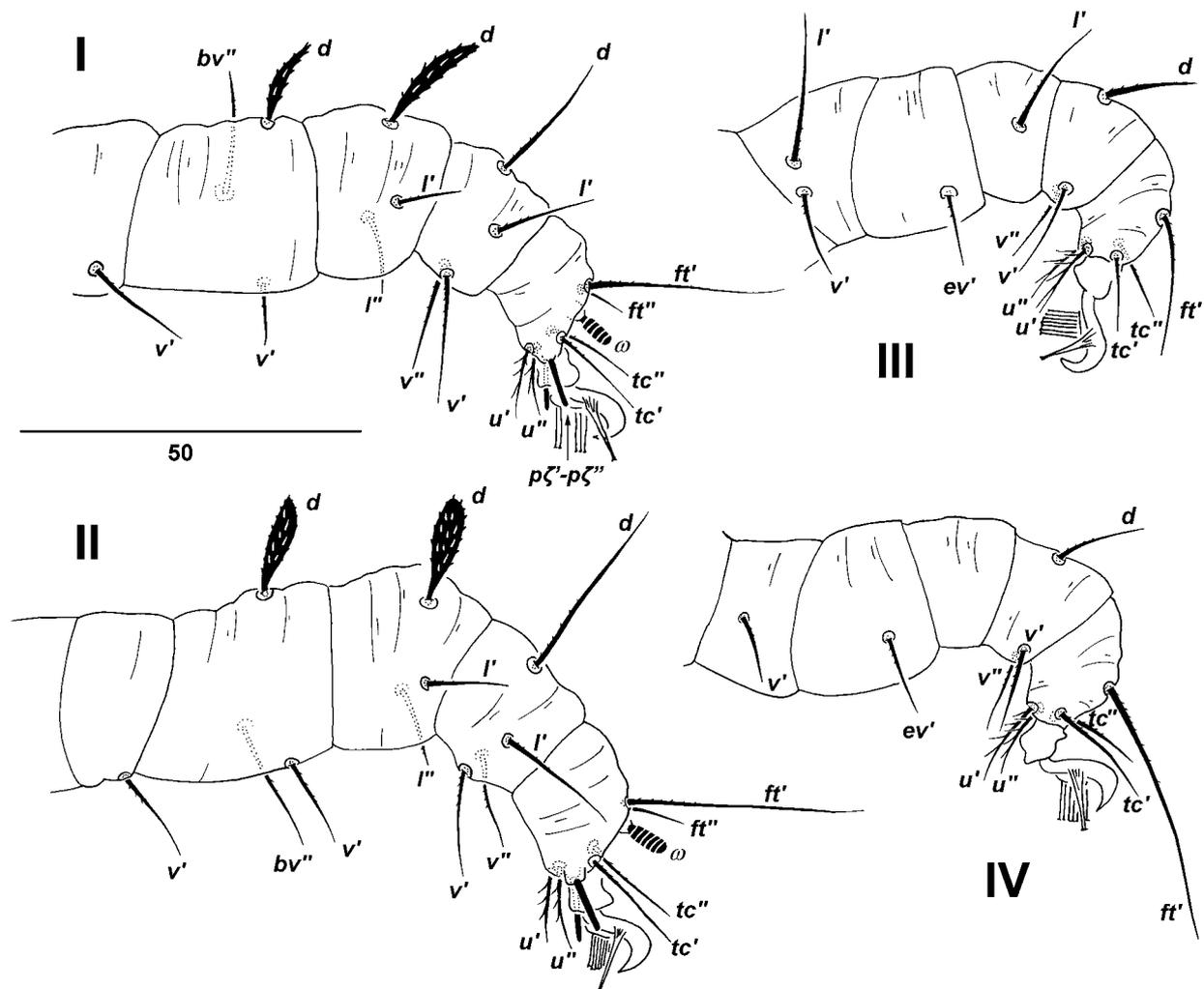


FIGURE 59. *Meyeraealpus delfinadae* (Smiley, Frost and Gerson), adult female, legs (left side), eupathidia ($p\zeta'-p\zeta''$) on leg II not labelled.

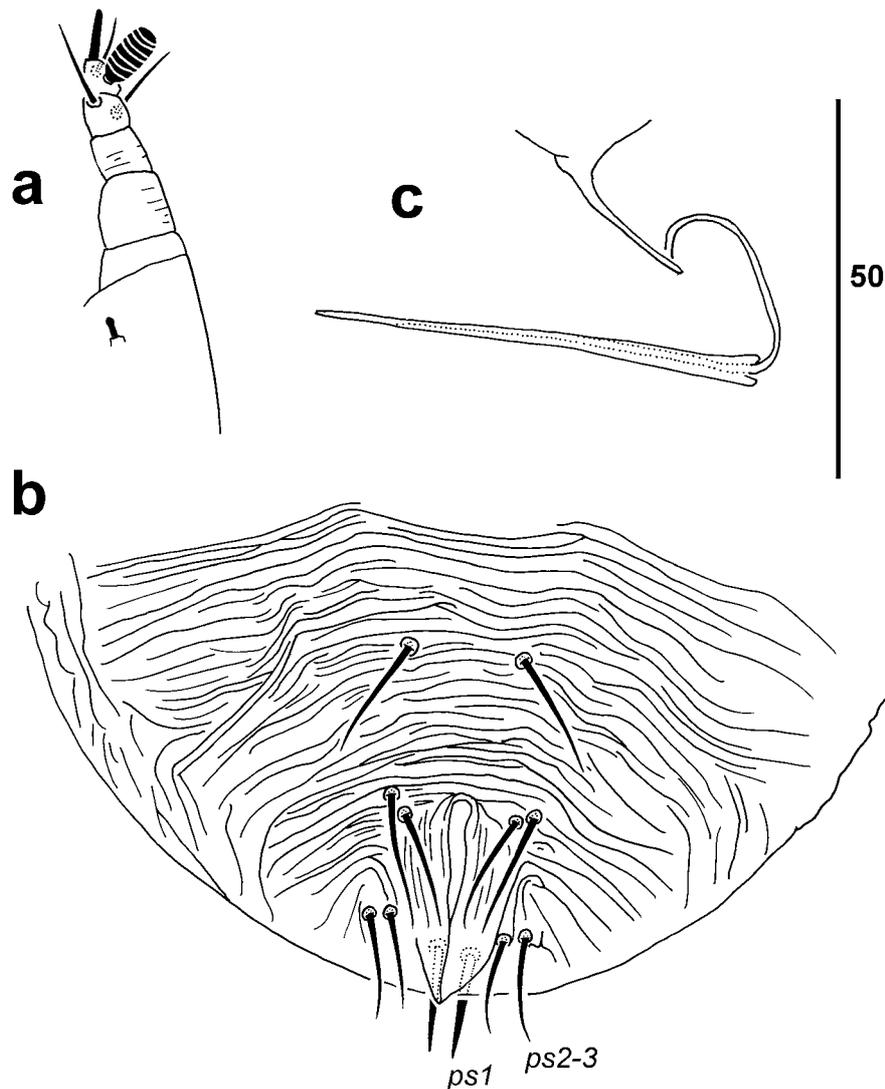


FIGURE 60. *Meyeraepalpus delphinadae* (Smiley, Frost and Gerson), adult male, a. palp; b. posterior venter; c. aedeagus.

swollen 8–9 long (Fig. 61). *Venter*. (Fig. 60b) Cuticle with fine longitudinal striae between *1a-1a*; broadly separated transverse striae between *1a-3a*; weak fine transverse striae *3a-4a*; broadly separated transverse striae and folds between *4a* and posterior margin of body. Coxal setae fine and finely barbed. Setae *agl*, *g1*, *g2*, *ps2*, *ps3* fine; setae *ps1* modified to form thick spines (Fig. 60b). Setal lengths: *1a* 59–66, *1b* 26–30, *2b* 25–29, *2c* 21–24, *3a* 43–61, *3b* 23–26, *4a* 40–49, *4b* 24–28, *agl* 17–19, *g1* 15–18, *g2* 17–18, *ps1* 13–15, *ps2* 11–14, *ps3* 13–15. *Aedeagus*. (Fig. 60c) Narrow, sclerotised, tapering to a blunt point, 60–61 long. *Legs*. (Figs 62, 63) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' , significantly swollen (ta I 12–14 long; ta II 8–12 long) and 2 eupathidia $p\zeta'-p\zeta''$ (7–8 long). Solenidia significantly broader and longer than those of female (Fig. 63).

DEUTONYMPH (n = 5). *Dorsum*. (Figs 57c, 64) Body measurements: distance between setae *v2-h1* 260–275, *sc2-sc2* 120; other measurements: *v2-v2* 34, *sc1-sc1* 109, *c1-c1* 26–28, *c2-c2* 122, *c3-c3* 150, *d1-d1* 21, *d2-d2* 108–110, *d3-d3* 150–165, *e1-e1* 18–20, *e2-e2* 100–102, *e3-e3* 90–100, *f2-f2* 80–95, *f3-f3* 66–67, *h1-h1* 19–20, *h2-h2* 41–50. Anterior margin of prodorsal shield without notch (Fig. 57c). Prodorsal shield smooth with few irregular creases. Opisthosoma with irregular transverse striae and some patches of smooth cuticle, including setae *c1*. Lateral cuticle smooth with weak irregular striae. Dorsal setae broadly lanceolate, except narrowly lanceolate setae *f3* and *h2*. Setal lengths: *v2* 17–19, *sc1* 14–15, *sc2* 13–14, *c1* 17–18, *c2* 12–17, *c3* 11, *d1* 16–17, *d2* 12–14, *d3* 15–17, *e1* 15, *e2* 11–13, *e3* 14–16, *f2* 11, *f3* 19, *h1* 9–10, *h2* 15–20. *Palps*. Palps similar to adult. Tibial setae, dorsal 6–7 long, ventral 8–9 long; tarsal eupathidia 4–5, 5–6 long, solenidion 3–4 long. *Venter*. Cuticle with fine transverse striae to anterior of *ag*, longitudinal striae becoming coarse around anal region. Coxal, genital and anal setae fine. Setal lengths: *1a* 40–48, *1b* 16–20, *2b* 14–19, *2c* 18–20, *3a* 30–40, *3b* 15–17, *4a* 25–28, *4b* 14–17, *agl* 15, *g1* 16,

ps1 8, *ps2* 8–10, *ps3* 8. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 2-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-1-1-3-5, 1-0-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (6–7, 6 long). Leg setation as in adult except: tr IV without seta v' . Setae v' added to tr I–III.

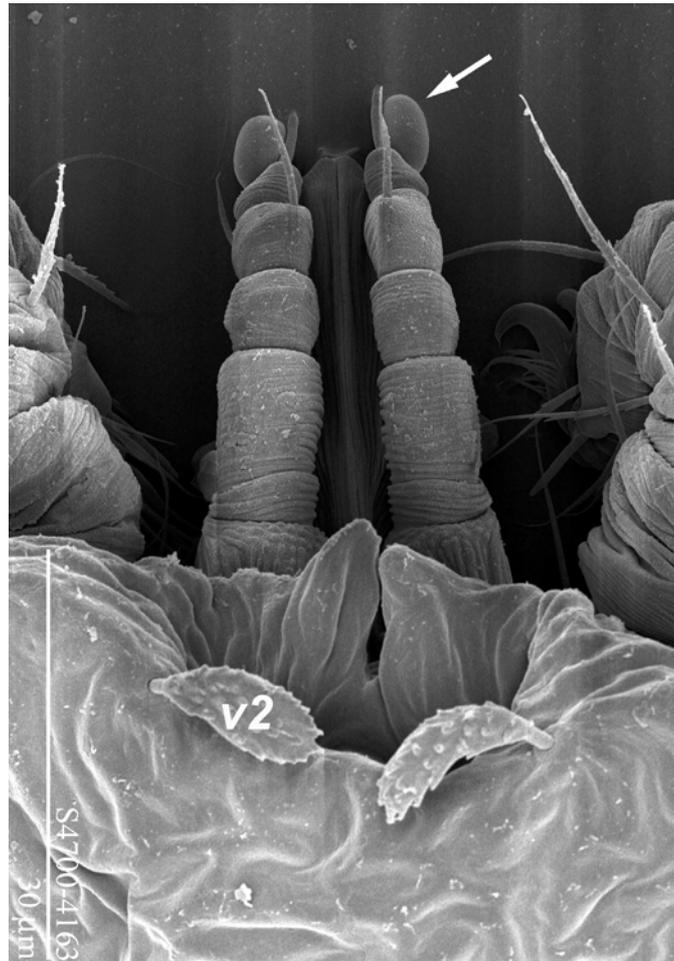


FIGURE 61. *Meyeraepalpus delphinadae* (Smiley, Frost and Gerson), adult male, dorsal gnathosoma, arrow indicates swollen solenidion on palp tarsus.

PROTONYMPH ($n = 3$). *Dorsum*. Body measurements: distance between setae $v2-h1$ 195, $sc2-sc2$ 100; other measurements: $v2-v2$ 30, $sc1-sc1$ 89, $c1-c1$ 23, $c2-c2$ 104, $c3-c3$ 140, $d1-d1$ 16, $d2-d2$ 93, $d3-d3$ 130, $e1-e1$ 16, $e2-e2$ 83, $e3-e3$ 80, $f2-f2$ 60, $f3-f3$ 40, $h1-h1$ 11, $h2-h2$ 23. Anterior margin of prodorsal shield without notch. Prodorsal shield smooth with few irregular creases. Opisthosoma with irregular transverse striae. Lateral cuticle smooth with weak irregular striae. Dorsal setae broadly lanceolate. Setal lengths: $v2$ 15, $sc1$ 11, $sc2$ 12, $c1$ 16, $c2$ 9, $c3$ 13, $d1$ 11, $d2$ 12, $d3$ 12, $e1$ 11, $e2$ 8, $e3$ 11, $f2$ 10, $f3$ 19, $h1$ 7, $h2$ 17. *Palps*. Palps similar to adult. Tibial setae about 5 long; tarsal eupathidia 4, 5 long, solenidion 3 long. *Venter*. Striation same as deutonymph. Coxal, genital and anal setae fine. Setal lengths: $1a$ 40, $1b$ 15, $1c$ 12, $2b$ 14, $3a$ 40, $3b$ 13, $ag1$ 7, $ps1$ 6, $ps2$ 4, $ps3$ 3. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 2-0-3-1-4-9(1), 1-0-3-1-4-9(1), 1-1-1-1-3-5, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 4–5, 4 long; ta II both 4 long). Leg setation as in deutonymph except: seta $2c$ absent; seta $4b$ absent; tr I–III without v' ; ge I–II without setae l' and d ; ta IV without setae tc' , tc'' . Setae l' added to tr III.

LARVA ($n = 1$). *Dorsum*. (Fig. 65) Body measurements: distance between setae $v2-h1$ 165, $sc2-sc2$ 91; other measurements: $v2-v2$ 29, $sc1-sc1$ 74, $c1-c1$ 21, $c2-c2$ 88, $c3-c3$ 125, $d1-d1$ 15, $d2-d2$ 74, $d3-d3$ 93, $e1-e1$ 15, $e2-e2$ 67, $e3-e3$ 63, $f2-f2$ 45, $f3-f3$ 44, $h1-h1$ 9, $h2-h2$ 24. Anterior margin of prodorsal shield without notch. Prodorsal shield smooth with few irregular creases. Opisthosoma with few irregular striae, especially mid-dorsally. Setal lengths: $v2$ 12–13, $sc1$ 12–13, $sc2$ 14–15, $c1$ 15, $c2$ 13–15, $c3$ 10–13, $d1$ 10–11, $d2$ 12–13, $d3$ 12–14, $e1$ 6–7, $e2$ 13–15, $e3$ 15, $f2$ 13–15, $f3$ 14–17, $h1$ 8–11, $h2$ 15–16. Dorsal setae lanceolate except setae $f2-f3$, $h1-h2$ thickened, barbed. *Palps*. Palps similar to adult. Tibial setae, dorsal 5 long, ventral 6 long; tarsal eupathidia 5, 6 long,

solenidion 3 long. *Venter*: Striation same as deutonymph. Coxal and anal setae fine. Setal lengths: *1a* ca. 30, *1b* 11, *3a* ca. 25, *ps1* 5, *ps2* 3, *ps3* 5. *Legs*. (Fig. 65) Setal formula for legs I–III (coxae to tarsi) 1-0-3-1-4-7(1), 0-0-3-1-4-7(1), 0-0-1-1-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (2 long) and 2 eupathidia $p\zeta'-p\zeta''$ (3 long). Leg setation as in protonymph, except: seta *2b* absent; seta *3b* absent; tr III without *l'*; ta I–III without setae *tc'*, *tc''*.

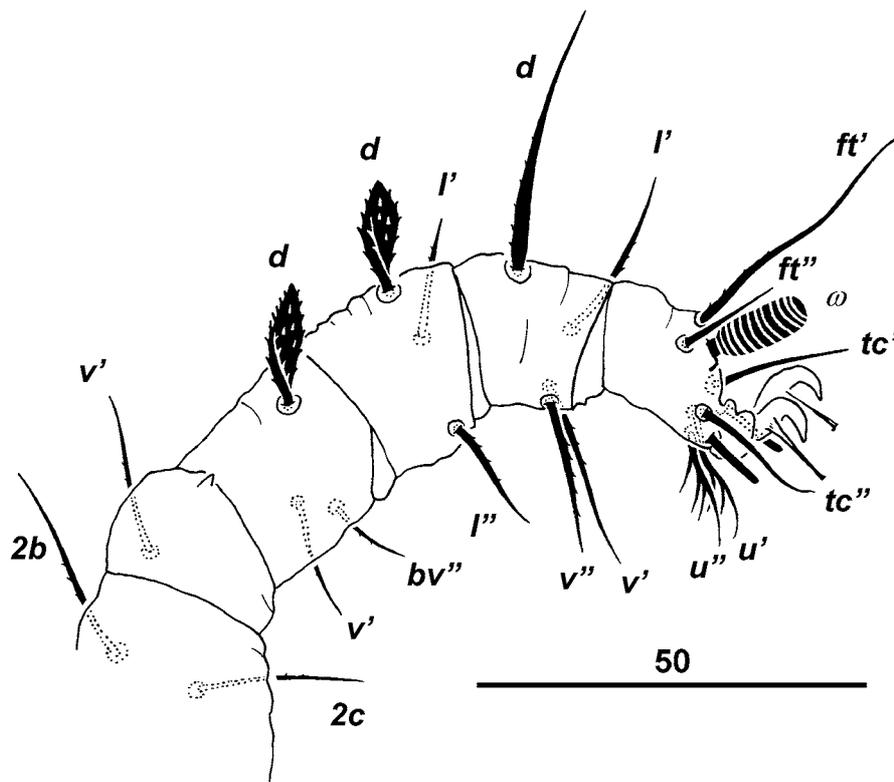


FIGURE 62. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), adult male, leg II (right side), eupathidia ($p\zeta'-p\zeta''$) not labelled.

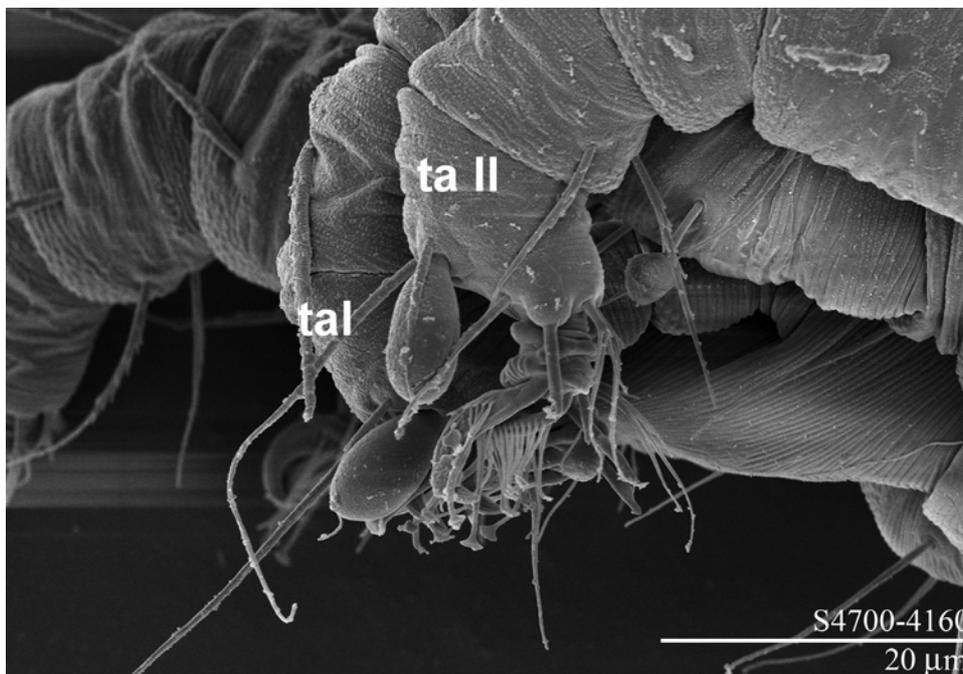


FIGURE 63. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), adult male, lateral view of legs I–II, indicating swollen solenidia.

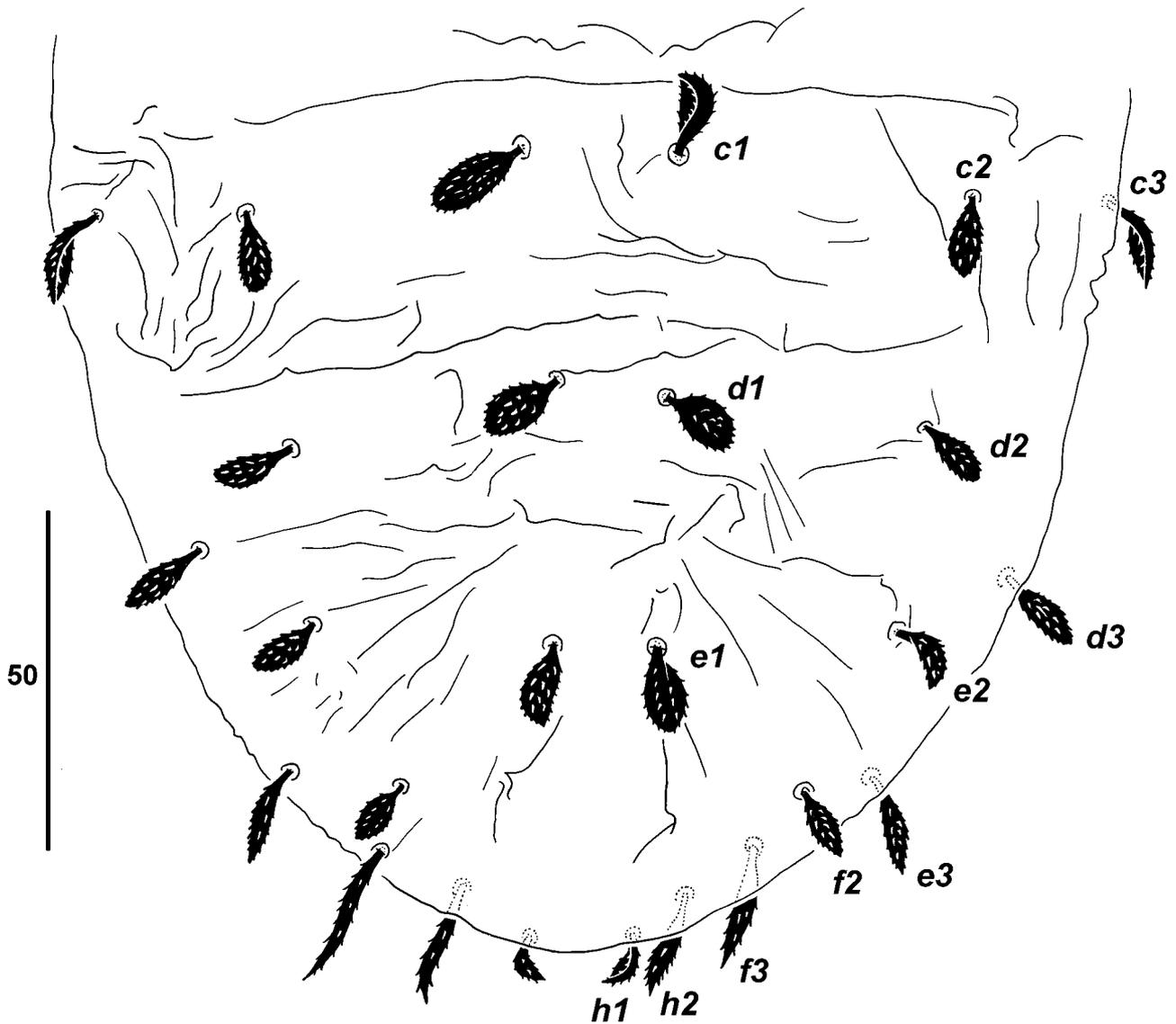


FIGURE 64. *Meyeraepalpus delphinadae* (Smiley, Frost and Gerson), deutonymph, dorsal opisthosoma.

Remarks. Specimens for this redescription were collected from the type host in the type locality. Individuals were collected from fine branches of the host (Fig. 66).

We are resurrecting the original generic placement of this species, *Meyeraepalpus delphinadae*, despite its recent placement within *Aegyptobia* by Mesa *et al.* (2009). This species would be unusual among *Aegyptobia* as it would be the only species we know that lacks seta *d* on femur III (Seeman & Beard 2011), has the gnathosoma partially concealed by the prodorsum, prodorsal lobes in a deep anterior concavity, and has a male with greatly swollen solenidia. The loss of seta *d* on femur III is unique among all species studied here, but the male with swollen solenidia also occurs in *Crossipalpus*, *Magdalenapalpus* and *Palpipalpus*. The concealed gnathosoma occurs in other tegopalpine mites, being partially concealed in *Magdalenapalpus* and *Palpipalpus*, and completely concealed in *Australopalpus*, *Chaudhripalpus*, *Crossipalpus*, *Philippipalpus* and *Tegopalpus*. *Meyeraepalpus delphinadae* also has two coxal setae, i.e. seta both *1b* and *1c* are present, and while this is unique for tegopalpine species, it is common for *Aegyptobia* (Seeman & Beard 2011).

Meyeraepalpus delphinadae is substantially different to the three genera with which it shares the character of swollen solenidium in the male, i.e., *Crossipalpus*, *Magdalenapalpus* and *Palpipalpus*. *Meyeraepalpus delphinadae* is different to *Crossipalpus*, which has four palpal segments, no prodorsal projections of any type, seta *f2* absent, no seta *1c*, two pairs of pseudanal (*ps*) setae, genual setal counts of 1-1-0-0, and its gnathosoma is completely concealed by the prodorsum; and is different to *Palpipalpus* which has a pair of rounded prodorsal lobes anterior to *v2*, two pairs of *ps* setae, coxae without *1c*, and genua with 2-2-0-0. *Meyeraepalpus delphinadae* bears a greater



FIGURE 65. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), larva, dorsum, with details of legs.

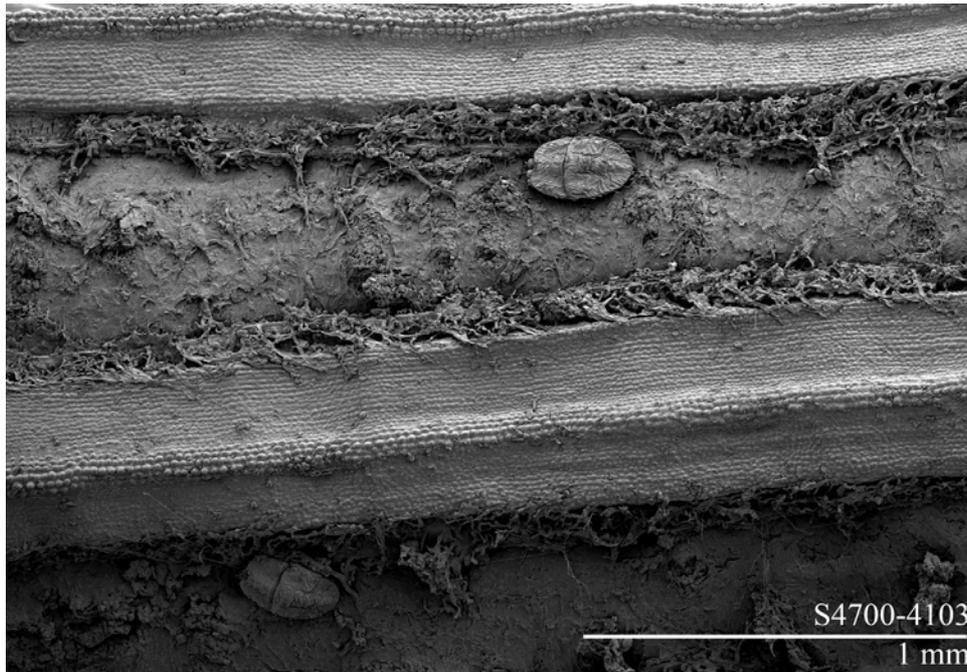


FIGURE 66. *Meyeraepalpus delfinadae* (Smiley, Frost and Gerson), adult females in habitat.

resemblance to the third genus, *Magdalenapalpus* (especially *Ma. strandmanni*, with setae *f2* present), where it was originally placed by Smiley *et al.* (1996). Mesa *et al.* (2009) moved the species to *Aegyptobia* because it “has a rostral shield and the anterior margin of the prodorsum is not invaginated”. However, adult *Me. delfinadae* do indeed have an invaginated anterior margin, formed by distinct lobes on the anterior margin of the prodorsum, that are often slightly retracted into the prodorsum, forming a shallow cavity anteroventral to setae *v2* (Figs 56, 57a, b). These lobes are not present on the immature life stages (Fig. 57c). The anterior lobes of *Me. delfinadae* are unlike any other found in *Aegyptobia*, which are formed by a simple notch in the prodorsal shield (e.g. Fig. 124a) or a forked extension of the prodorsal shield (e.g. *Aegyptobia bromi* Khanjani *et al.*, 2012a). Likewise the lobes on *Meyeraepalpus delfinadae* do not appear homologous with those of *Magdalenapalpus* (Figs 42, 43), but instead, they appear similar to those of *Chaudhripalpus* (Figs 1, 2, 8a) and *Tegopalpus* (Fig. 107a, 108, 110a, b, 111a), which originate from below the level of the dorsal surface of the prodorsum. Furthermore, *Me. delfinadae* does not share the same leg setation with species of *Magdalenapalpus* which all lack seta *1c* on cx I, *v'* on tr I–IV, *l'* and *l''* on ge I–III, and *tc''* on ta I–IV, all of which are present in *Me. delfinadae*.

It is for the above mentioned differences, and not those listed by Mesa *et al.* (2009) that we exclude *Me. delfinadae* from *Aegyptobia* and *Magdalenapalpus*. Further evidence is presented in our cladistic analysis, which places *Me. delfinadae* as a unique species and sister group to all other tegopalpine mites.

***Palpipalpus* Beard and Seeman gen. nov.**

Type species. *Palpipalpus hesperius* Beard and Seeman

Diagnosis. *All life stages:* dorsal opisthosoma with 13 pairs of strongly barbed setae; *c2*, *d2*, *e2*, and *f2* present; setae *e2* and *f2* inserted in more-or-less marginal position; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, setal formula 0, 0, 0, 2, 3(1); immature stages with anterior margin of prodorsum smoothly rounded, without projections/notches; ventral plate absent; 2 pairs of pseudanal setae (*ps1–2*) on weakly developed anal plates. *Adult female:* gnathosoma partially concealed by anterior margin of prodorsum (also in male); anterior margin of prodorsum with 1 pair of rounded lobes anterior to, but not bearing, setae *v2* (also in male); genital plate weakly developed, membranous; metapodal plates not developed; coxae I without *1c*; trochanters I–IV 1-1-2-1; femora I–IV 3-3-2-1; genua 2-2-0-0 (setae *d* and *l''* present); tibiae 4-4-3-3; tarsi I–IV with *tc''*. Solenidia of male

much thicker and longer than in female.

Etymology. The name *Palpipalpus* is derived from *palpus* (a feeler) and is repeated to emphasise and allude to the swollen sensory solenidia of the palps and tarsi I–II in the male.

Remarks. *Palpipalpus* most closely resembles *Crossipalpus*, with both genera sharing males with enlarged solenidia and only two pairs of *ps* setae. *Palpipalpus* differs to *Crossipalpus* by the presence of prodorsal lobes, seta *tc''* on tarsi I–IV, seta *f2* on the dorsal opisthosoma, and the palp tibial seta (all absent in *Crossipalpus*).

***Palpipalpus hesperius* Beard and Seeman sp. nov.**

(Figs 67–74)

Type material examined. Holotype female ex. *Allocasuarina* sp. (Casuarinaceae), **AUSTRALIA:** Western Australia, Walpole, Nornalup Inlet, Coalmine Beach, Walpole Yacht Club, 34°59'27"S 116°44'22"E, 09 May 2008, coll. J.J. Beard and R. Ochoa (WAM) (BRI voucher). **Paratypes.** 23 females, 2 males (separate slides); 1 male, 1 pharate deutonymph (same slide); 2 deutonymphs, 7 protonymphs, 5 larvae, same data as holotype (WAM, QM, ANIC, USNM).

Non-type material examined. 2 pharate deutonymphs, 1 pharate protonymph, same data as holotype (QM); 10 females, 1 pharate female, 14 deutonymphs, 2 pharate deutonymphs, 9 protonymphs, 9 larvae ex. stems of Western She-oak *Allocasuarina fraseriana* (Casuarinaceae) [on ridge], **AUSTRALIA:** Western Australia, internal road to Wellington Dam, Wellington National Park, 33°20'24"S 115°57'22"E, 20 April 2009, coll. J.J. Beard (QM) (BRI voucher); 14 females, 3 males, 3 pharate females, 2 deutonymphs, 4 protonymphs, 2 larvae ex. *Allocasuarina* sp., **AUSTRALIA:** Western Australia, Wellington National Park, 33°19'18"S 115°58'50"E, 06 May 2008, coll. J.J. Beard and R. Ochoa (QM).

Diagnosis. Dorsal setae short, palmate, heavily barbed. Dorsal opisthosomal setae *e2* and *f2* inserted close to marginal position. Prodorsum with oblique folds and weakly papillate sculpturing; dorsal opisthosomal shield with transverse to oblique folds laterally, with weak papillate sculpturing anteriorly; lateral cuticle papillate. Setae *v'* added to tr II and IV in the adult (*v'* normally added to tr II in deutonymph).

FEMALE (n = 48). **Dorsum.** (Fig. 67a) Body measurements: distance between setae *v2-h1* 280–325 [325]; *sc2-sc2* 111–125 [120]; other measurements: *v2-v2* 35–42 [42], *sc1-sc1* 83–96 [91], *c1-c1* 26–36 [33], *c2-c2* 91–110 [100], *c3-c3* 160–185 [180], *d1-d1* 20–25 [22], *d2-d2* 110–120 [120], *d3-d3* 140–155 [145], *e1-e1* 15–17 [15], *e2-e2* 125–135 [125], *e3-e3* 115–135 [125], *f2-f2* 93–110 [100], *f3-f3* 81–105 [98], *h1-h1* 18–32 [21], *h2-h2* 53–76 [61]. Gnathosoma partially concealed by prodorsum. Anterior margin of prodorsum with pair of lobes forming a shallow median notch (internal depth 8–13); lobes anterior to setae *v2*. Prodorsal shield with rugose-lineate sculpturing. Opisthosomal shield mostly with rugose sculpturing, but becoming smooth between *d1-e1*, three longitudinal ridges between *c1-c1* and *d1-d1*, and several ridges between *e1-h1*. Lateral cuticle surrounding shields papillate, cuticle between shields papillate to tessellate. All dorsal setae barbed, lanceolate. Setal lengths: *v2* 13–19 [17], *sc1* 16–18 [16], *sc2* 17–19 [17], *c1* 18–20 [20], *c2* 18–20 [19], *c3* 17–18 [18], *d1* 14–17 [14], *d2* 15–17 [broken], *d3* 13–17 [16], *e1* 9–11 [10], *e2* 13–17 [15], *e3* 12–18 [15], *f2* 11–17 [13], *f3* 14–18 [17], *h1* 11–15 [13], *h2* 14–17 [16]. **Palps.** (Fig. 67b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 10–11 [11] long, ventral 6–9 [7] long; tarsal eupathidia 5–6 [5] long, 7–9 [8] long; solenidium 7–8 [8] long. **Venter.** (Fig. 68) Cuticle with transverse striae, becoming longitudinal midway between *4a* and *ag*, extending to genital area; fine striae become coarse lateral to genital area. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield smooth, poorly defined, ca. 17–26 [22] long, 36–45 [45] wide; anal setae *ps1–2* inserted in longitudinal row on anal plates; setae *ps1* absent. Coxal setae fine, smooth except *2c* with weak barbs; setae *ag1*, *g1–2*, *ps1* barbed, *ps2* smooth. Setal lengths: *1a* 42–55 [55], *1b* 18–28 [20], *2b* 17–22 [21], *2c* 20–27 [24], *3a* 35–52 [35], *3b* 18–22 [20], *4a* 33–43 [40], *4b* 16–22 [22], *ag1* 17–21 [18], *g1* 21–23 [22], *g2* 18–23 [22], *ps1* 13–17 [14], *ps2* 12–14 [13]. **Spermatheca.** (Fig. 69) Spermathecal tube long, 1 wide, straight for ca. 30, then convoluted for another ca. 100, terminating in membranous sac 7–9 long, 2–3 wide. Genital opening between setae *ps2*. **Legs.** (Fig. 70) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-2-4-9(1), 2-1-3-2-4-9(1), 1-2-2-0-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidium ω'' (9-10 [10] long) and 2 eupathidia $p\zeta'-p\zeta'''$ (8-9 [8-9] long). Leg setation as in Table 1 except: coxae I without *1c*; genua I–II with *d* and *l''* (ge I–II without *l'*, ge III–IV nude). Setae *v'* added to tr II and IV.

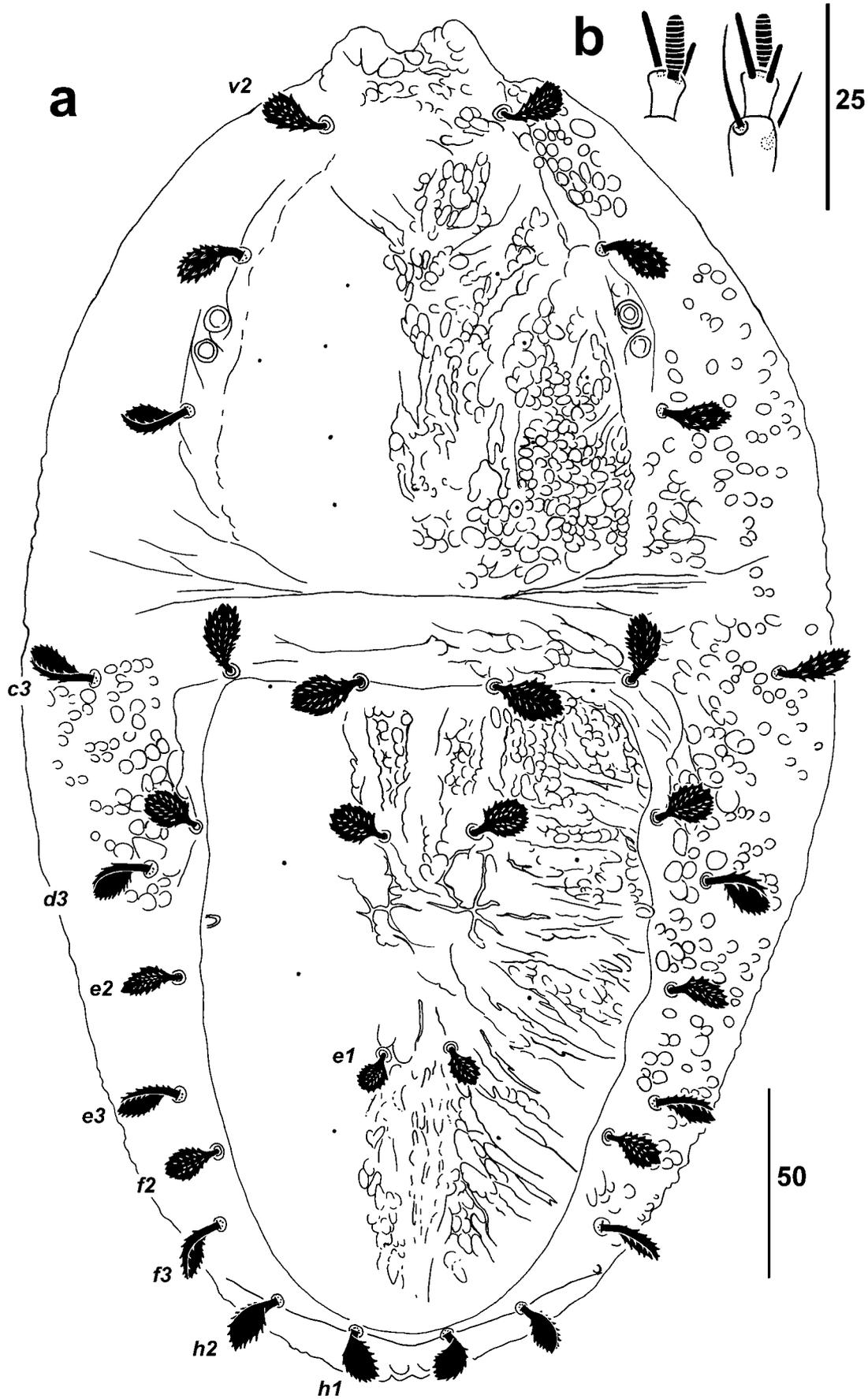


FIGURE 67. *Palpupalpus hesperius* Beard and Seeman, adult female, a. dorsum; b. detail of palp.

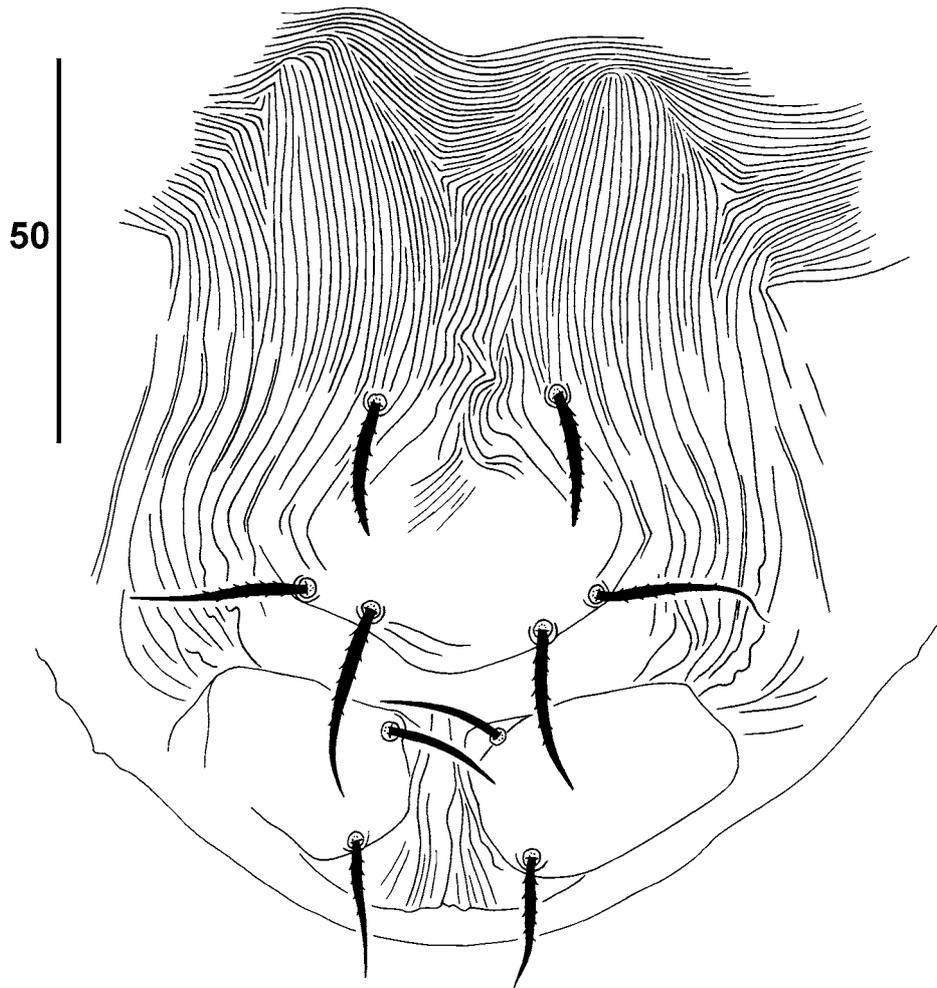


FIGURE 68. *Palpipalpus hesperius* Beard and Seeman, adult female, posterior venter.

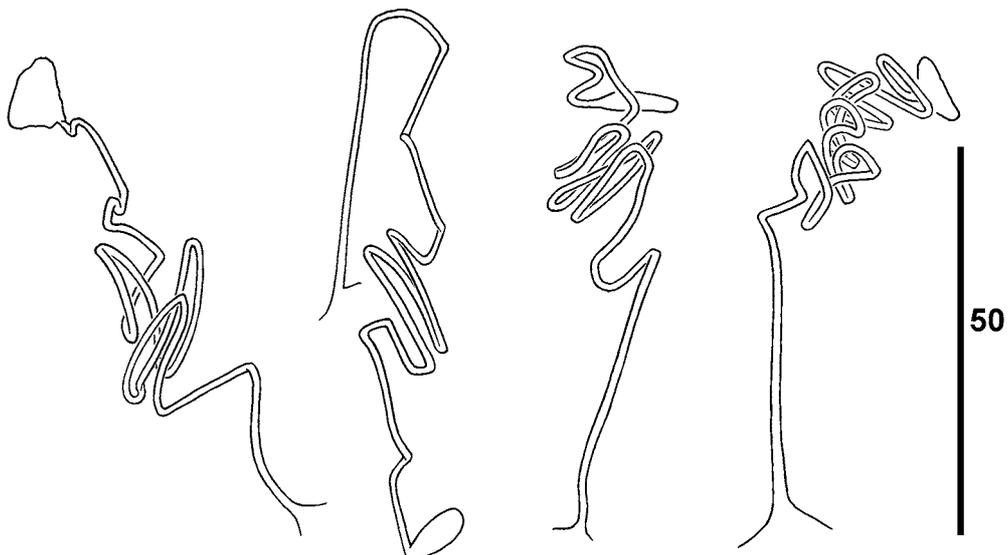


FIGURE 69. *Palpipalpus hesperius* Beard and Seeman, adult female spermatheca.

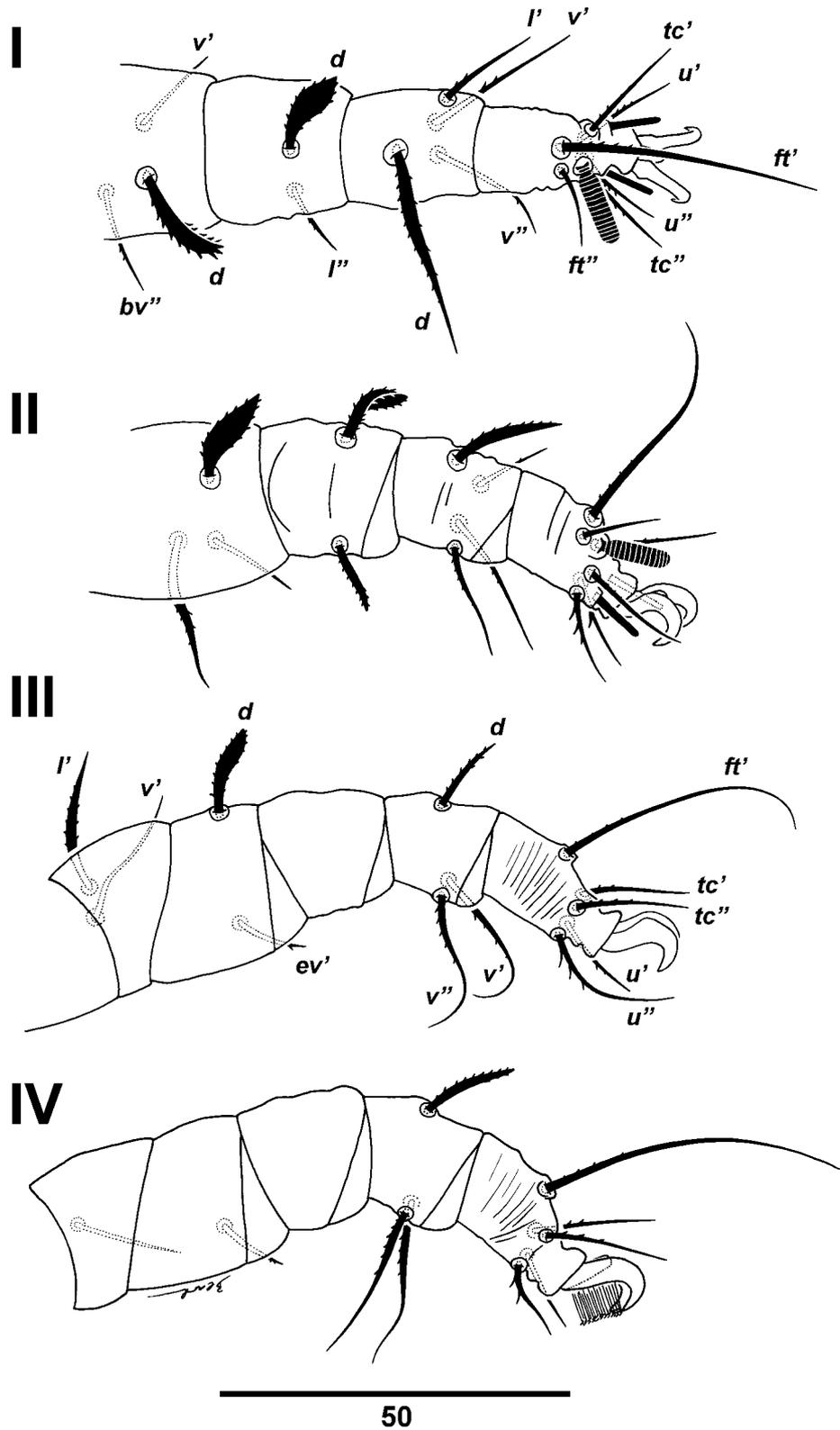


FIGURE 70. *Palpupalpus hesperius* Beard and Seeman, adult female, legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

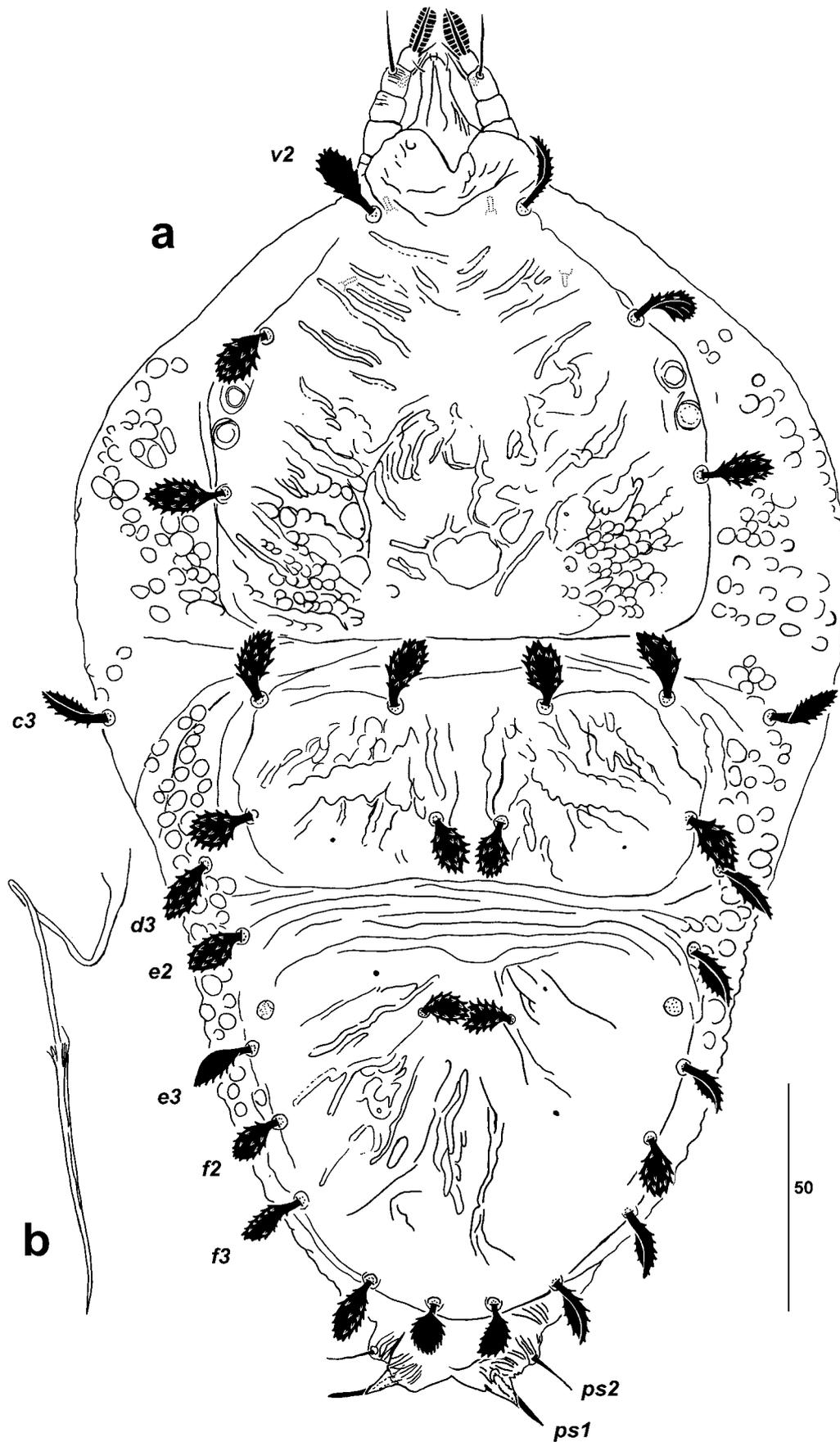


FIGURE 71. *Palpipalpus hesperius* Beard and Seeman, adult male, a. dorsum with details of palp; b. detail of aedeagus.

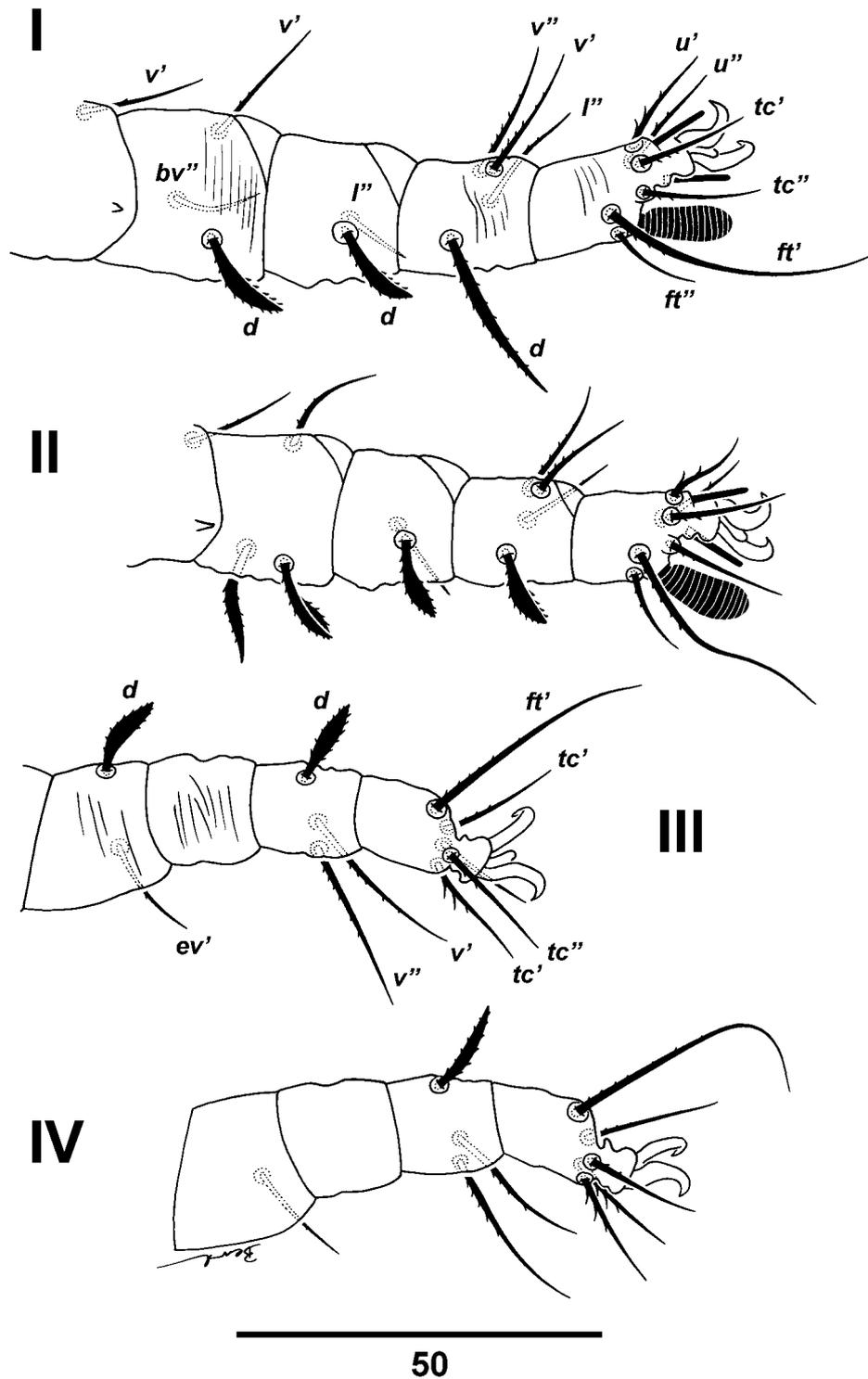


FIGURE 72. *Palpipalpus hesperius* Beard and Seeman, adult male, legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

MALE (n = 6). *Dorsum*. (Fig. 71a) Body measurements: distance between setae $v2-h1$ 215–235, $sc2-sc2$ 92–98; other measurements: $v2-v2$ 23–30, $sc1-sc1$ 66–75, $c1-c1$ 21–29, $c2-c2$ 79–87, $c3-c3$ 114–125, $d1-d1$ 10–15, $d2-d2$ 85–91, $d3-d3$ 95–110, $e1-e1$ 12–17, $e2-e2$ 87–92, $e3-e3$ 83–88, $f2-f2$ 70–88, $f3-f3$ 62–75, $h1-h1$ 9–15, $h2-h2$ 24–36. Anterior margin of prodorsum with small lobes forming a shallow median notch (internal depth 9–11). Prodorsal, mesonotal and opisthonotal shields surrounded by striate cuticle medially, papillate cuticle laterally. Shield sculpture and dorsal setae similar to female, but sculpture not as rugose on mesonotal and opisthonotal shield. Setal lengths: $v2$ 14–18, $sc1$ 13–15, $sc2$ 14–17, $c1$ 15–16, $c2$ 14–15, $c3$ 14–17, $d1$ 11–13, $d2$ 14–15, $d3$ 13–

15, *e1* 10–11, *e2* 10–14, *e3* 14–15, *f2* 11–13, *f3* 14–15, *h1* 10–11, *h2* 14–15. *Palps*. (Fig. 71a) Palps similar to female. Tibial setae, dorsal 9–11 long, ventral 6–7 long, tarsal eupathidia 3–4, 9 long; solenidion 10 long. *Venter*. Striation similar to female. Coxal setae fine, except *2c* with few minute barbs. Seta *ag1*, *g1*–2, *ps2* smooth. Setae *ps1* blade-like, thickened (sexually dimorphic). Setal lengths: *1a* 45–55, *1b* 17–27, *2b* 18–27, *2c* 17–20, *3a* 33–47, *3b* 15–22, *4a* 30–45, *4b* 16–23, *ag1* 12–17, *g1* 9–12, *g2* 12–15, *ps1* 14–17, *ps2* 8–10. *Aedeagus*. (Fig. 71b) Narrow, sclerotised, tapering to a point, 55–60 long. Membranous duct runs from inside aedeagus. *Legs*. (Fig. 72) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 12–13 long, ta II 11–12 long) and 2 eupathidia $p\zeta''$ – $p\zeta'''$ (ta I 7–8 long; ta II 6–8, 7–8 long). Solenidia swollen, much thicker and longer than in female.

DEUTONYMPH (n = 18). *Dorsum*. Body measurements: distance between setae *v2-h1* 225–275, *sc2-sc2* 85–96; other measurements: *v2-v2* 22–30, *sc1-sc1* 68–79, *c1-c1* 21–37, *c2-c2* 78–89, *c3-c3* 125–145, *d1-d1* 16–21, *d2-d2* 74–84, *d3-d3* 97–115, *e1-e1* 14–20, *e2-e2* 90–110, *e3-e3* 86–102, *f2-f2* 72–84, *f3-f3* 58–83, *h1-h1* 18–27, *h2-h2* 31–60. Anterior margin of prodorsum without medial notch. Prodorsal shield with weakly rugose sculpturing and punctate cuticle. Opisthosomal shield covered with patches of weakly rugose sculpturing on punctate cuticle (*c1-c2*, *d1-d2* on irregular plates) interspersed by coarse irregularly transverse striae. Setal lengths: *v2* 22, *sc1* 16–20, *sc2* 19–21, *c1* 18–22, *c2* 16–18, *c3* 17–21, *d1* 13–18, *d2* 16–19, *d3* 17–21, *e1* 11–14, *e2* 16–22, *e3* 14–18, *f2* 14–17, *f3* 16–21, *h1* 11–14, *h2* 16–20. *Palps*. Palps similar to adult. Tibial setae, dorsal 6–7 long, ventral 8–9 long; tarsal eupathidia 4, 6–8 long; solenidion 5–7 long. *Venter*. Cuticle with transverse striae to midway between *4a* and *ag*, becoming longitudinal, striae coarse around anal region. Anal setae *ps1*–2 on weakly defined anal plates. Coxal setae fine; setae *ag1*, *g1*, *ps1*–2 smooth. Setal lengths: *1a* 33–35, *1b* 13–20, *2b* 12–18, *2c* 20–21, *3a* 28–37, *3b* 14, *4a* 20–31, *4b* 10–15, *ag1* 11–14, *g1* 14–18, *ps2* 6–8, *ps3* 7–8. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-1-3-2-4-9(1), 2-0-3-2-4-9(1), 1-2-2-0-3-5, 1-0-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (6–7 long) and 2 eupathidia $p\zeta''$ – $p\zeta'''$ (6–8 long). Leg setation as in female, except tr II and tr IV without seta *v'*. Setae *v'* added to tr I and III.

PROTONYMPH (n = 20). *Dorsum*. Body measurements: distance between setae *v2-h1* 175–205, *sc2-sc2* 72–87; other measurements: *v2-v2* 18–29, *sc1-sc1* 56–70, *c1-c1* 16–22, *c2-c2* 63–78, *c3-c3* 100–135, *d1-d1* 11–19, *d2-d2* 59–72, *d3-d3* 80–110, *e1-e1* 8–13, *e2-e2* 72–87, *e3-e3* 68–76, *f2-f2* 52–62, *f3-f3* 42–53, *h1-h1* 12–18, *h2-h2* 25–34. Anterior margin of prodorsum without medial notch. Prodorsal shield with weakly rugose sculpturing and punctate cuticle. Opisthosomal shield with the setae *c1-c2* and *d1-d2* on separate paired plates, each with weakly rugose sculpturing on punctate cuticle. Irregular pygidial shield bears *e1*, *f2-f3*, sculpturing similar to other shields. Setal lengths: *v2* 16–21, *sc1* 13–18, *sc2* 15–20, *c1* 15–18, *c2* 13–19, *c3* 14–18, *d1* 11–18, *d2* 14–18, *d3* 13–19, *e1* 9–13, *e2* 13–18, *e3* 14–20, *f2* 12–15, *f3* 13–18, *h1* 10–13, *h2* 14–18. *Palps*. Palps similar to adult. Tibial seta, dorsal 4–5 long, ventral 7–8 long; tarsal eupathidia 3, 5–6 long; solenidion 5 long. *Venter*. Striation similar to deutonymph. Anal setae *ps2*–3 on weakly defined anal plates. Coxal setae fine; setae *ag1*, *g1*, *ps1*–2 smooth. Setal lengths: *1a* 33–40, *1b* 14–17, *2b* 15–19, *3a* 25–30, *3b* 8–17, *ag1* 11–14, *ps1* 5–7, *ps2* 5–7. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-4-9(1), 1-0-3-0-4-9(1), 1-1-2-0-3-5, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (5–6 long) and 2 eupathidia $p\zeta''$ – $p\zeta'''$ (5–6 long). Leg setation as in deutonymph except: seta *2c* absent; seta *4b* absent; tr I and III without seta *v'*, ge I–II without seta *d*, *l''*; ta IV without setae *tc'*, *tc''*. Setae *l'* added to tr III.

LARVA (n = 16). *Dorsum*. (Fig. 73) Body measurements: distance between setae *v2-h1* 155–175, *sc2-sc2* 67–74; other measurements: *v2-v2* 16–31, *sc1-sc1* 55–60, *c1-c1* 9–16, *c2-c2* 62–70, *c3-c3* 96–104, *d1-d1* 6–11, *d2-d2* 58–59, *d3-d3* 76–81, *e1-e1* 4–6, *e2-e2* 67–70, *e3-e3* 40–67, *f2-f2* 42–54, *f3-f3* 29–40, *h1-h1* 4–8, *h2-h2* 15–23. Anterior margin of prodorsum without medial notch. Prodorsal shield smooth with few creases. Irregular, weakly rugose pygidial shield. Lateral cuticle smooth to striate; cuticle between shields irregular coarse striae. Setal lengths: *v2* 14–19, *sc1* 11–13, *sc2* 16–18, *c1* 13–17, *c2* 11–16, *c3* 12–15, *d1* 14–16, *d2* 12–14, *d3* 12–15, *e1* 9–15, *e2* 13–15, *e3* 10–15, *f2* 11–14, *f3* 12–15, *h1* 13, *h2* 11–14. *Palps*. (Fig. 73) Palps similar to adult. Tibial setae, dorsal 6–7 long, ventral 5 long; tarsal eupathidia 3–4, 5–6 long; solenidion 4 long. *Venter*. (Fig. 74) Striation similar to deutonymph. Anal setae *ps1*–2 on weakly defined anal plates. Coxal setae fine. Setal lengths: *1a* 24–27, *1b* 13–17, *3a* 29–33, *ps1* 6–8, *ps2* 5–7. *Legs*. (Fig. 73) Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-4-7(1), 0-0-3-0-4-7(1), 0-0-2-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta''$ – $p\zeta'''$ (4–5, 4–5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr III without *l'*; ta I–III without seta *tc'*, *tc''*.

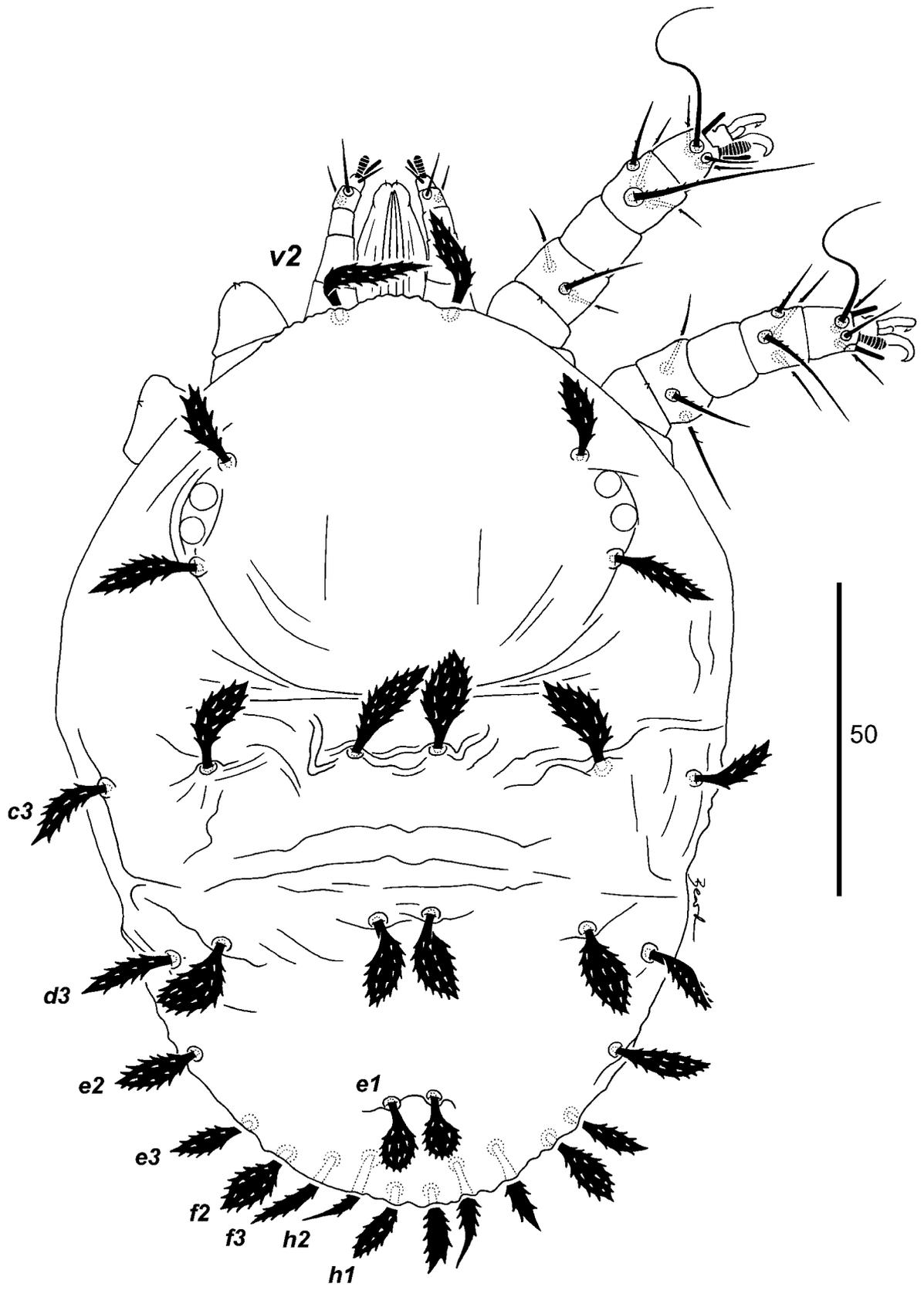


FIGURE 73. *Palpipalpus hesperius* Beard and Seeman, larva dorsum, with details of palps and legs I-II.

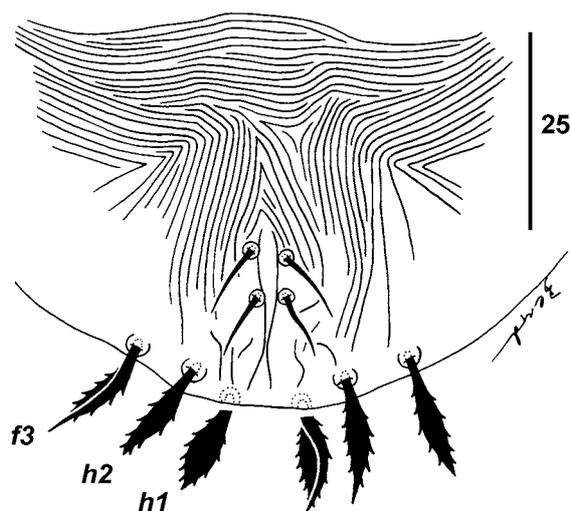


FIGURE 74. *Palpipalpus hesperius* Beard and Seeman, larva, posterior venter.

Etymology. This specific name, *hesperius*, is a Latin word meaning “western” and alludes to the State where the mites were collected.

Remarks. *Palpipalpus hesperius* is unusual in the delayed expression of seta *v'* on tr II. This seta is normally expressed in the deutonymph, but in this species it does not appear until the adult. A similar ontogenetic delay occurs in the unrelated species *Chaudhripalpus creelae*. This mite was red and found on the bark of its host.

Palpipalpus is morphologically similar to *Crossipalpus* but can be separated from it by the presence of dorsal setae *f2* (absent on *Crossipalpus*), and genera I–II with two setae (one seta on *Crossipalpus*).

Palpipalpus is also morphologically similar to *Phytoptipalpus* (most species) and *Aegyptobia* in that they share a full complement of setae on the dorsal shield. In addition, *Palpipalpus* and *Phytoptipalpus* both have two pairs of *ps* setae, while *Aegyptobia* differs in having three pairs of *ps* setae. *Palpipalpus* also differs in having the gnathosoma almost entirely covered by the prodorsum, seta *1c* is absent, and seta *l'* is absent on genera I–III.

***Pentamerismus* McGregor, 1949**

Type species. *Tenuipalpus erythreus* Ewing, 1917: 152, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 12–13 pairs of setae; *c2*, *d2*, and *e2* present; seta *f2* present or absent; setae *e2* and *f2* (when present) inserted in marginal position, aligned with *c3*, *d3*, *e3* and *f3*; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, palp setal formula variable 0-0/1-0-1/2-3(1); immature stages with anterior margin of prodorsum smoothly rounded, without projections/notches; gnathosoma not concealed by prodorsum; ventral plate absent; three pairs of pseudanal setae (*ps1-3*) on weakly to well developed anal plates. *Adult female:* anterior margin of prodorsal shield with a median notch forming 1 pair of lobes anterior to setae *v2*, or smoothly rounded; gnathosoma completely exposed, not concealed by anterior margin of prodorsum; genital plate weakly to well developed, membranous; metapodal plates usually present; coxae I with *1c* present or absent. Solenidia of male of similar thickness and length to those of female.

Remarks. *Pentamerismus* is almost identical to *Aegyptobia*, except that setae *e2* and *f2* (when present) are inserted in a marginal position, aligned with setae *c3*, *d3*, *e3* and *f3*, instead of the more usual sublateral position aligned with *c2* and *d2*.

***Pentamerismus sititoris* Beard and Seeman sp. nov.**

(Figs 75–81)

Type material examined. Holotype female ex. Belah *Casuarina cristata* (Casuarinaceae), AUSTRALIA: New

South Wales, Newell Highway, approx. 15 km N Moree, 86 km S Goondiwindi, 29°21'20"S 150°00'24"E, 21 August 2007, coll. J.J. Beard and P.I. Forster (QM). Paratypes. 8 females, 1 male, 2 deutonymphs, 2 protonymphs, larva, same data as holotype (QM, ANIC).

Non-type material examined. 5 females, 1 male, 2 deutonymphs, 2 protonymphs, 2 larvae, same data as holotype; 12 females, 10 males, 1 protonymph, 1 larva ex. *Casuarina cristata* (Casuarinaceae) under scales at tip of needles, **AUSTRALIA:** New South Wales, nr Lightning Ridge, Castlereagh Highway, 45 km S Hebel, 28°44'43"S, 148°09'12"E, 06 May 2007, coll. J.J. Beard and P.I. Forster; **AUSTRALIA:** 1 female, 1 male, same data except Castlereagh Highway, 6.5 km N Lightning Ridge, 29°25'10"S, 147°53'21"E (QM, USNM)).

Diagnosis. Dorsal opisthosomal setae *f2* present. Palp setal formula 0-0-0-2-3(1), with palp tibial setae *l'PTi* and *l''PTi* both present. Anterior margin of prodorsal shield with short notch. Dorsal shields with finely reticulate mosaic sculpturing; dorsal setae broadly lanceolate to palmate; lateral margins of opisthosoma coarsely papillate. Posterior ventral setae *ag* palmate, barbed; setae *g1-2* broadly lanceolate, barbed; setae *ps1-2* lanceolate, barbed; setae *ps3* fine, smooth. Seta *lc* absent. Setae *d* on femora and genua I–II palmate to broadly lanceolate, barbed; seta *ev'* on femora III broadly lanceolate, barbed; setae *v'*, *v''* on tibiae III with broad bases, barbed.

FEMALE (n = 28). *Dorsum*. (Fig. 75) Body measurements: distance between setae *v2-h1* 225–255 [250], *sc2-sc2* 110–120 [120]; other measurements: *v2-v2* 41–46 [43], *sc1-sc1* 83–88 [84], *c1-c1* 54–63 [63], *c2-c2* 125–135 [135], *c3-c3* 170–180 [175], *d1-d1* 34–40 [40], *d2-d2* 105–115 [115], *d3-d3* 150–155 [155], *e1-e1* 32–39 [39], *e2-e2* 135–145 [145], *e3-e3* 120–140 [130], *f2-f2* 110–115 [115], *f3-f3* 89–100 [95], *h1-h1* 27–32 [30], *h2-h2* 60–68 [68]. Anterior margin of prodorsal shield with 1 pair of small lobes forming short medial notch (internal depth 7–11). Dorsal shields with finely reticulate mosaic sculpturing. Lateral cuticle surrounding shields smooth anteriorly, becoming coarsely papillate posteriorly. All dorsal setae barbed; *v2*, *sc1*, *sc2*, *c1-3* lanceolate with broadly rounded tips; all other setae broad, rounded. Setal lengths: *v2* 23–24 [23], *sc1* 23–26 [26], *sc2* 25–30 [30], *c1* 24–28 [25], *c2* 24–28 [28], *c3* 21–24 [24], *d1* 17–20 [17], *d2* 19–26 [20], *d3* 19–23 [23], *e1* 17–22 [19], *e2* 17–20 [20], *e3* 17–20 [19], *f2* 17–20 [19], *f3* 17–21 [17], *h1* 17–20 [17], *h2* 16–19 [19]. *Palps*. (Fig. 75) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 7–8 [7] long, ventral 4–5 [4] long; tarsal eupathidia 4 [4], 4–6 [6] long; solenidion 6 [6] long. *Venter*. (Fig. 76a) Cuticle with transverse striae, abruptly becoming longitudinal posterior to cx IV, extending to genital area; fine striae become coarse lateral to genital area. Circular thickening present in metapodal region, ca. 20–24 diameter, rugose-papillate. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield lightly punctate with transverse reticulation posteriorly, margins irregular, ca. 25–35 [25] long, 36–42 [42] wide; anal setae *ps1-3* inserted in longitudinal row on anal plates. Coxal setae fine, except *2c* lanceolate; setae *agl* palmate, barbed; *g1-2*, *ps1-2* thick, broadly lanceolate, barbed; *ps3* fine, smooth. Setal lengths: *1a* 40–51 [40], *1b* 24–32 [24], *2b* 22–28 [24], *2c* 14–16 [14], *3a* 35–41 [35], *3b* 13–19 [13], *4a* 32–35 [32], *4b* 12–18 [12], *agl* 13–15 [13], *g1* 17–18 [17], *g2* 16–18 [18], *ps1* 12–17 [13], *ps2* 12–15 [12], *ps3* 7–10 [10]. *Spermatheca*. (Fig. 76b) Spermathecal tube long, narrow, convoluted, 1 µm wide, ca. 120 long, terminating in membranous sac. Spermatheca vesicle not visible. Genital opening between anal valves and posterior margin of genital shield. *Legs*. (Figs 75, 77a) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-2-1-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 11 [11] long, ta II 10–11 [10] long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 6–7 [6], 7 [7] long; ta II 6–7 [6], 6 [6] long). Leg setation as in Table 1 except: coxae I without *lc*. Setae *v'* added to tr IV.

MALE (n = 13). *Dorsum*. (Fig. 78) Body measurements: distance between setae *v2-h1* 195–210, *sc2-sc2* 90–105; other measurements: *v2-v2* 32–35, *sc1-sc1* 66–79, *c1-c1* 40–55, *c2-c2* 96–120, *c3-c3* 135–155, *d1-d1* 24–37, *d2-d2* 80–106, *d3-d3* 110–140, *e1-e1* 34–42, *e2-e2* 105–130, *e3-e3* 97–120, *f2-f2* 87–105, *f3-f3* 71–90, *h1-h1* 25–27, *h2-h2* 54–63. Anterior margin of prodorsum with small lobes forming a short median notch (internal depth 7). Prodorsal, mesonotal and pygidial shields with sculpture and dorsal setae similar to female. Setal lengths: *v2* 18–21, *sc1* 18–22, *sc2* 19–22, *c1* 18–20, *c2* 19–21, *c3* 20–22, *d1* 12–13, *d2* 16–20, *d3* 16–17, *e1* 13–15, *e2* 16–18, *e3* 16–20, *f2* 15–16, *f3* 14–18, *h1* 15–16, *h2* 14–16. *Palps*. (Fig. 78) Palps similar to female. Tibial setae, dorsal 6 long, ventral 5 long; tarsal eupathidia 4–5, 4–6 long; solenidion 5–6 long. *Venter*. (Fig. 79) Striation similar to female. Posterior opisthosoma with 2 irregular, poorly defined, striated subcircular plates, ca. 25–30 x 30–45 diameter; *g1-2*, *ps1-3* on weakly sclerotised anal valves. Coxal setae fine, except *2c* lanceolate. Seta *agl* broadly rounded, barbed; *g1* lanceolate, barbed; *ps1* spine-like, thickened. Setal lengths: *1a* 45–65, *1b* 20–23, *2b* 17–19, *2c* 10–13, *3a* 40–42, *3b* 9–12, *4a* 25–27, *4b* 8–12, *agl* 12, *g1* 12–13, *g2* 6–7, *ps1* 13–15, *ps2* 6–7, *ps3* 7. *Aedeagus*. (Fig. 79) Narrow, sclerotised, tapering to a point, 63–74 long. Membranous duct runs from inside aedeagus,



FIGURE 75. *Pentamerismus sititoris* Beard and Seeman, adult female, dorsum with details of palps and legs I–II; solenidion ω'' and eupathidia ($p\zeta''$ – $p\zeta'''$) not labelled.

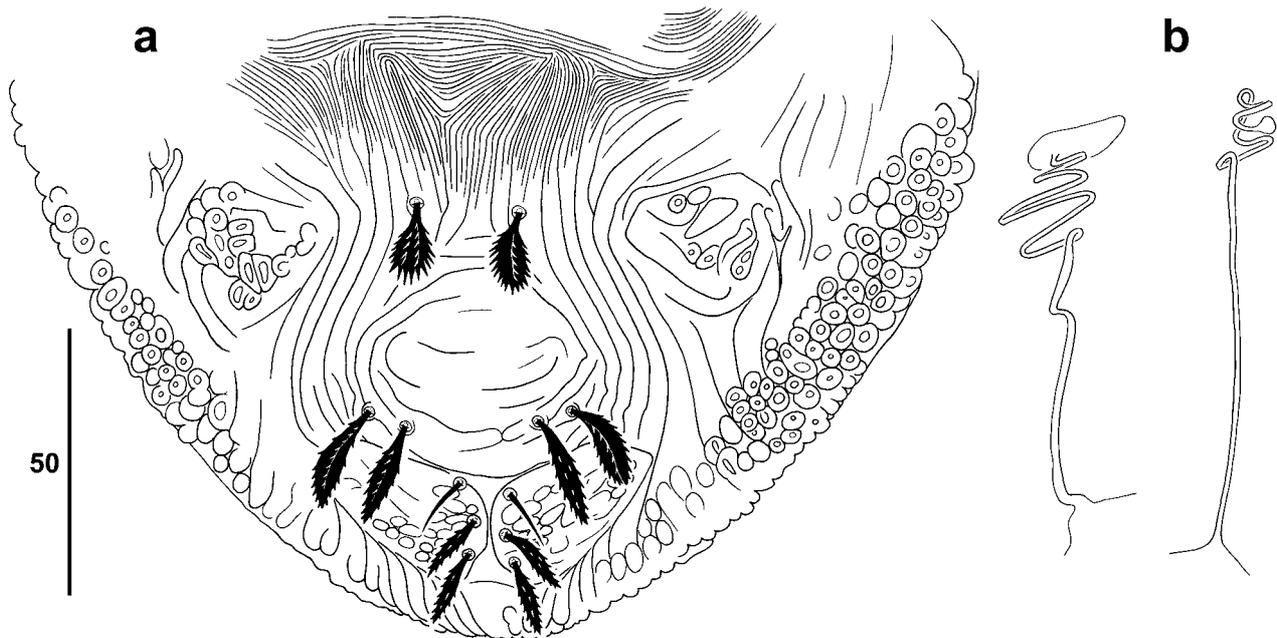


FIGURE 76. *Pentamerismus siitoris* Beard and Seeman, adult female, a. posterior venter; b. spermatheca.

becoming obscure after 20–55 μm . *Legs*. (Fig. 78) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 13 long, ta II 12 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (6 long, 5–6 long). Solenidia slightly thicker and longer than in female.

DEUTONYMPH ($n = 3$). *Dorsum*. (Fig. 80) Body measurements: distance between setae $v2-h1$ 215–235, $sc2-sc2$ 105–115; other measurements: $v2-v2$ 34–39, $sc1-sc1$ 84–89, $c1-c1$ 34–43, $c2-c2$ 110–120, $c3-c3$ 155, $d1-d1$ 38–39, $d2-d2$ 105–115, $d3-d3$ 145–155, $e1-e1$ 32–34, $e2-e2$ 138–143, $e3-e3$ 125–130, $f2-f2$ 110–115, $f3-f3$ 83–90, $h1-h1$ 31–32, $h2-h2$ 53–60. Anterior margin of prodorsum without medial lobes or notch. Prodorsal shield poorly defined, with oblique-longitudinal striations. Opisthosomal shield absent; transverse striae between setal row C and row D; posterior to setal row D striations become oblique laterally, tending to mosaic-like medially. Lateral setae more elongate than those of adult, slightly concave. Setal lengths: $v2$ 15–18, $sc1$ 15–18, $sc2$ 18–21, $c1$ 11–17, $c2$ 18–20, $c3$ 26–27, $d1$ 15, $d2$ 24–26, $d3$ 26–27, $e1$ 18–20, $e2$ 23–26, $e3$ 23–26, $f2$ 20–24, $f3$ 22–26, $h1$ 19–23, $h2$ 22–25. *Palps*. (Fig. 80) Palps similar to adult. Tibial setae, dorsal 6 long, 4 long; tarsal eupathidia 3, 4 long; solenidion 4 long. *Venter*. Cuticle with transverse striae, becoming coarse behind cx IV; anal setae $ps1-3$ on weakly defined anal plates. Coxal setae fine, except $2c$ barbed; setae agl thick, barbed. Setal lengths: $1a$ 27–45, $1b$ 12–15, $2b$ 11–16, $2c$ 9–11, $3a$ 33, $3b$ 6–9, $4a$ 17–24, $4b$ 6–8, agl 8–10, gl 11, $ps1$ 3, $ps2$ 4–5, $ps3$ 4–5. *Legs*. (Figs 77b, 80) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-2-1-3-5, 1-0-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 6–7 long, ta II 5–6 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (3–4, 4 long). Leg setation as in adult except: tr IV without seta v' . Setae v' added to tr I–III.

PROTONYMPH ($n = 6$). *Dorsum*. Body measurements: distance between setae $v2-h1$ 165–195, $sc2-sc2$ 78–90; other measurements: $v2-v2$ 26–31, $sc1-sc1$ 65–69, $c1-c1$ 28–32, $c2-c2$ 89–98, $c3-c3$ 130–135, $d1-d1$ 22–29, $d2-d2$ 84–89, $d3-d3$ 110–125, $e1-e1$ 18–22, $e2-e2$ 100–110, $e3-e3$ 95–105, $f2-f2$ 76–90, $f3-f3$ 70–73, $h1-h1$ 19–24, $h2-h2$ 40–50. Anterior margin of prodorsum without medial notch. Prodorsal shield absent, prodorsum with concave striations. Opisthosomal shield absent; transverse striae gradually becoming oblique, tending to convex posteriorly. Setae more elongate than those of adult. Setal lengths: $v2$ 10–15, $sc1$ 12–14, $sc2$ 13–15, $c1$ 11–12, $c2$ 14–15, $c3$ 14–20, $d1$ 9–12, $d2$ 17–21, $d3$ 25–26, $e1$ 14–17, $e2$ 16–22, $e3$ 19–23, $f2$ 21–23, $f3$ 17–21, $h1$ 18–20, $h2$ 20–23. *Palps*. Palps similar to adult. Tibial setae, dorsal 5–6 long, 4 long; tarsal eupathidia both 3 long; solenidion 3–4 long. *Venter*. Cuticle with transverse striae, becoming coarse behind cx IV. Anal setae $ps1-3$ on weakly defined anal plates. Coxal setae fine. Setal lengths: $1a$ 15–17, $1b$ 6–7, $2b$ 7, $3a$ 12–23, $3b$ 6, agl 7, $ps1$ 2–3, $ps2$ 2–3, $ps3$ 3. *Legs*. (Fig. 81a) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-9(1), 1-0-3-1-4-9(1), 1-1-2-1-3-5, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (ta I 4 long; ta II 3 long). Leg setation as in deutonymph except: seta $2c$ absent; seta $4b$ absent; tr I–III without seta v' ; ge I–II without seta d, l'' ; ta IV without setae tc', tc'' . Setae l' added to tr III.

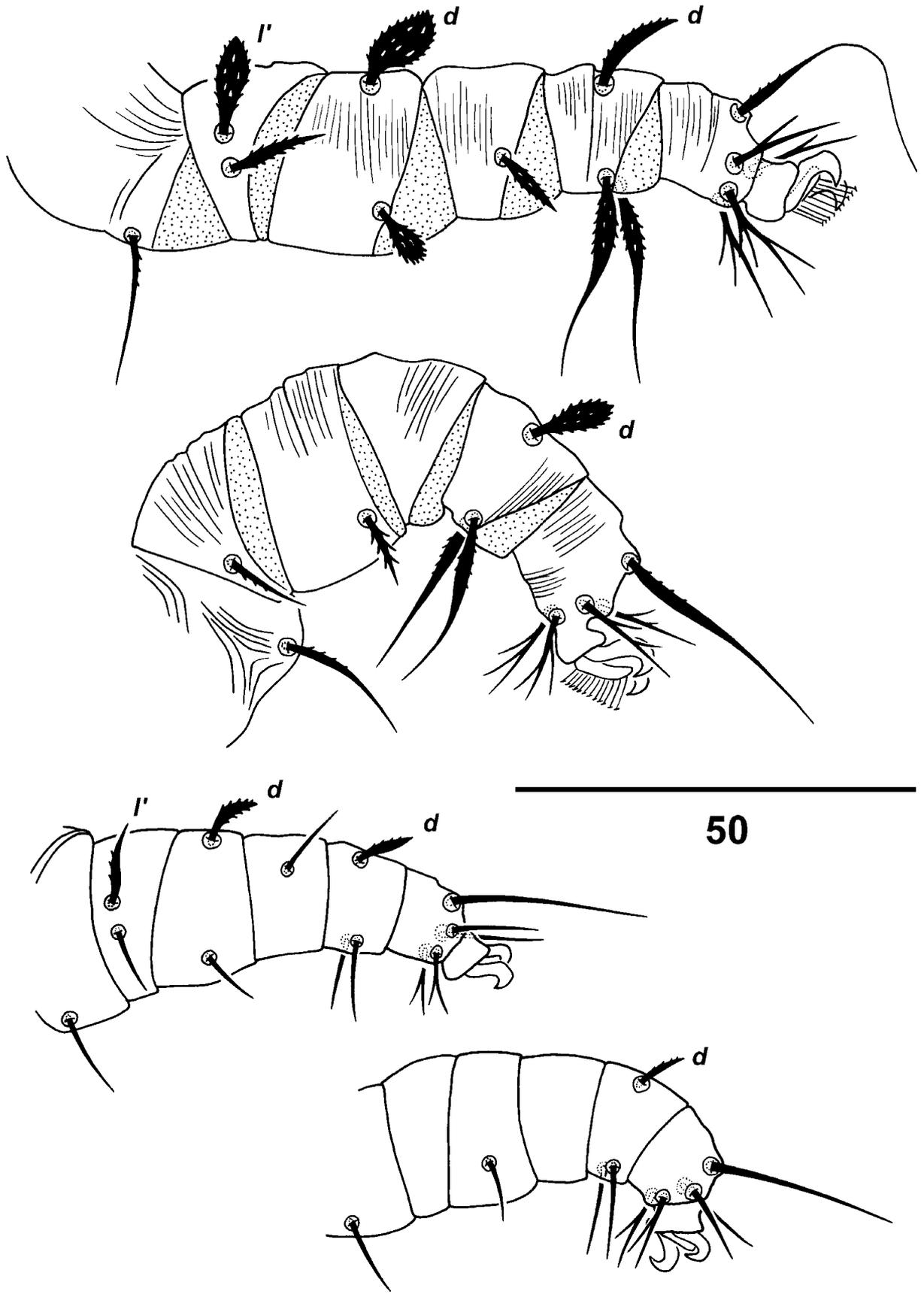


FIGURE 77. *Pentamerismus sititoris* Beard and Seeman, a. adult female legs III–IV (right side, ventral aspect); b. deutonymph legs III–IV (right side, ventral aspect).

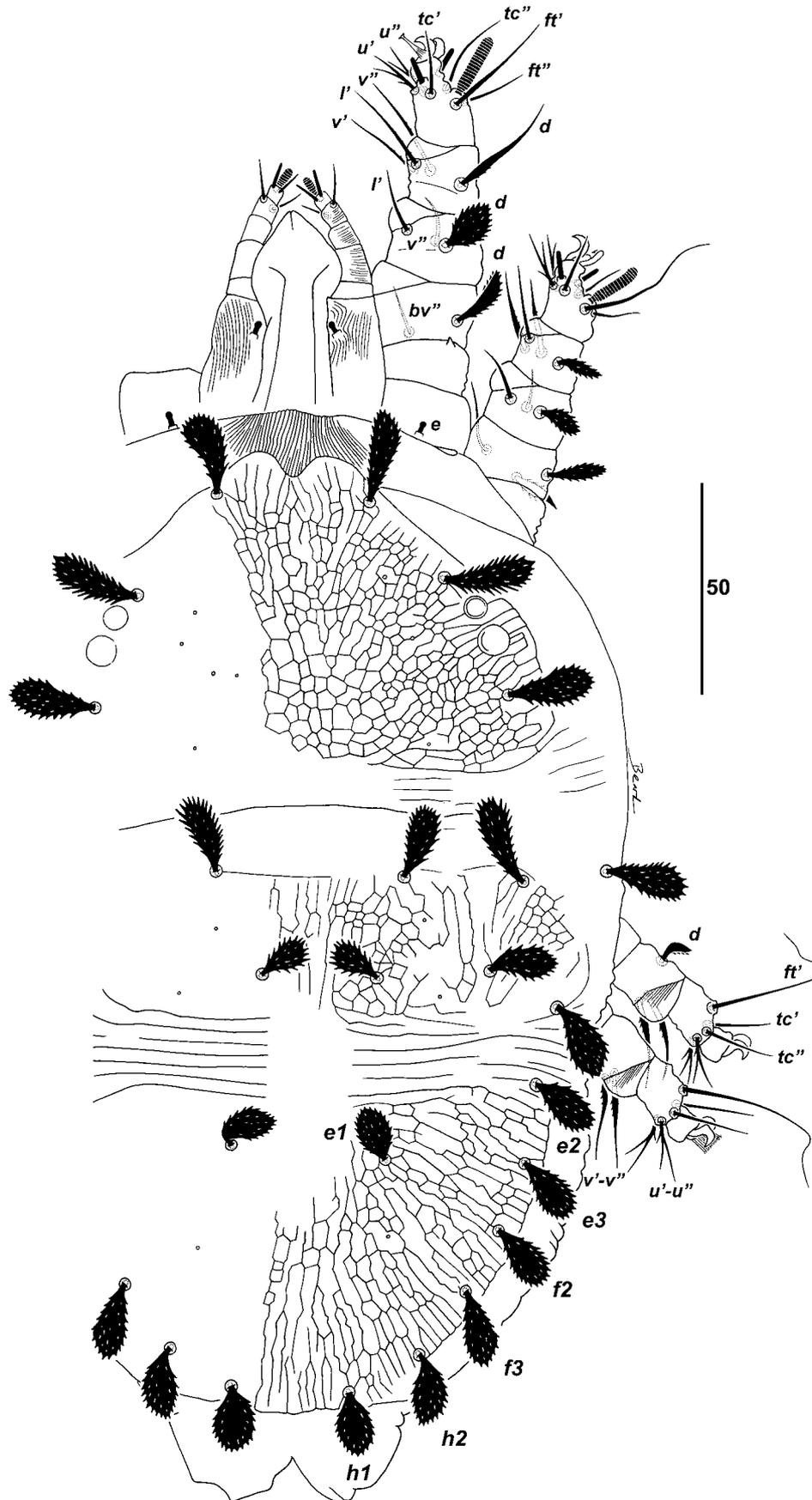


FIGURE 78. *Pentamerismus sititoris* Beard and Seeman, adult male, dorsum with details of legs and palps; solenidion ω'' and eupathidia ($p\zeta''-p\zeta'''$) not labelled.

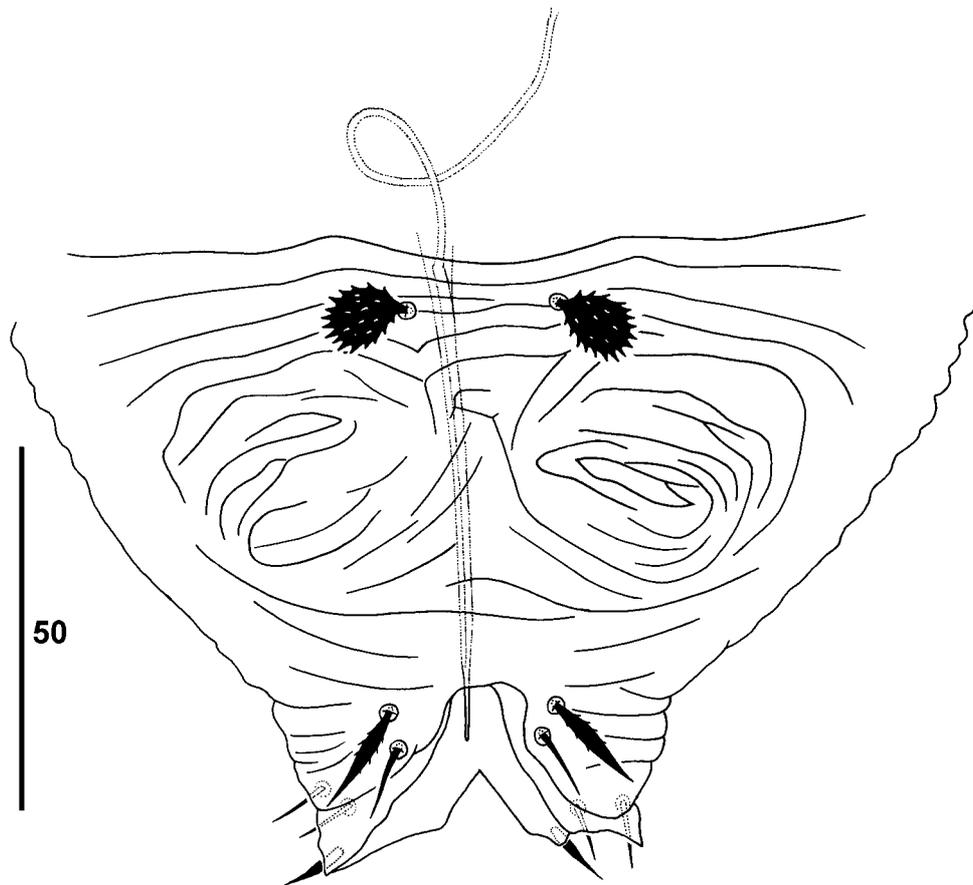


FIGURE 79. *Pentamerismus sititoris* Beard and Seeman, adult male, posterior venter with detail of aedeagus.

LARVA (n = 3). *Dorsum*. Body measurements: distance between setae *v2-h1* 130–155, *sc2-sc2* 65–67; other measurements: *v2-v2* 22–25, *sc1-sc1* 50–53, *c1-c1* 17–18, *c2-c2* 68–74, *c3-c3* 90, *d1-d1* 12, *d2-d2* 60, *d3-d3* 80, *e1-e1* 7, *e2-e2* 67, *e3-e3* 55, *f2-f2* 45, *f3-f3* 30, *h1-h1* 8, *h2-h2* 16–38. Anterior margin of prodorsum without medial notch. Prodorsal shield absent, with longitudinal striations becoming broader medially. Opisthosomal shield absent; coarse, irregular transverse striae. Setae with more elongate proportions than those of adult. Setal lengths: *v2* 13–15, *sc1* 15–18, *sc2* 13, *c1* 12, *c2* 15–17, *c3* 14–17, *d1* 17–18, *d2* 15, *d3* 15, *e1* 19, *e2* 15, *e3* 15–16, *f2* 16, *f3* 17, *h1* 14, *h2* 15. *Palps*. (Fig. 81c) Palps similar to adult. Tibial setae, dorsal 5–6 long, venter 4–5 long; tarsal eupathidia 3–4, 4 long; solenidion 4 long. *Venter*: Cuticle with transverse striae, becoming coarse behind cx IV. Anal setae *ps1–3* on weakly defined anal plates. Coxal setae fine. Setal lengths: *1a* 22–35, *1b* 9–10, *3a* 27–40, *ps1* 3–4, *ps2* 3–4, *ps3* 3–4. *Legs*. (Fig. 81b) Setal formula for legs I–III (coxae to tarsi) 1-0-3-1-4-7(1), 0-0-3-1-4-7(1), 0-0-2-1-3-3. Tarsi I and II each with 1 anti-axial solenidion ω'' (ta I 4–6 long, ta II 4–5 long) and 2 eupathidia $p\zeta'$ - $p\zeta''$ (ta I 4–5 long; ta II 3–4 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta tc' , tc'' .

Etymology. The specific name *sititoris*, is masculine Latin for “one who thirsts”, in reference to the dry habitat in which this species lives.

Remarks. These mites were matt red and found hiding in leaf buds and under leaf scales. Individuals of this species were found in association with *Chaudhripalpus costacola* and *Philippipalpus belah*.

Pentamerismus sititoris is similar to *P. hicklingorum* and *P. wardo*, but can be separated from these two species by the posterior ventral setae *g1–2* and *ps1–2* being thick, broadly lanceolate and heavily barbed, and setae *ag* being palmate and strongly barbed (setae *g1–2* fine, setiform and weakly barbed, setae *ps1* thicker than *ps2–3*, and setae *ag* setiform to lanceolate in *P. hicklingorum* and *P. wardo*).

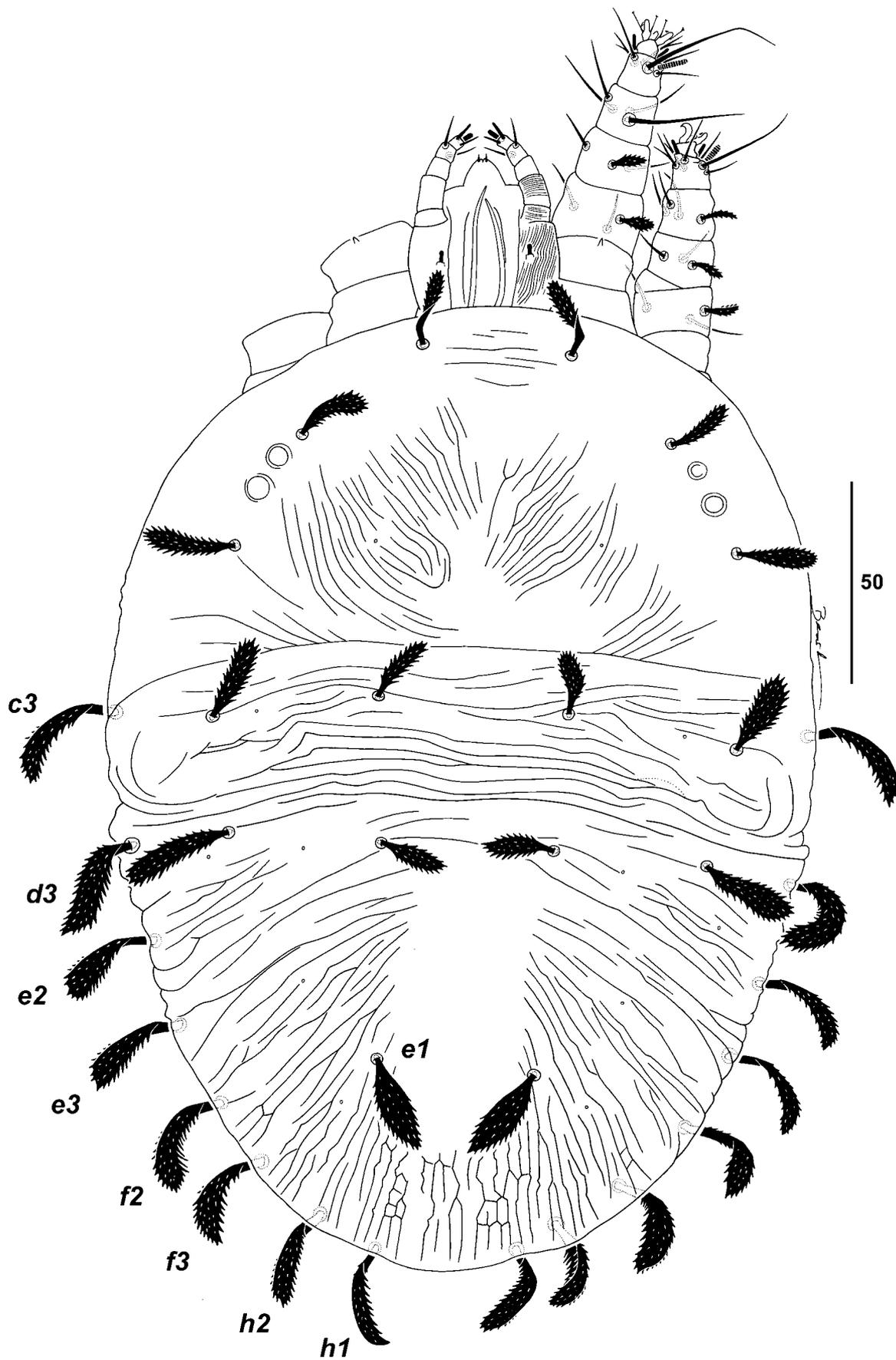


FIGURE 80. *Pentamerismus sititoris* Beard and Seeman, deutonymph, dorsum with details of legs I–II and palps.

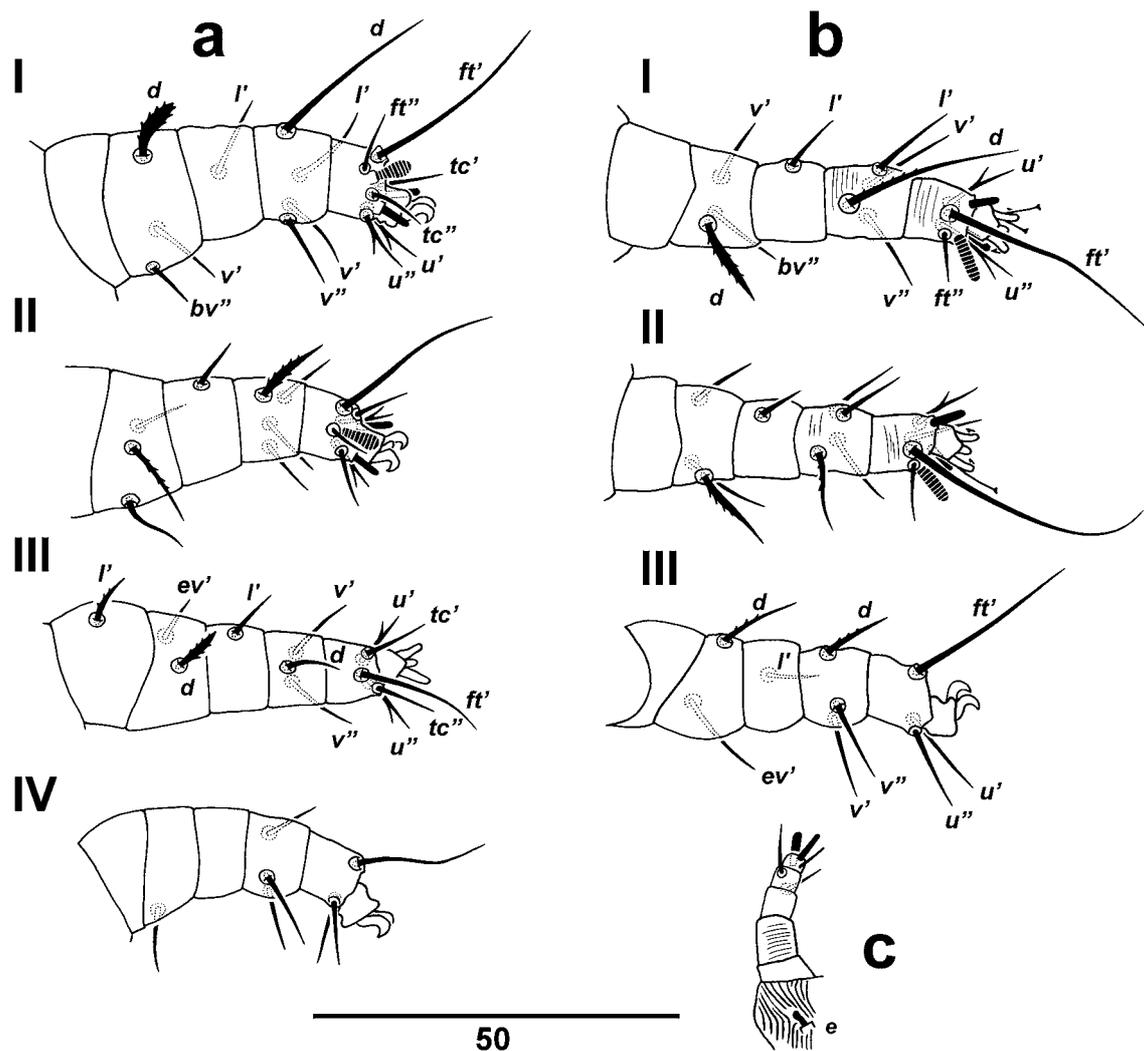


FIGURE 81. *Pentamerismus sititoris* Beard and Seeman, immatures, a. protonymph legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I; b. larva legs (right side), solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I; c. larva palp.

***Pentamerismus wardo* Seeman and Beard sp. nov.**

(Figs 82–87)

Type material examined. Holotype female ex. *Allocasuarina scleroclada* (Casuarinaceae), **AUSTRALIA:** Western Australia, approx. 3 km N Coomberdale, along Moora-Watheroo Road, 30°24'17"S 116°02'29"E, 15 April 2009, coll. J.J. Beard (WAM) (BRI voucher, BRI [AQ814925]). Paratypes. 6 females, 3 pharate females, 2 males, 2 pharate males, 4 larvae, same data as holotype (WAM, QM, ANIC, USNM).

Diagnosis. Dorsal opisthosomal setae f_2 present. Palp setal formula 0-0-0-2-3(1), with palp tibial setae $l'PTi$ and $l''PTi$ both present. Anterior margin of prodorsal shield with short notch. Dorsal shields with irregular weakly reticulate to rugose mosaic sculpturing; dorsal setae broadly lanceolate, barbed; lateral margins of opisthosoma with transverse to oblique folds or striae. Posterior ventral setae ag fine, barbed; setae g_1-2 fine, barbed; setae ps_1-3 fine, ps_1 slightly thicker than ps_2-3 , ps_1-2 barbed, ps_3 smooth. Seta lc absent. Setae d on femora and genua I–II lanceolate; seta ev' on femora III fine, smooth; setae v', v'' on tibiae III fine, smooth to weakly barbed.

FEMALE ($n = 7$). **Dorsum.** (Fig. 82a) Body measurements: distance between setae v_2-v_2 220–260 [260], sc_2-sc_2 105–120 [110]; other measurements: v_2-v_2 40–46 [45], sc_1-sc_1 77–86 [86], c_1-c_1 49–72 [51], c_2-c_2 110–135 [110], c_3-c_3 160–180 [160], d_1-d_1 33–38 [38], d_2-d_2 90–115 [98], d_3-d_3 130–150 [135], e_1-e_1 36–43 [41], e_2-e_2 120–140 [130], e_3-e_3 110–125 [115], f_2-f_2 96–110 [100], f_3-f_3 77–89 [80], h_1-h_1 24–29 [24], h_2-h_2 54–63 [54].

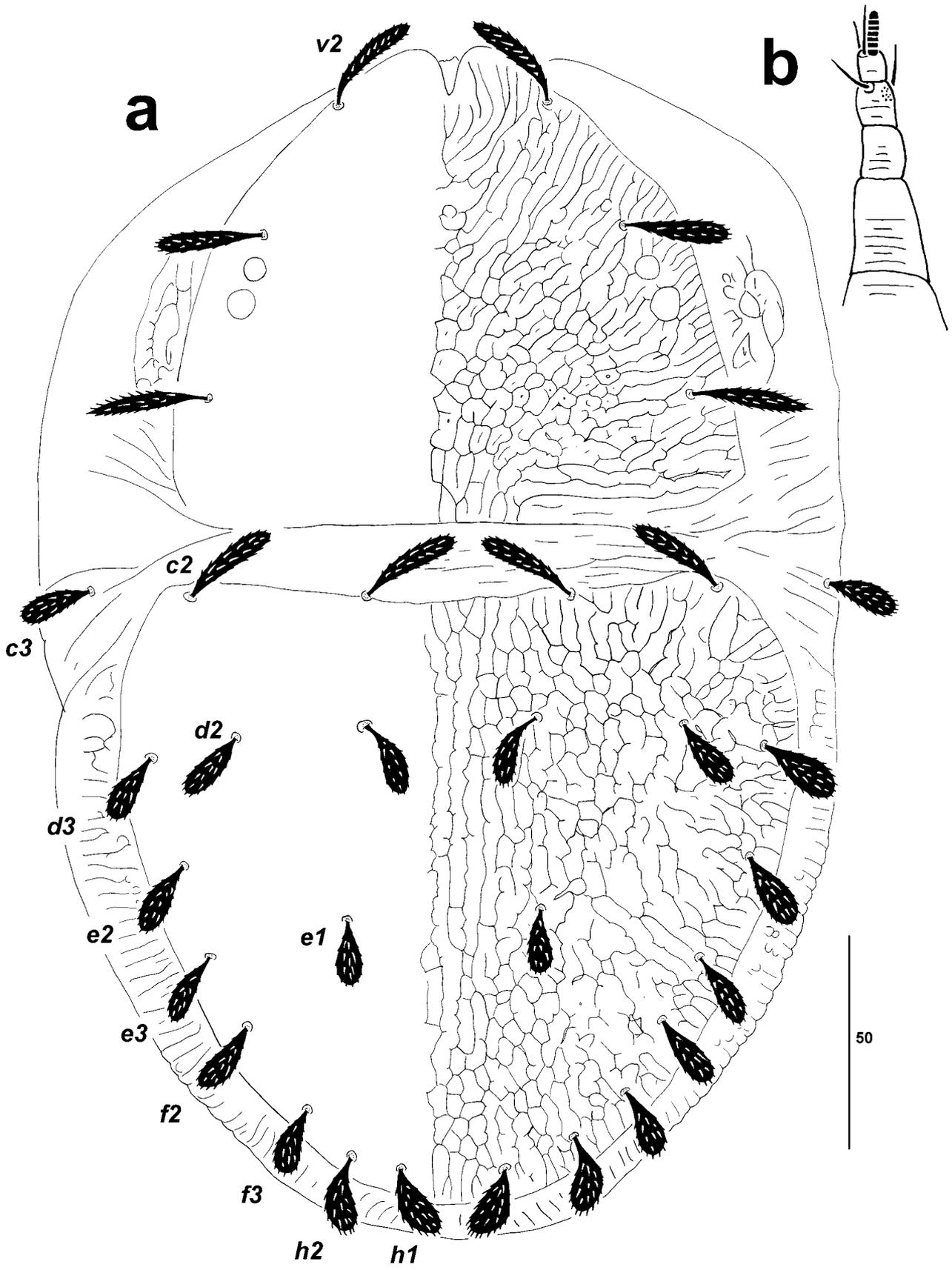


FIGURE 82. *Pentamerismus wardo* Seaman and Beard, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

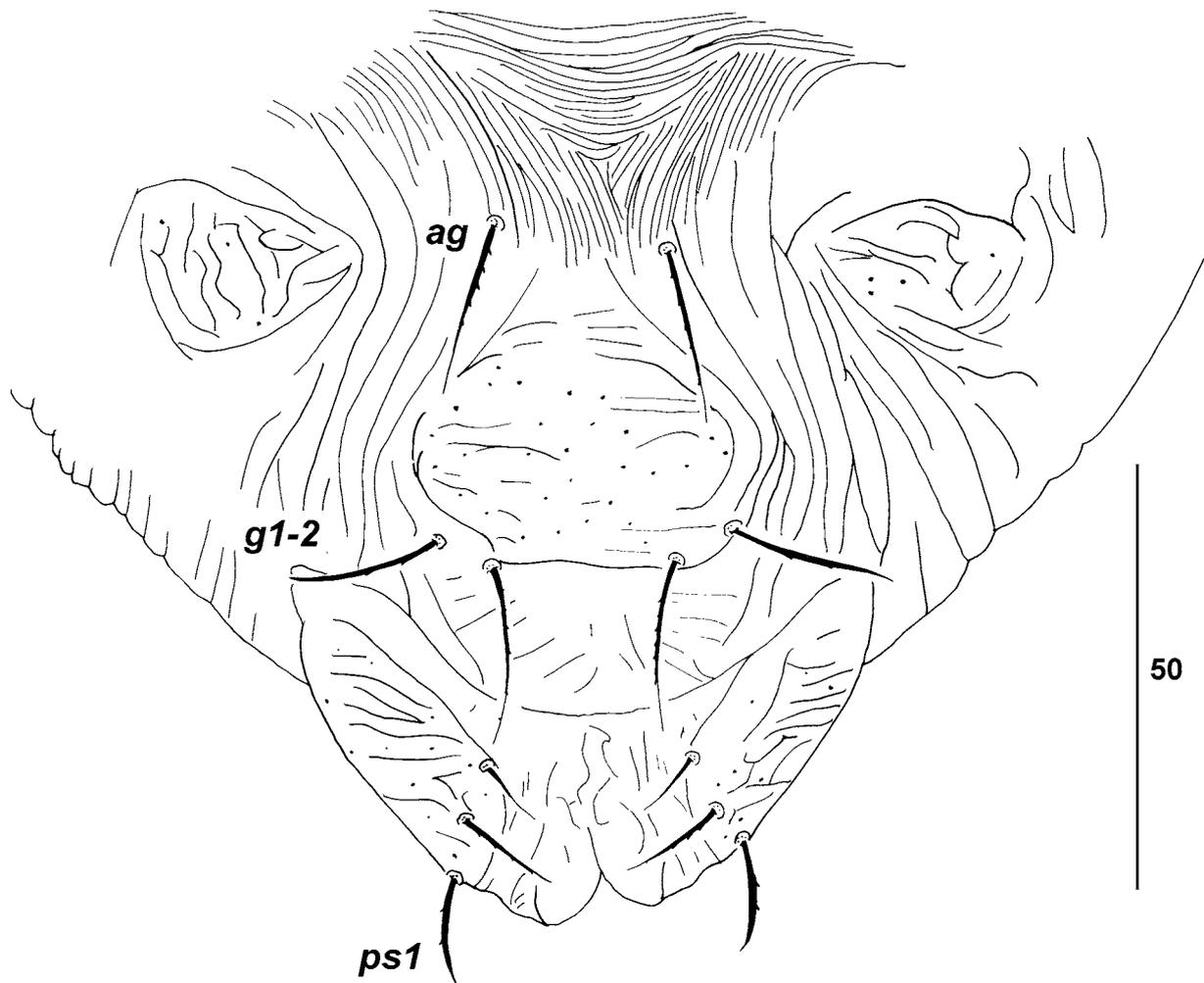


FIGURE 83. *Pentamerismus wardo* Seeman and Beard, adult female, posterior venter.

Anterior margin of prodorsal shield with 1 pair of small lobes forming short medial notch (internal depth 9–12). Prodorsal shield with irregular weakly reticulate to rugose mosaic of polygonal cells medially, with cells elongate anteriorly and laterally. Opisthosomal shield with similar pattern to prodorsal shield, except pattern less complete, especially laterally. Lateral cuticle surrounding prodorsal shield smooth to weakly rugose medially, with some weak folds posteriorly; lateral cuticle surrounding opisthosoma with transverse to oblique folds and striae. All dorsal setae barbed, lanceolate, becoming broader posteriorly. Setal lengths: *v2* 22–27 [22], *sc1* 24–27 [24], *sc2* 26–31 [26], *c1* 22–26 [22], *c2* 25–26 [25], *c3* 20–23 [20], *d1* 16–17 [not measurable], *d2* 16–20 [16], *d3* 18–20 [18], *e1* 15–17 [not measurable], *e2* 17–19 [17], *e3* 19–21 [19], *f2* 17–19 [17], *f3* 17–19 [17], *h1* 17–18 [17], *h2* 18–20 [18]. *Palps.* (Fig. 82b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 5–6 [6] long, ventral 7–9 [7] long; tarsal eupathidia 3–4 [3] long, 5 [5] long; solenidion 5–6 [5] long. *Venter.* (Fig. 83) Cuticle with transverse striae, becoming longitudinal just anterior to setae *ag*, becoming coarse around genital area. Circular thickening present in metapodal region, ca. 25 diameter, rugose. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield punctate, margins irregular, 30–32 [32] long, 40–45 [43] wide; anal setae *ps1*–*ps3* inserted in longitudinal row on anal plates. Coxal setae fine, except *2c* thickened, barbed; setae *ag1* fine, barbed; *g1*–*g2*, *ps1*–*ps2* fine, barbed; *ps3* fine, smooth. Setal lengths: *1a* 47–52 [47], *1b* 18–31 [17], *2b* 20–25 [20], *2c* 16–20 [17], *3a* 49–58 [49], *3b* 15–19 [19], *4a* 46–55 [46], *4b* 11–17 [15], *ag1* 12–20 [19], *g1* 18–24 [20], *g2* 15–22 [15], *ps1* 13–15 [13], *ps2* 13–14 [13], *ps3* 7–8 [17]. *Spermatheca.* Spermathecal tube long, narrow, convoluted, < 1 wide, > 70 long. Spermatheca vesicle obscured in all specimens. Genital opening between anal valves and posterior margin of genital shield. *Legs.* (Fig. 84) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-2-1-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (9–10 [9] long) and 2 eupathidia $p\zeta'-p\zeta''$ (6–7 [7] long). Leg setation as in Table 1 except coxae I without *1c*.

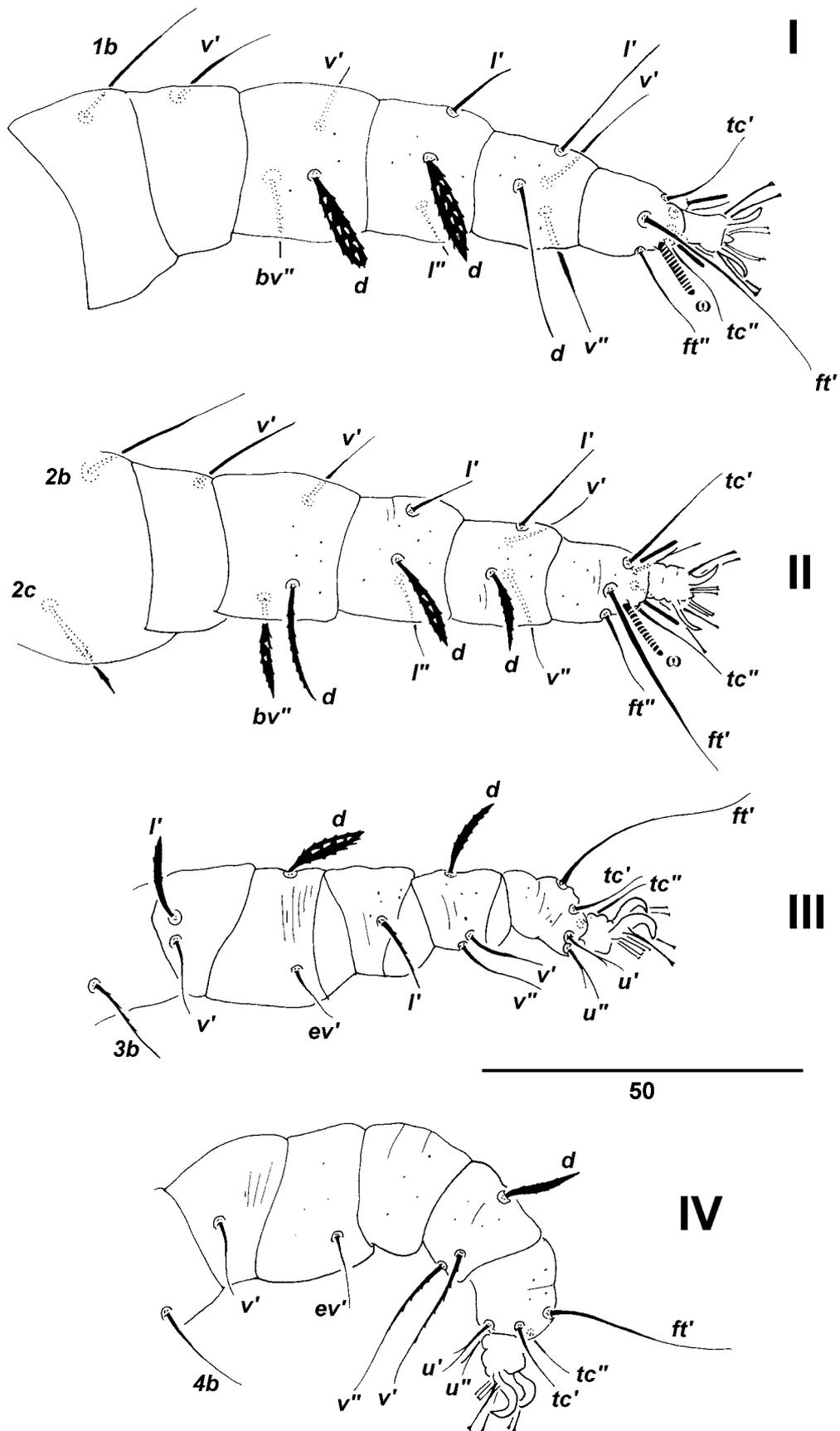


FIGURE 84. *Pentamerismus wardo* Seeman and Beard, adult female, legs (right side), eupathidia ($p\zeta'$ - $p\zeta''$) and unguinal setae (u' - u'') not labelled on legs I-II.

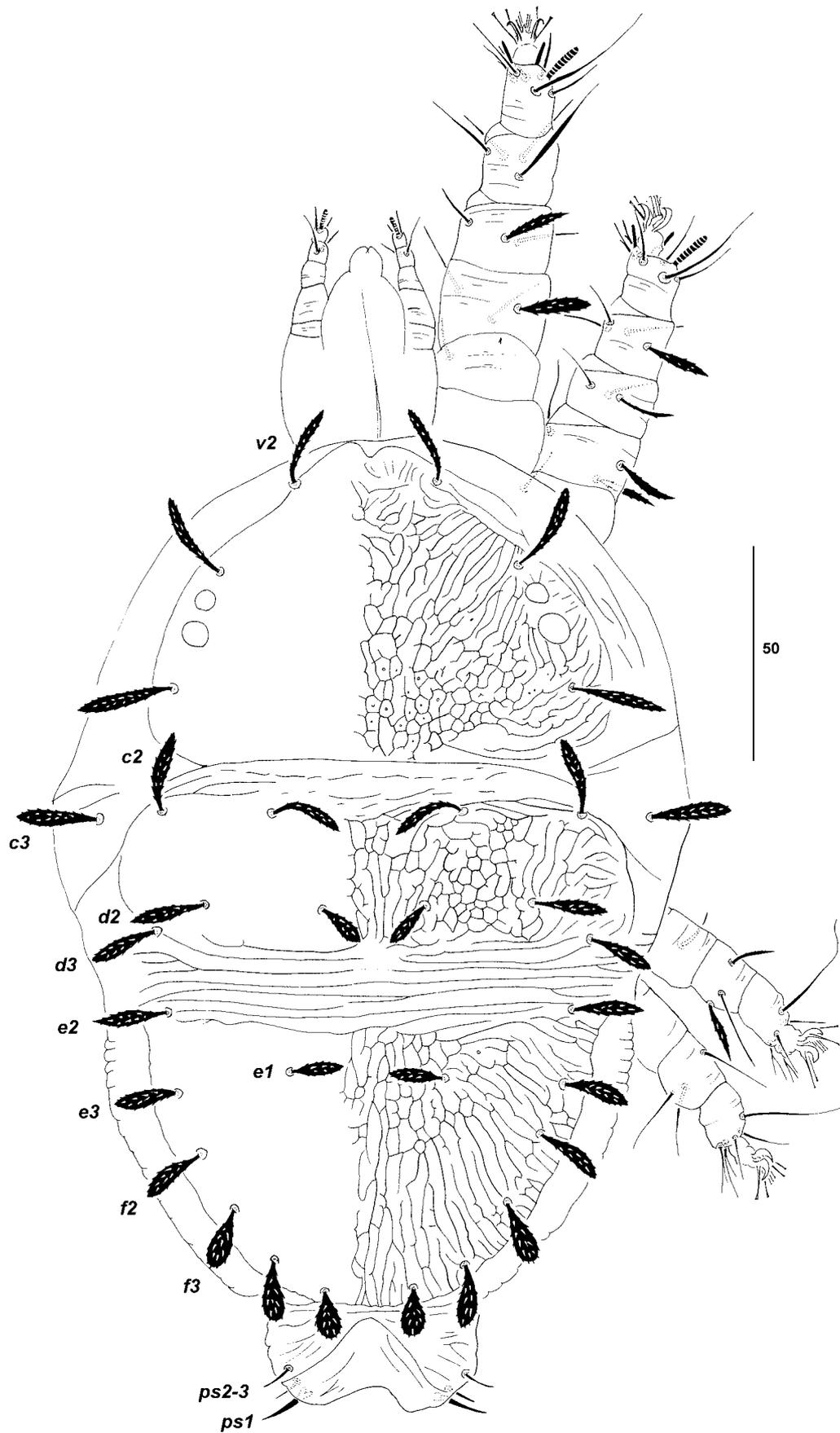


FIGURE 85. *Pentamerismus wardo* Seeman and Beard, adult male, dorsum with details of legs and palps.

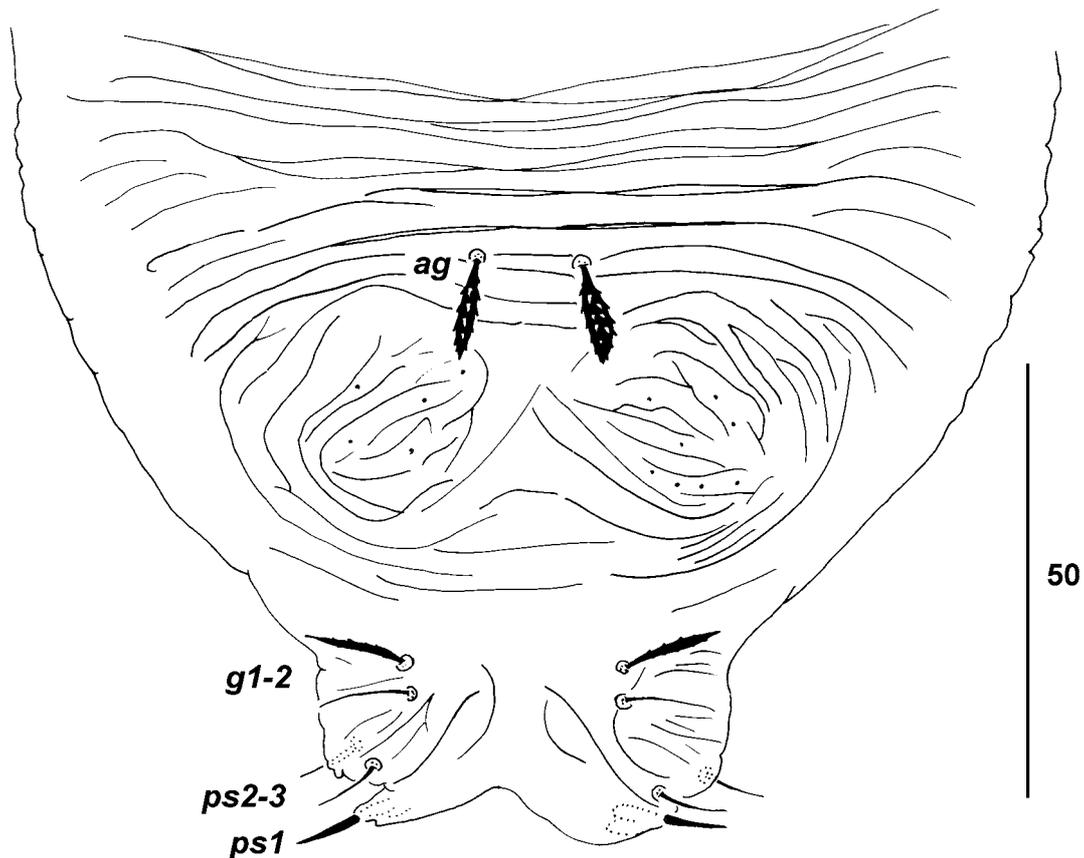


FIGURE 86. *Pentamerismus wardo* Seeman and Beard, adult male, posterior venter.

MALE (n = 2). *Dorsum*. (Fig. 85) Body measurements: distance between setae *v2-h1* 185–190, *sc2-sc2* 85–88; other measurements: *v2-v2* 26–30, *sc1-sc1* 63–67, *c1-c1* 39–41, *c2-c2* 89–93, *c3-c3* 120–125, *d1-d1* 20–22, *d2-d2* 70–74, *d3-d3* 93–97, *e1-e1* 29–34, *e2-e2* 89–93, *e3-e3* 17, *f2-f2* 76–77, *f3-f3* 61–63, *h1-h1* 13–14, *h2-h2* 15. Anterior margin of prodorsum with pair of small lobes forming a short medial notch (internal depth 3–4). Prodorsal, mesonotal and pygidial shields with sculpture and dorsal setae similar to female. Medial soft cuticle striated, lateral cuticle smooth, becoming festoid posteriorly. Setal lengths: *v2* 20–22, *sc1* 21, *sc2* 21–22, *c1* 18, *c2* 19–21, *c3* 17, *d1* 11–13, *d2* 15, *d3* 15–16, *e1* 12, *e2* 16, *e3* 17, *f2* 16, *f3* 16–17, *h1* 13–14, *h2* 15. *Palps*. (Fig. 85) Palps similar to female. Tibial setae, dorsal 6 long, ventral 7–8 long; tarsal eupathidia 3, 5–6 long; solenidion 4–5 long. *Venter*. (Fig. 86) Striae entirely transverse, becoming coarse behind cx IV. Posterior opisthosoma with 2 irregular, poorly defined, striated subcircular plates, ca. 30 in diameter; *g1-2*, *ps1-3* on weakly sclerotised anal valves; *ps1* modified, thickened. Coxal setae fine, except *2c* thickened, barbed. Seta *ag1* narrowly lanceolate, barbed; *g1* lanceolate; *g2*, *ps2*, *ps3* smooth; *ps1* spine-like, thickened. Setal lengths: *1a* 38–48, *1b* 26, *2b* 26, *2c* 13, *3a* 30–37, *3b* 18–19, *4a* 47, *4b* 20, *ag1* 13, *g1* 11, *g2* 11–13, *ps1* 11–14, *ps2* 7, *ps3* 6–7. *Aedeagus*. Narrow, sclerotised, tapering to a point, 66 long, curved. Membranous duct runs from inside aedeagus. *Legs*. (Fig. 85) Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (9–10 long) and 2 eupathidia $p\zeta'-p\zeta''$ (about 6 long).

LARVA (n = 2). *Dorsum*. (Fig. 87) Body measurements: distance between setae *v2-h1* 130–140, *sc2-sc2* 54–59; other measurements: *v2-v2* 20–22, *sc1-sc1* 44–48, *c1-c1* 17–20, *c2-c2* 61, *c3-c3* 87–89, *d1-d1* 13, *d2-d2* 51–52, *d3-d3* 72–76, *e1-e1* 8–10, *e2-e2* 56–61, *e3-e3* 50–53, *f2-f2* 36–38, *f3-f3* 24–31, *h1-h1* 4–6, *h2-h2* 11–16. Anterior margin of prodorsum without medial notch. Prodorsal shield 54–57 long, 64 wide, defined by numerous longitudinal striations. Opisthosomal shield absent; coarse, irregular transverse striae, becoming obsolete between *d1-e1*. Setae similar in length to those of adult; setae narrowly lanceolate to thickened, barbed; setae *d1* and *e1* broadest; setae *v2*, *sc1*, *sc2*, *h2* narrowest. Setal lengths: *v2* 14–19, *sc1* 13–15, *sc2* 14–17, *c1* 19–20, *c2* 14, *c3* 14–15, *d1* 19–20, *d2* 17–18, *d3* 17–20, *e1* 21–22, *e2* 20–21, *e3* 20–23, *f2* 20, *f3* 24–26, *h1* 24–25, *h2* 20. *Palps*. (Fig. 87) Palps similar to adult. Tibial setae, dorsal 4 long, ventral 5 long; tarsal eupathidia 3, 4 long; solenidion 3

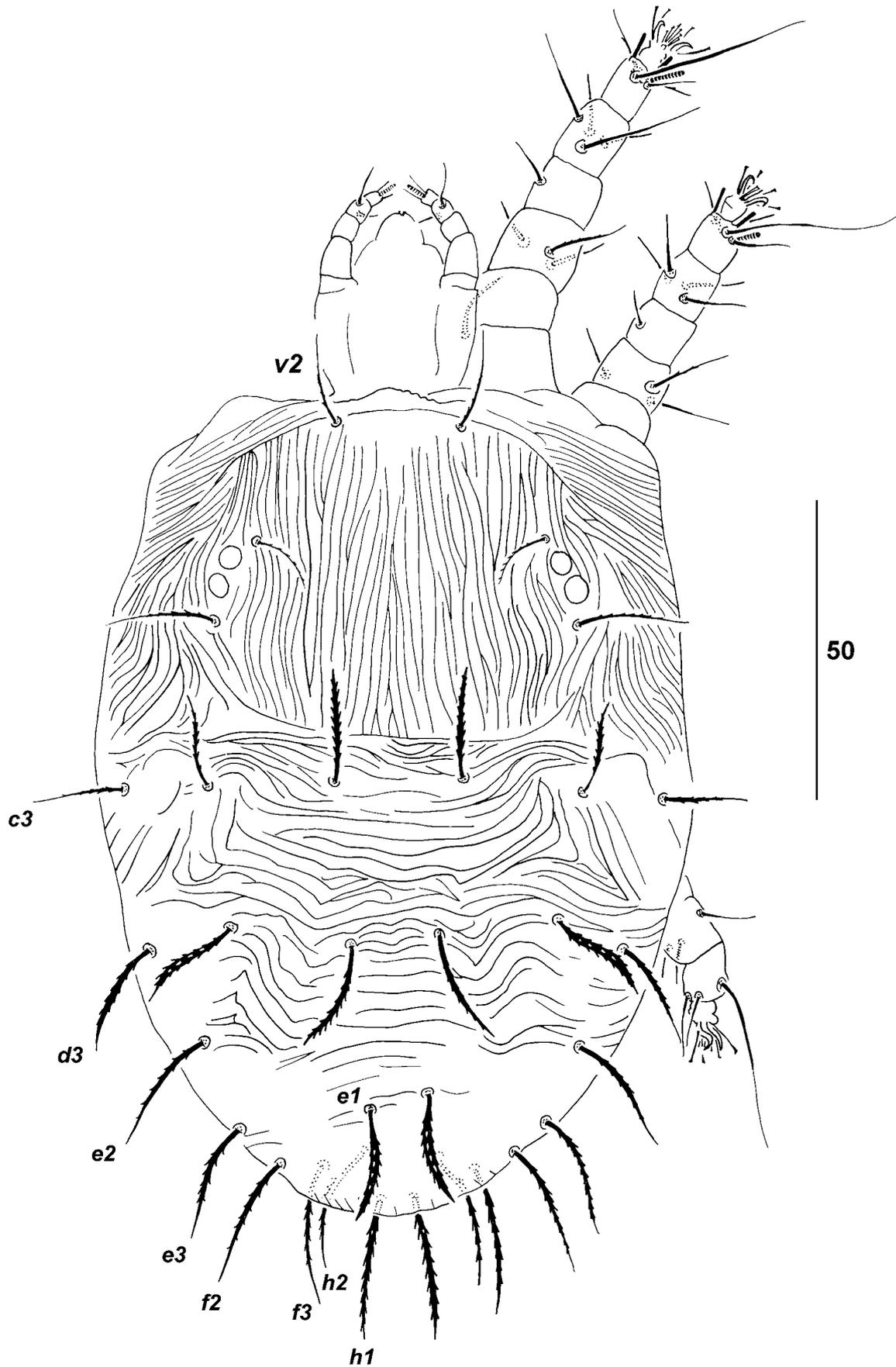


FIGURE 87. *Pentamerismus wardo* Seeman and Beard, larva, dorsum with detail of legs and palps.

long. *Venter*. Cuticle with transverse striae to setae *3a*, oblique posterior to *3a*, transverse to midway between *3a* and *ps3*, then longitudinal anal area, slightly coarser around anal area. Anal setae *ps1–3* on weakly defined anal plates. Coxal setae fine. Setal lengths: *1a* 25–30, *1b* 15, *3a* 35–38, *ps1* 3–4, *ps2* 4–5, *ps3* 4–5. *Legs*. (Fig. 87) Setal formula for legs I–III (coxae to tarsi) 1-0-3-1-4-7(1), 0-0-3-1-4-7(1), 0-0-2-1-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 5 long, ta II 4 long) and 2 eupathidia $p\zeta''-p\zeta'''$ (about 4 long). Leg setation as in Table 1.

Etymology. The specific name, *wardo*, is an Australian indigenous word meaning “a little bird” referring specifically to the Willy Wagtail (*Rhipidura leucophrys* Latham (Rhipiduridae)), and is the source of the town name Watheroo, near which this mite was collected.

Remarks. *Pentamerismus wardo* is similar to *P. hicklingorum*, but can be separated by having two setae on the palp tibia (one seta on the palp tibia of *P. hicklingorum*) and the dorsal cuticle being weakly reticulate (with broadly rounded folds on *P. hicklingorum*).

Individuals were found buried in the thick pubescence present on the tips of the needle-like stems and branchlets of the host.

***Pentamerismus hicklingorum* Seeman and Beard sp. nov.**

(Figs 88–94)

Type material examined. Holotype female ex. Coastal She-Oak, *Casuarina equisetifolia* (Casuarinaceae), AUSTRALIA: Southeast Queensland, Beachmere, Bayside Drive, 27° 05'52" S, 153°05'21" E, 25 June 2010, coll. O.D. Seeman (QM). Paratypes. 8 females, 3 males, 2 deutonymphs, 1 protonymph, 4 larvae, same data as holotype (QM, ANIC).

Diagnosis. Dorsal opisthosomal setae *f2* present. Palp setal formula 0-0-0-1-3(1), with palp tibial setae *l'PTi* absent, *l'PTi* present. Anterior margin of prodorsal shield notched, forming 1 pair of short rounded lobes. Dorsal shields coarsely rugose with broadly rounded folds and weak reticulation; dorsal setae broadly lanceolate, barbed; lateral margins of opisthosoma coarsely papillate. Setae *ag* lanceolate, barbed; setae *g1–2* fine, barbed; setae *ps1–3* fine, *ps1* barbed slightly thicker than *ps2–3*, *ps2–3* fine, smooth. Seta *lc* absent. Setae *d* on femora and genua I–II lanceolate; seta *ev'* on femora III fine, smooth; setae *v'*, *v''* on tibiae III fine, smooth.

FEMALE (n = 9). *Dorsum*. (Figs 88a, 94) Body measurements: distance between setae *v2–h1* 230–270 [240], *sc2–sc2* 105–110 [105]; other measurements: *v2–v2* 46–51 [51], *sc1–sc1* 79–87 [83], *c1–c1* 51–55 [54], *c2–c2* 115–120 [115], *c3–c3* 155–160 [155], *d1–d1* 37–44 [37], *d2–d2* 97–100 [98], *d3–d3* 140–145 [140], *e1–e1* 35–41 [36], *e2–e2* 135–140 [135], *e3–e3* 120–130 [125], *f2–f2* 105–120 [110], *f3–f3* 85–100 [87], *h1–h1* 23–31 [24], *h2–h2* 47–60 [56]. Anterior margin of prodorsal shield with 1 pair of small rounded lobes, forming short medial notch (internal depth 6–8). Dorsal shields coarsely rugose with broadly rounded folds and weak reticulation (Fig. 94). Lateral cuticle surrounding shields coarsely papillate; cuticle between shields rugose. All dorsal setae barbed, lanceolate. Setal lengths: *v2* 24–30 [25], *sc1* 25–28 [25], *sc2* 28–31 [31], *c1* 25–31 [28], *c2* 20–29 [25], *c3* 22–26 [26], *d1* 19–26 [24], *d2* 22–24 [23], *d3* 25–27 [27], *e1* 18–22 [18], *e2* 20–25 [23], *e3* 18–21 [20], *f2* 18–20 [20], *f3* 17–22 [18], *h1* 17–19 [19], *h2* 17–19 [19]. *Palps*. (Fig. 88b) Setal formula 0, 0, 0, 1, 3(1s+2e). Tibial setae, dorsal 9–10 [10] long; tarsal eupathidia 5–6 [6], 6–8 [7] long; solenidion 6 [6] long. *Venter*. (Fig. 89a) Cuticle with transverse striae, becoming longitudinal just anterior to setae *ag*, becoming coarse around genital area. Circular thickening present in metapodal region, ca. 25 diameter, weakly rugose. Setae *g1* inserted in more-or-less transverse line with *g2*, *g2* slightly anterior to *g1*. Genital shield mostly smooth, margins irregular, 30–33 [33] long, 41–44 [42] wide; anal setae *ps1–3* inserted in longitudinal row on anal plates. Coxal setae fine, except *2c* barbed; setae *ag1* lanceolate, barbed; *g1–2* fine, barbed; setae *ps1–3* fine; *ps1* barbed slightly thicker than *ps2–3*; *ps2–3* smooth. Setal lengths: *1a* 51–58 [54], *1b* 25–30 [26], *2b* 21–23 [21], *2c* 17–18 [18], *3a* 40–58 [45], *3b* 13–15 [15], *4a* 40–45 [45], *4b* 11–15 [11], *ag1* 16–21 [21], *g1* 22–24 [22], *g2* 19–22 [19], *ps1* 13–15 [15], *ps2* 13–14 [14], *ps3* 7–8 [7]. *Spermatheca*. (Fig. 89b) Spermathecal tube long, narrow, convoluted, < 1 wide, ca. 130 long, terminating in membranous sac. Spermatheca vesicle visible in 2 specimens: 1 specimen with round spermatheca, ca. 3 diameter; second specimen with elongate spermatheca 6 long, 1–2 wide. Genital opening between anal valves and posterior margin of genital shield. *Legs*. (Fig. 90) Setal formula for legs I–IV (coxae to tarsi) 1-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-2-1-3-5, 1-1-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 13–14 [14] long, ta II 13 [13] long) and 2 eupathidia $p\zeta''-p\zeta'''$ (6–7 [6–7] long). Leg setation as in Table 1 except coxae I without *lc*. Setae *v'* added to tr IV.

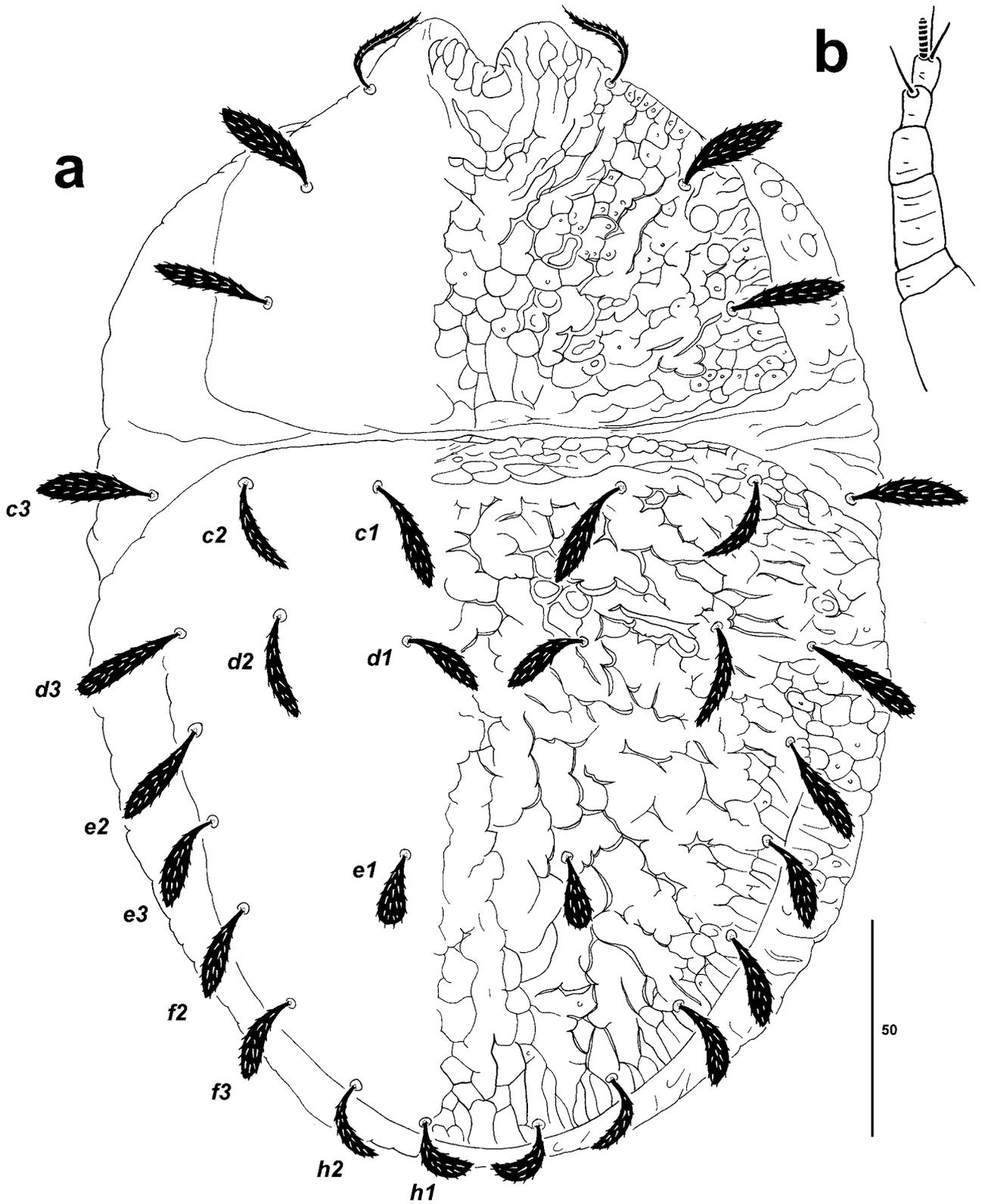


FIGURE 88. *Pentamerismus hicklingorum* Seeman and Beard, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

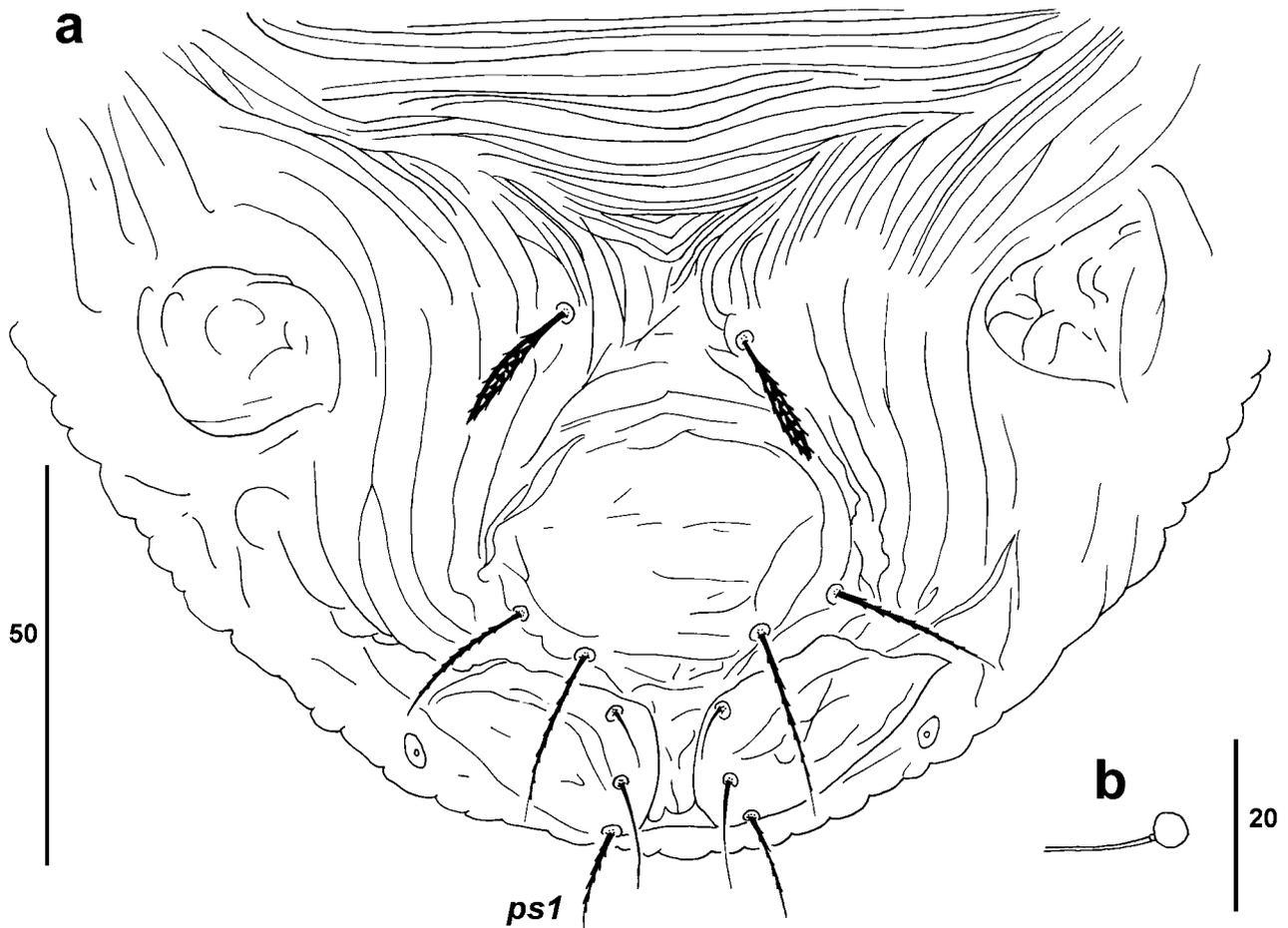


FIGURE 89. *Pentamerismus hicklingorum* Seeman and Beard, adult female, a. posterior venter; b. detail of spermatheca.

MALE (n = 3). *Dorsum*. (Fig. 91) Body measurements: distance between setae *v2-h1* 190–200, *sc2-sc2* 86–91; other measurements: *v2-v2* 34–35, *sc1-sc1* 68–69, *c1-c1* 32–33, *c2-c2* 90–92, *c3-c3* 115–125, *d1-d1* 22–28, *d2-d2* 73–81, *d3-d3* 100–105, *e1-e1* 34–40, *e2-e2* 90–92, *e3-e3* 91–96, *f2-f2* 80–83, *f3-f3* 63–65, *h1-h1* 16–20, *h2-h2* 41–45. Anterior margin of prodorsum with pair of small lobes forming a short medial notch (internal depth 5–6). Prodorsal, mesonotal and pygidial shields with sculpture and dorsal setae similar to female. Medial soft cuticle striated, lateral cuticle reticulated to striated. Setal lengths: *v2* 21–22, *sc1* 17, *sc2* 21, *c1* 18–20, *c2* 17–22, *c3* 16–17, *d1* 13–15, *d2* 13–15, *d3* 14–16, *e1* 13–15, *e2* 15–16, *e3* 15–16, *f2* 15, *f3* 14–16, *h1* 13–15, *h2* 15–16. *Palps*. Palps similar to female. Tibial seta 8–10 long; tarsal eupathidia 5–6, 7 long; solenidion 7 long. *Venter*. (Fig. 92a) Striae entirely transverse, becoming coarse behind cx IV. Posterior opisthosoma with 2 irregular, poorly defined, striated subcircular plates, ca. 25–35 in diameter; *gl-2*, *ps1-3* on weakly sclerotised anal valves. Coxal setae fine, except *2c* barbed. Seta *ag1* lanceolate, barbed; *g1* barbed; *g2*, *ps2*, *ps3* smooth; *ps1* spine-like, thickened. Setal lengths: *1a* 38–50, *1b* 22–26, *2b* 15, *2c* 15–17, *3a* 37–45, *3b* 11–15, *4a* 40–45, *4b* 15–25, *ag1* 13–16, *g1* 6–7, *g2* 14–15, *ps1* 8–14, *ps2* 7–10, *ps3* 6–8. *Aedeagus*. (Fig. 92b) Narrow, sclerotised, tapering to a point, 65–68 long; curved in 2 preparations. Membranous duct runs from inside aedeagus. *Legs*. Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (15–17 long) and 2 eupathidia $p\zeta'-p\zeta'''$ (6–7 long). Solenidia slightly thicker and longer than in female.

DEUTONYMPH (n = 2). *Dorsum*. Body measurements: distance between setae *v2-h1* 185–195, *sc2-sc2* 90–91; other measurements: *v2-v2* 30, *sc1-sc1* 73–75, *c1-c1* 28–30, *c2-c2* 88–96, *c3-c3* 122–131, *d1-d1* 23–25, *d2-d2* 81, *d3-d3* 110–114, *e1-e1* 27–28, *e2-e2* 103–105, *e3-e3* 95–102, *f2-f2* 79–90, *f3-f3* 70–75, *h1-h1* 21–22, *h2-h2* 43–48. Anterior margin of prodorsum without medial lobes or notch. Prodorsal shield poorly defined, with fine oblique-longitudinal striations. Transverse striae between setal row C to midway between rows D and E; then opisthosomal shield region with irregular polygons arranged in oblique to longitudinal pattern. Setae *v2*, *sc1* thickened slightly, barbed; setae *sc2* narrowly lanceolate; opisthosomal setae lanceolate. Setal lengths: *v2* 10–16,

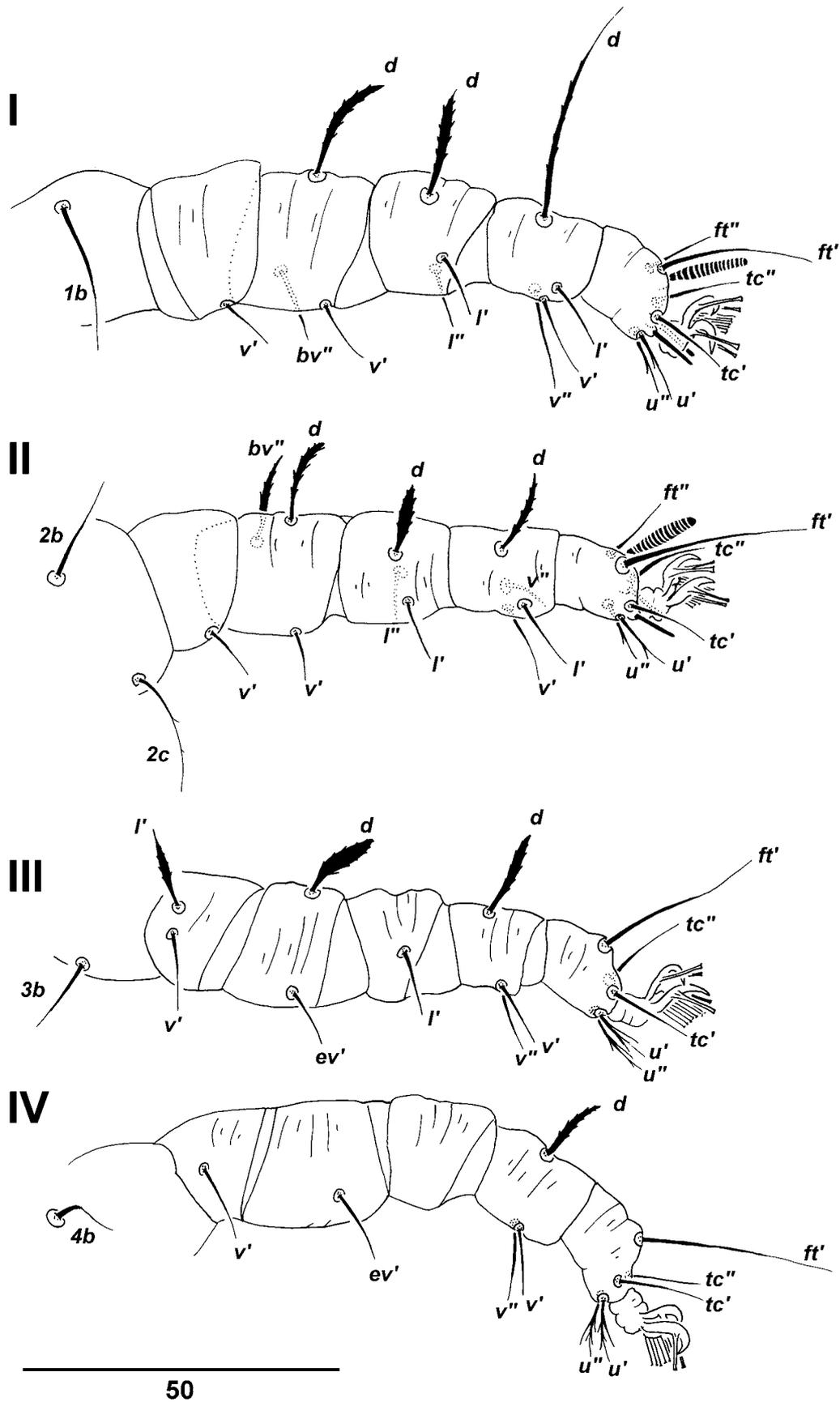


FIGURE 90. *Pentamerismus hicklingorum* Seeman and Beard, adult female, legs (legs I–II left side, ventral aspect; legs III–IV right side, ventral aspect); solenidion ω'' and eupathidia ($p\zeta''$ – $p\zeta'''$) not labelled on legs I–II.

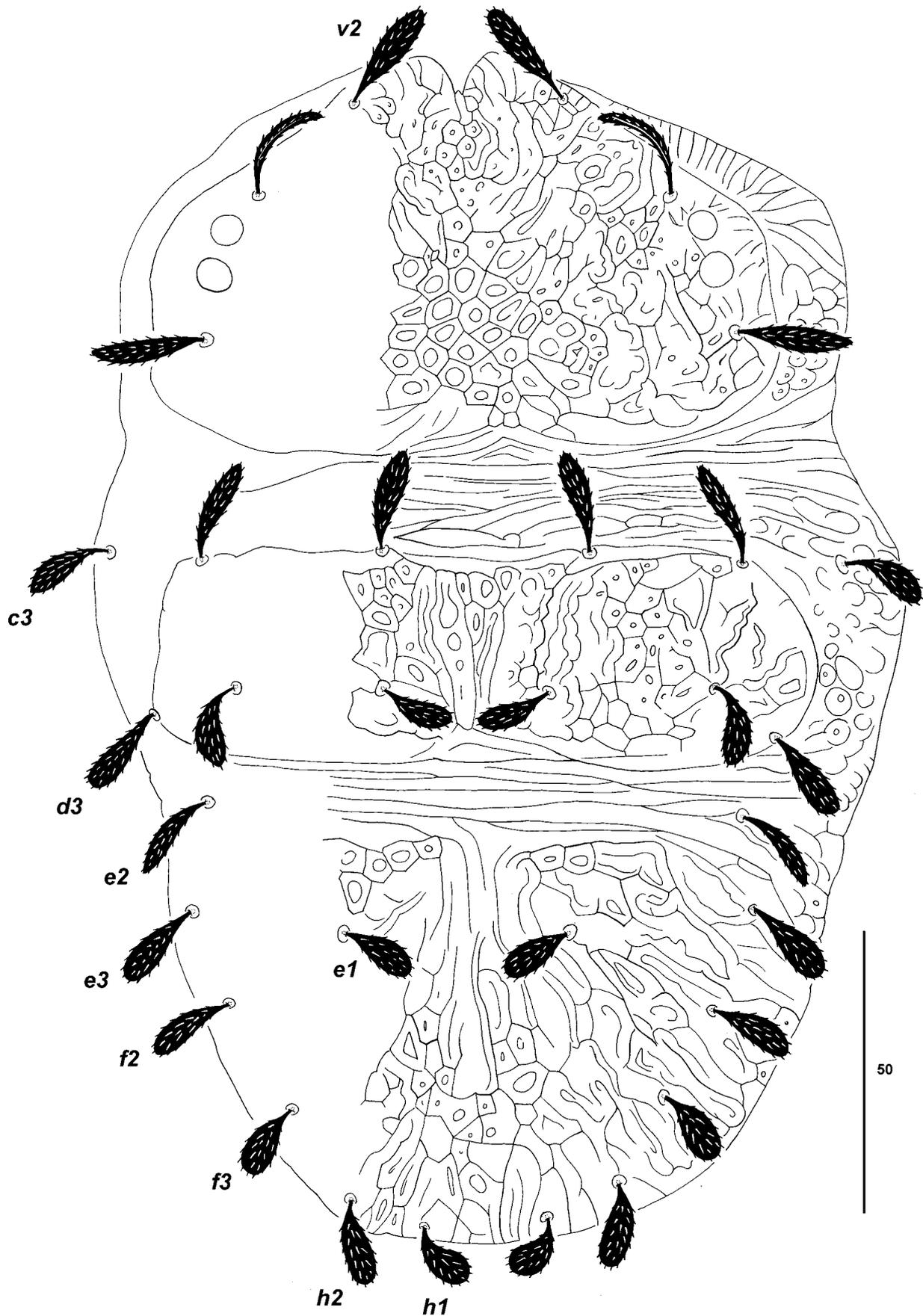


FIGURE 91. *Pentamerismus hicklingorum* Seeman and Beard, adult male, dorsum.

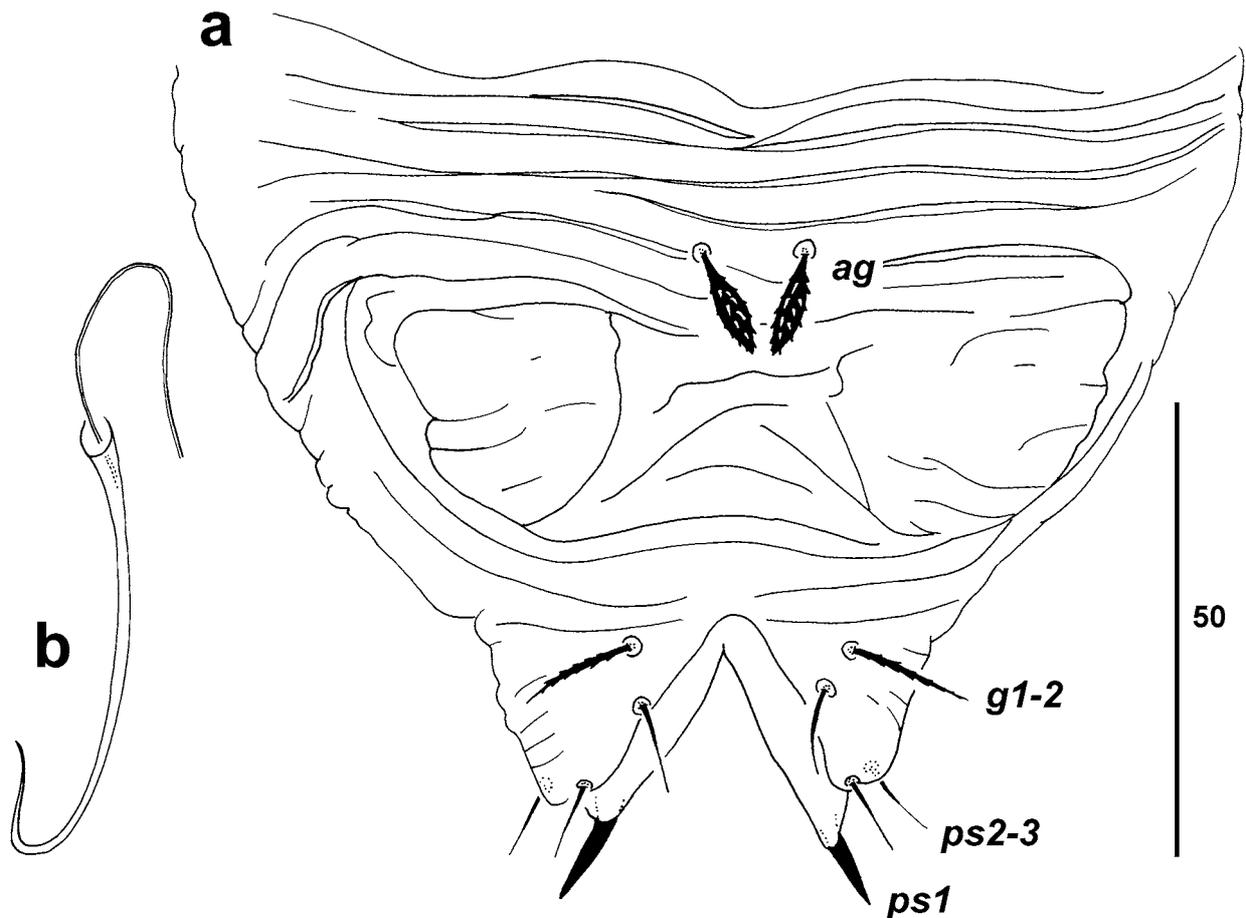


FIGURE 92. *Pentamerismus hicklingorum* Seeman and Beard, adult male, a. posterior venter; b. aedeagus.

sc1 15–16, *sc2* 15–18, *c1* 16–17, *c2* 16–21, *c3* 21–23, *d1* 13–17, *d2* 19–20, *d3* 27, *e1* 16–19, *e2* 23–27, *e3* 20–22, *f2* 21–25, *f3* 21–22, *h1* 16–19, *h2* 16–21. *Palps.* Palps similar to adult. Tibial seta 7 long; tarsal eupathidia 3, 5 long; solenidion 3 long. *Venter.* Striation similar to female; anal setae *ps1*–3 on weakly defined anal plates. Coxal setae fine, except *2c* barbed; setae *ag1* and *ps1* with few or no barbs; other setae smooth. Setal lengths: *1a* 33–35, *1b* 14–15, *2b* 10–11, *2c* 13–14, *3a* 25–40, *3b* 8–12, *4a* 19–29, *4b* 7–10, *ag1* 13–14, *g1* 11–12, *ps1* 6, *ps2* 6, *ps3* 6. *Legs.* Setal formula for legs I–IV (coxae to tarsi) 1-1-3-3-4-9(1), 2-1-3-3-4-9(1), 1-2-2-1-3-5, 1-0-1-0-3-5. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 6–8 long, ta II 6–7 long) and 2 eupathidia $p\zeta'$ - $p\zeta''$ (about 5 long). Leg setation as in adult except: tr IV without seta *v'*. Setae *v'* added to tr I–III.

PROTONYMPH (*n* = 1). *Dorsum.* Body measurements: distance between setae *v2*-*h1* 145, *sc2*-*sc2* 80; other measurements: *v2*-*v2* 27, *sc1*-*sc1* 66, *c1*-*c1* 20, *c2*-*c2* 83, *c3*-*c3* 110, *d1*-*d1* 19, *d2*-*d2* 71, *d3*-*d3* 92, *e1*-*e1* 18, *e2*-*e2* 78, *e3*-*e3* 70, *f2*-*f2* 48, *f3*-*f3* 45, *h1* missing on left hand side, *h2*-*h2* 23. Anterior margin of prodorsum without medial notch. Dorsal cuticle similar to deutonymph, except opisthosoma with coarse irregular striae only. Setae similar in length to those of adult; narrowly lanceolate, barbed. Setal lengths: *v2* 19, *sc1* 14, *sc2* 15, *c1* 19, *c2* 19, *c3* 20, *d1* 17, *d2* 23, *d3* 23, *e1* 23, *e2* 25, *e3* 20, *f2* 24, *f3* 23, *h1* 23, *h2* 18. *Palps.* Palps similar to adult. Tibial seta 6 long; tarsal eupathidia 3, 5 long; solenidion 3 long. *Venter.* Cuticle same as deutonymph. Anal setae *ps1*–3 on weakly defined anal plates. Coxal and anal setae fine, except *2a* with few barbs. Setal lengths: *1a* 33, *1b* 8, *2b* 10, *3a* 35, *3b* 10, *ag1* 9, *ps1* 5, *ps2* 5, *ps3* 5. *Legs.* Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-9(1), 1-0-3-1-4-9(1), 1-1-2-1-3-5, 0-0-1-0-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'$ - $p\zeta''$ (3-4 long). Leg setation as in deutonymph except: seta *2c* absent; seta *4b* absent; tr I–III without seta *v'*; ge I–II without seta *d*, *l''*; ta IV without setae *tc'*, *tc''*. Setae *l'* added to tr III.

LARVA (*n* = 4). *Dorsum.* (Fig. 93) Body measurements: distance between setae *v2*-*h1* 110–125, *sc2*-*sc2* 56–59; other measurements: *v2*-*v2* 23–27, *sc1*-*sc1* 48–51, *c1*-*c1* 14–17, *c2*-*c2* 57–63, *c3*-*c3* 81–87, *d1*-*d1* 9–11, *d2*-*d2* 51–58, *d3*-*d3* 68–74, *e1*-*e1* 7, *e2*-*e2* 52–57, *e3*-*e3* 41–46, *f2*-*f2* 30–35, *f3*-*f3* 22–28, *h1*-*h1* 9–10, *h2*-*h2* 13–14.

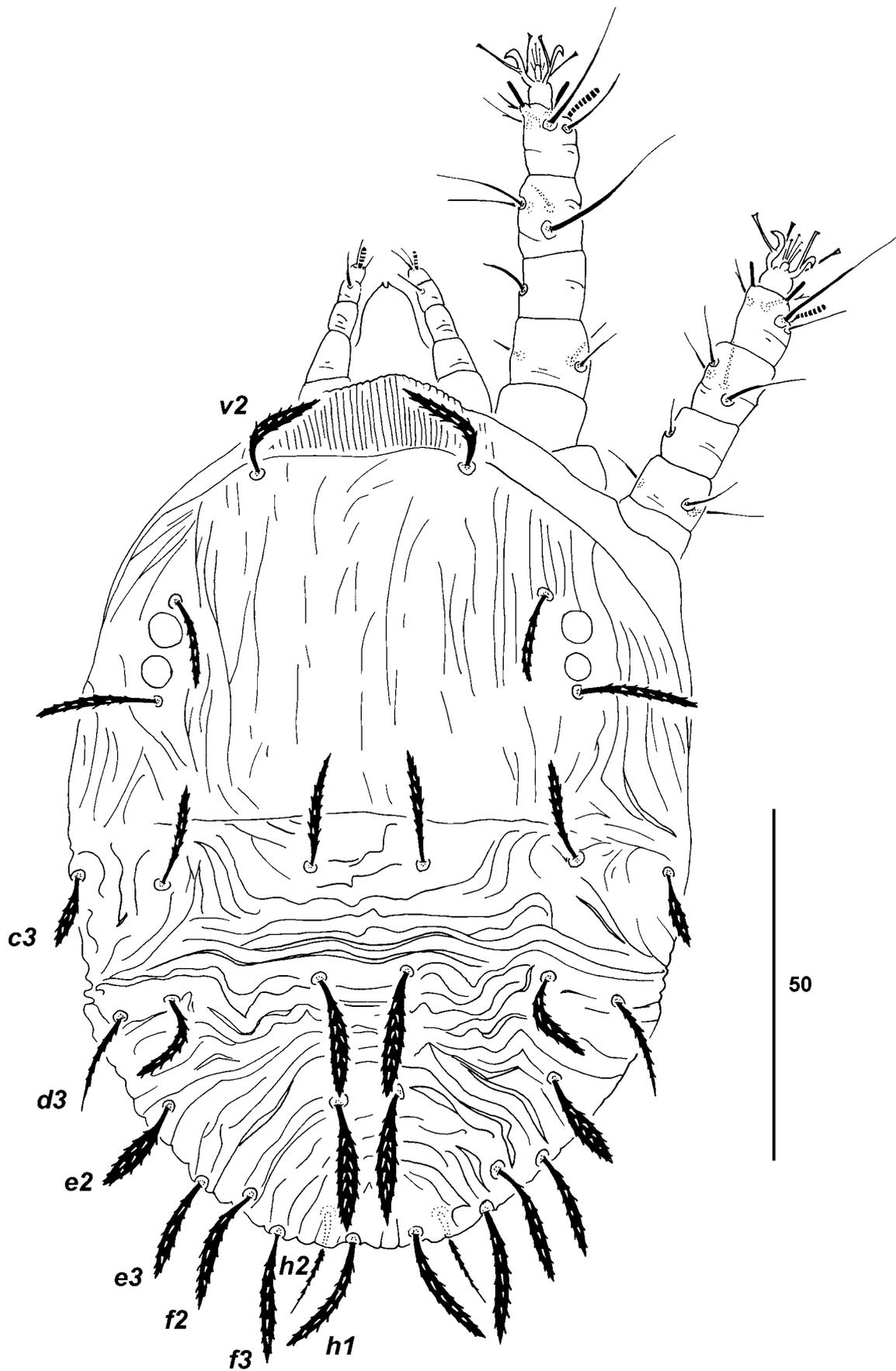


FIGURE 93. *Pentamerismus hicklingorum* Seeman and Beard, larva, dorsum with details of legs I–II and palps.



FIGURE 94. *Pentamerismus hicklingorum* Seeman and Beard, adult female, moulting in close association with deutonymphal and protonymphal skins.

Anterior margin of prodorsum without medial notch. Prodorsal shield absent, with longitudinal striations. Opisthosomal shield absent; coarse, irregular transverse striae, becoming oblique posteriorly. Setae similar in length to those of adult; setae narrowly lanceolate to thickened, barbed; setae *d1* and *e1* broadest; setae *h2* narrowest. Setal lengths: *v2* 14–18, *sc1* 12–15, *sc2* 14–16, *c1* 15–19, *c2* 15, *c3* 11–14, *d1* 20, *d2* 14–16, *d3* 13–16, *e1* 18–22, *e2* 14–17, *e3* 15–16, *f2* 15, *f3* 15–16, *h1* 14–16, *h2* 16–18. *Palps.* (Fig. 93) Palps similar to adult. Tibial seta 6–7 long; tarsal eupathidia both 5 long; solenidion 3 long. *Venter:* Cuticle with transverse striae to setae *3a*, longitudinal to anal area, slightly coarser around anal area. Anal setae *ps1–3* on weakly defined anal plates. Coxal setae fine. Setal lengths: *1a* 28–37, *1b* 13–19, *3a* 32–40, *ps1* 4–5, *ps2* 4–5, *ps3* 4–5. *Legs.* (Fig. 93) Setal formula for legs I–III (coxae to tarsi) 1-0-3-1-4-7(1), 0-0-3-1-4-7(1), 0-0-2-1-3-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (4–5 long). Leg setation as in protonymph except: seta *2b* absent; seta *3b* absent; tr I–III nude; ta I–III without seta *tc'*, *tc''*.

Etymology. It is with great pleasure that the manuscript's second author names this species for his mother's family, the Hicklings.

Remarks. *Pentamerismus hicklingorum* is similar to *P. wardo*, but can be separated by having one seta on the palp tibia (two setae on the palp tibia of *P. wardo*) and the dorsal cuticle having broadly rounded folds (weakly reticulate on *P. wardo*).

Individual adults were found in close association with their cast nymphal skins (Fig. 94), and often still within the deutonymphal and/or protonymphal skins.

Philippipalpus Corpuz-Raros, 1978

Type species. *Philippipalpus agohoi* Corpuz-Raros, 1978, by original designation.

Diagnosis. *All life stages:* dorsal opisthosoma with 10 pairs of lanceolate to weakly palmate setae; *c2*, *d2* and *f2* absent; setae *e2* in marginal position, aligned with *c3*, *d3*, *e3*, and *f3*; setae *h2* similar in size and form to other dorsal setae; palps 5-segmented, palp setal formula 0, 0, 0, 2, 3(1); immature stages with anterior margin of prodorsum smoothly rounded, without projections/notches; ventral plate absent; 3 pairs of pseudanal setae (*ps1–3*)

on weakly developed membranous anal plates. *Adult female*: gnathosoma usually completely concealed by prodorsum; anterior margin of prodorsum with deep medial notch, forming 1 pair of broad fleshy lobes each bearing setae *v2* (usually inserted beneath a fold); genital plate weakly developed, membranous; metapodal plates not developed; coxae I without *1c*; trochanters I–IV 0-0-1-0 (*v'* absent on tr I–IV; *l'* present on tr III); femora I–IV 3-3-2-1; genua 1-1-0-0 (*d* present on ge I–II); tibiae 4-4-2-2 (seta *d* absent ti III–IV); tarsi I–IV without *tc''*. Solenidia of male similar in thickness and length to those of female.

Remarks. Smiley *et al.* (1996) and Mesa *et al.* (2009) described the genus with setae *d2* present and *e2* absent; however we feel that *d2* is in fact absent and *e2* is present on the margin, as in most of the related tegopalpine genera (Beard *et al.* 2013).

Species of *Philippipalpus* are morphologically similar to species in the genera *Tegopalpus* and *Chaudhripalpus*, as all three genera have dorsal setae *c2* absent and three pairs of *ps* setae present (*ps1*–*3*). *Philippipalpus* can be separated from both these genera by the presence of dorsal setae *e2* (absent in both *Tegopalpus* and *Chaudhripalpus*). Species of *Philippipalpus* are separated here using subtle differences in ornamentation, striation and measurements, unlike the other genera of Tegopalpinae. We feel that because each new species of *Philippipalpus* presented here occupies a single host species, and no other species of flat mite in this subfamily inhabits more than one species of she-oak, it is evidence to support their separation at the species level. Nevertheless, we acknowledge further collecting from a greater geographical range is warranted to test the validity of these species.

Philippipalpus is unusual in lacking both setae *v'* on all trochanters (*l'* present on tr III) and *d* on tibiae III–IV.

***Philippipalpus agohoi* Corpuz-Raros, 1978**

(Figs 95–97)

Philippipalpus agohoi Corpuz-Raros, 1978: 220, fig. 5.

Philippipalpus agohoi Smiley *et al.* (1996): 172, figs 11–15.

Type material examined. 5 female paratypes ex. Coastal She-Oak (“Agoho”) *Casuarina equisetifolia* (Casuarinaceae), THE PHILIPPINES, Cagayan, Sta. Ana, 31 March 1977, coll. J.M. Sotto (USNM, 2 slides).

Diagnosis. Distance between setae *v2-h1* 300–310. Distance between *e2-e2* 130–140. Prodorsal shield with oblique depressions, covered with fine reticulate sculpturing. Cuticle between prodorsal and opisthosomal shields (sejugal region) strongly papillate-striate. Opisthosomal shield with 4–5 pairs of broad transverse depressions with finely reticulate cuticle within each depression sublaterally; 4–5 smooth ridges in sublateral cuticle associated with depressions; mesonotal region indistinctly separated from pygidial region. Lateral cuticle with > 100 strong papillae. Cuticle between *3a-4a* with mixed striae. Vesicle of spermatheca round, 2 x 2, with granulate appearance.

FEMALE (5 paratypes). *Dorsum*. (Fig. 95a) Body measurements: distance between setae *v2-h1* 300–310, *sc2-sc2* 115–125; other measurements: *v2-v2* 25–38, *sc1-sc1* 88–95, *c1-c1* 35–42, *c3-c3* 150–165, *d1-d1* 26–29, *d3-d3* 135–150, *e1-e1* 16–23, *e2-e2* 130–140, *e3-e3* 115–120, *f3-f3* 90–98, *h1-h1* 21–28, *h2-h2* 58–67. Gnathosoma completely concealed beneath the prodorsum. Anterior margin of the prodorsum with deep medial notch (internal depth 15–19), forming 1 pair of broad fleshy lobes; setae *v2* inserted beneath a fold on the lobes; anterior notch located within a weak depression (Fig. 95a). Prodorsal shield with fine reticulation of small cells; 4–5 pairs of oblique depressions and associated oblique ridges on lateral margin of shield medad setae *sc1*–*2*; laterad cuticle strongly papillate. Three pairs of tiny pores present sublaterally, in longitudinal row. Cuticle between prodorsal and opisthosomal shield (sejugal region) obviously papillate. Opisthosomal shield with smooth to folded and papillate sculpturing medially between *c1-e1*; 4–5 pairs of broad transverse depressions with finely reticulate cuticle within each depression sublaterally; 4–5 pairs of smooth transverse ridges in sublateral cuticle between the depressions; lateral cuticle strongly papillate; posterior cuticle between *e1-h1* finely striate to reticulate. Paired tiny pores between each of *c1-c3*, *d1-d3*, and 2 pairs sublateral to *e1*; 1 pair of large pores present medad *d3-e3* (total 5 pairs of pores visible). All dorsal setae barbed, thick, with triangular cross-section (except *e1*, *h1*). Setal lengths: *v2* 17–20, *sc1* 18–22, *sc2* 21–23, *c1* 19–24, *c3* 18–23, *d1* 13–18, *d3* 21–22, *e1* 12–15, *e2* 21–24, *e3* 21–24, *f3* 20–23, *h1* 14–16, *h2* 19–22. *Palps*. (Fig. 95b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 7–8 long, ventral 9–11 long; tarsal eupathidia 5–7 long, 7–8 long; solenidion 6–7 long. *Venter*. (Fig. 96a) Cuticle anterolaterad *1a* with granular appearance; cuticle between *1b-1a* with longitudinal striae; *1a-3a* with transverse striae; striae mixed

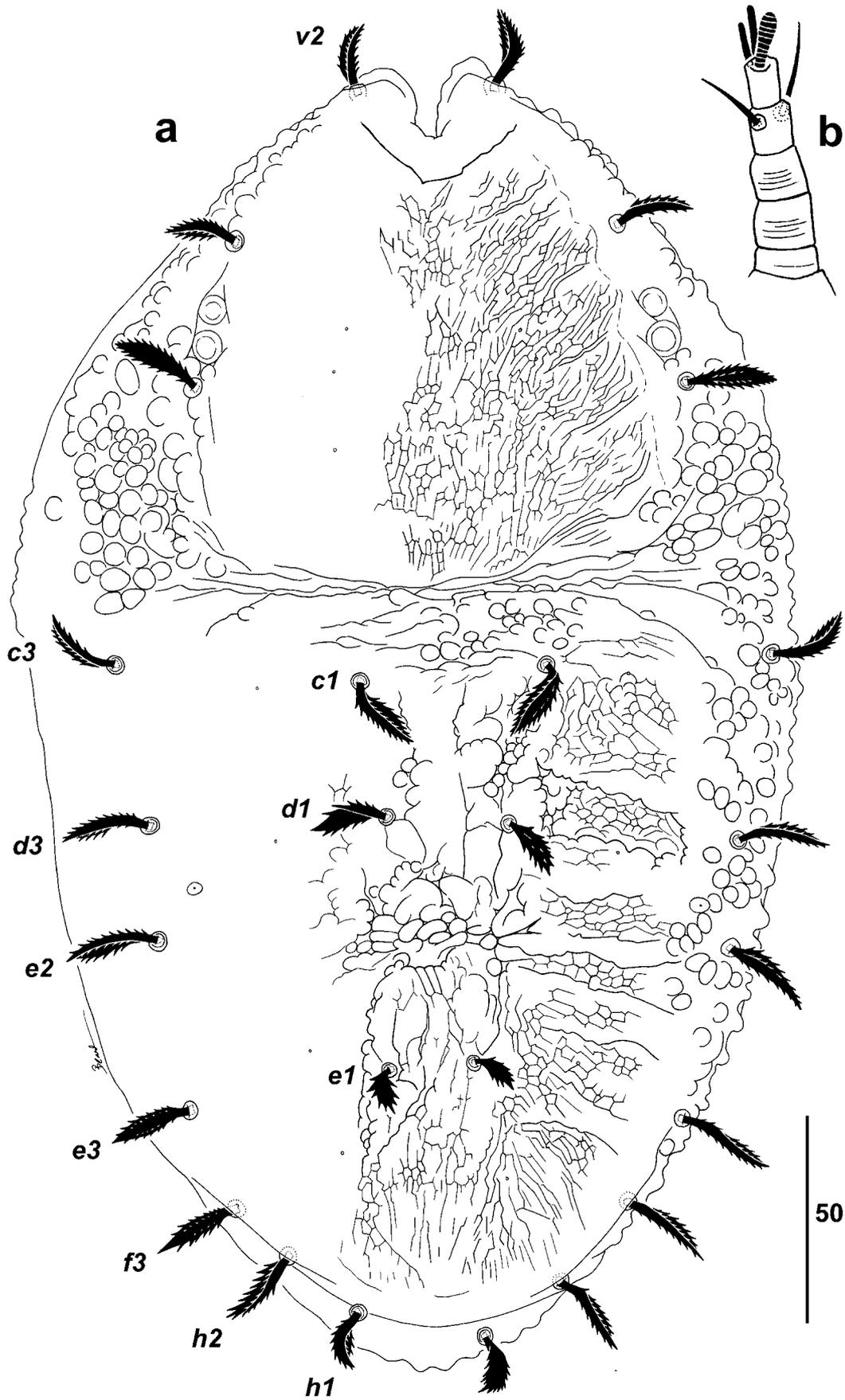


FIGURE 95. *Philippipalpus agohoi* Corpuz-Raros, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

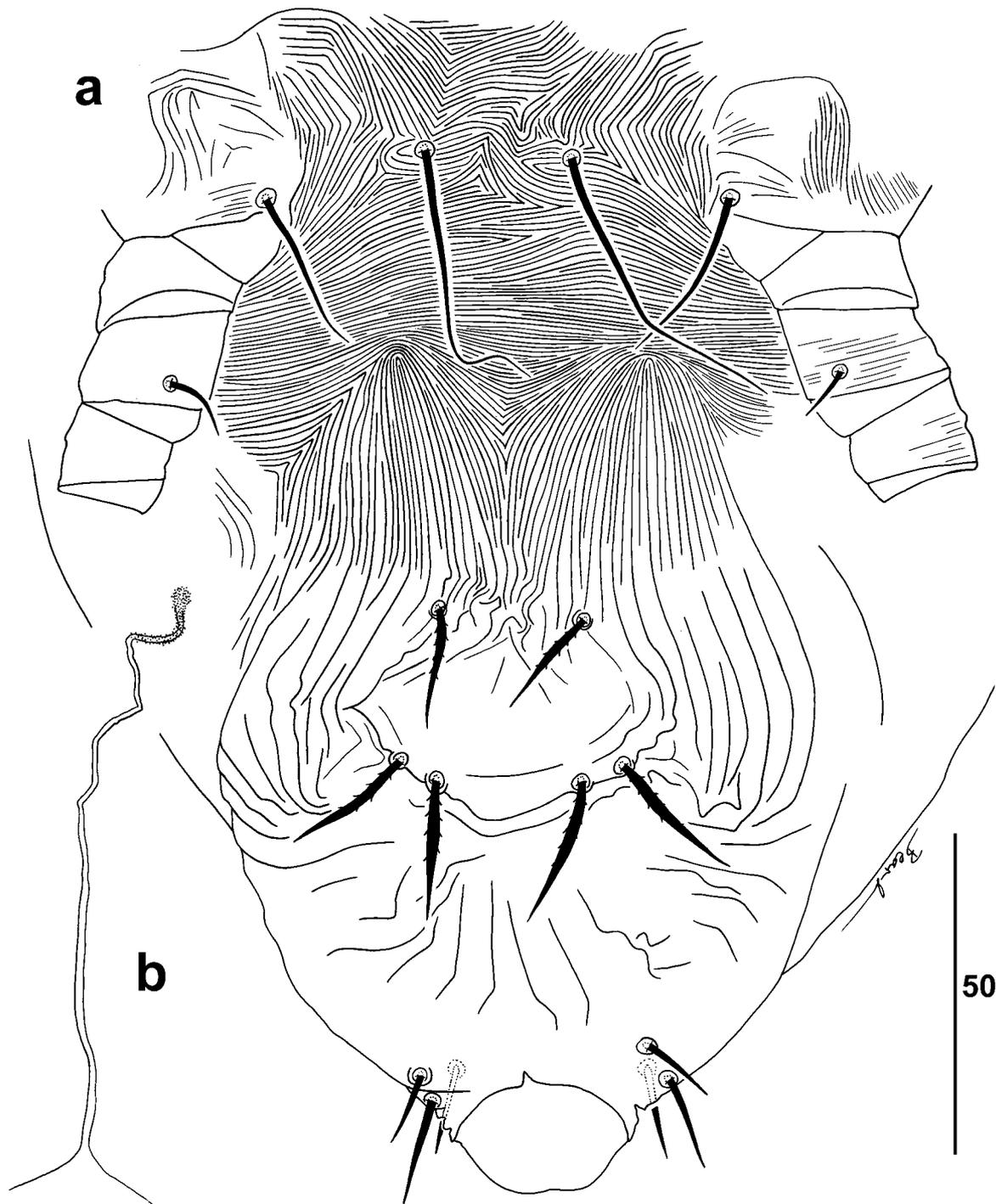


FIGURE 96. *Philippipalpus agohoi* Corpuz-Raros, adult female, a. posterior venter; b. spermatheca.

between *3a-3a*; *3a-4a* with transverse to wavy striae; *4a-4a* with mixed striae becoming transverse posterior to *4a*, then longitudinal around the genital region. Genital setae inserted in more-or-less transverse line along posterior margin of genital shield, setae *g1* inserted slightly posterior to *g2*. Genital shield membranous, weakly developed, smooth. All coxal setae fine. Setal lengths: *1a* 52–78, *1b* 20–28, *2b* 18–22, *2c* 21–23, *3a* 48–74, *3b* 22–31, *4a* 44–53, *4b* 26–29, *ag1* 15–19, *g1* 21–25, *g2* 18–21, *ps1* 14–17, *ps2* 13–17, *ps3* 9–12. *Spermatheca*. (Fig. 96b) Spermathecal tube long and narrow, 100–105 long, ending in a granular, membranous vesicle. Genital opening anteromedad anal setae *ps3*. *Legs*. (Fig. 97) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (10–11 long) and 2 eupathidia $p\zeta''$ - $p\zeta'''$ (7–8, 8–9 long). Leg setation as in Table 1 except: coxae I without *1c*; tr I–IV without *v'* (*l'* present on tr III); ge I–II with *d*, ge I–IV without *l'*, ge I–II without *l''*; ti III–IV without *d*; ta I–IV without *tc''*.

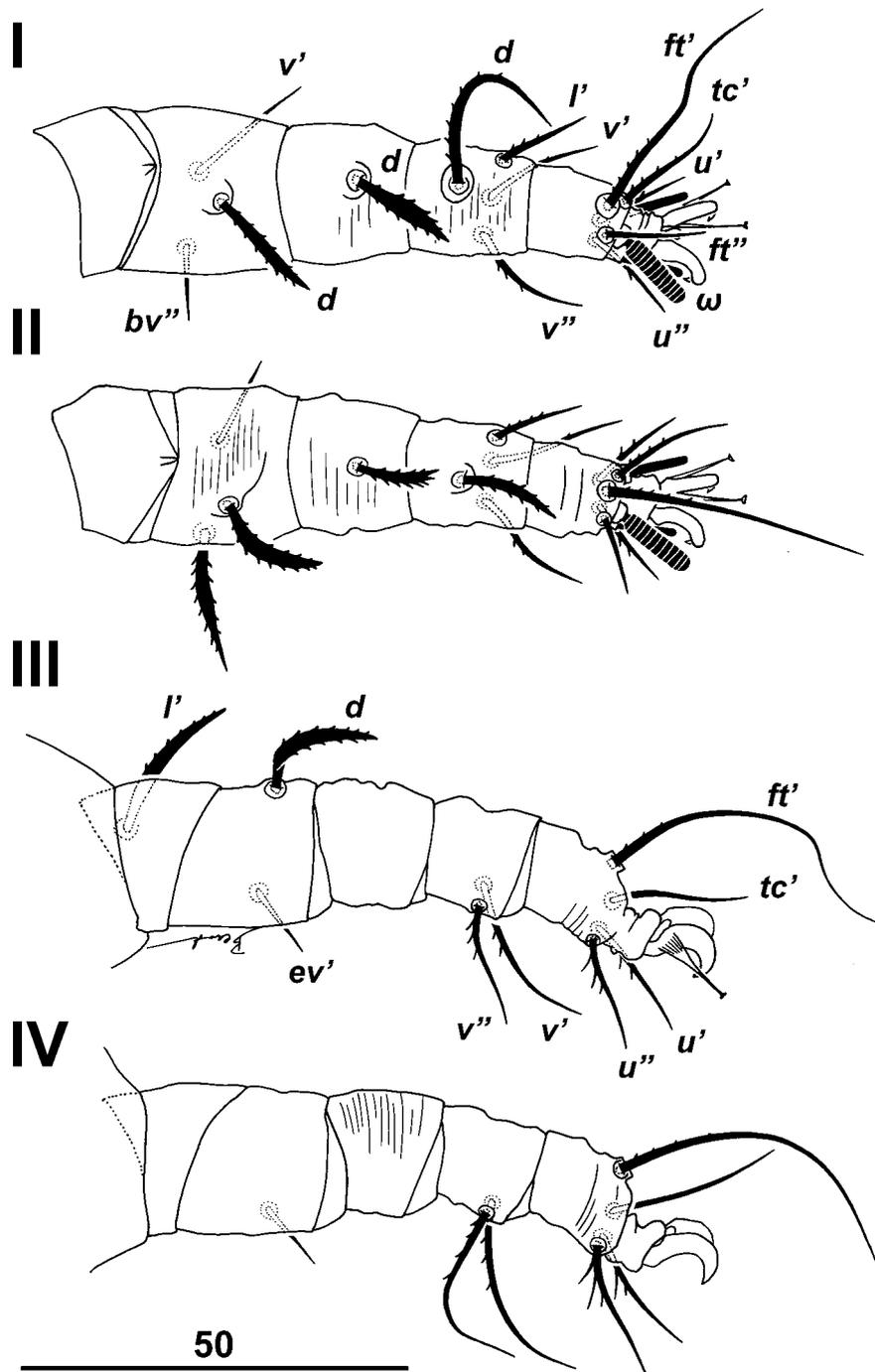


FIGURE 97. *Philippipalpus agohoi* Corpuz-Raros, adult female, legs (right side), eupathidia ($p\zeta'$ - $p\zeta''$) not labelled on leg I.

OTHER STAGES. Unknown.

Remarks. The redescription of Smiley *et al.* (1996) reported two setae on genu I, but there is only one dorsal seta present on this segment. Also, they reported the setal count on tarsi I–II as 6(1), but the count is actually 8(1). *Philippipalpus agohoi* and *P. flumaquercus* are similar in that they both have strongly papillate dorsolateral cuticle, and can be separated from *P. nigraquercus* and *P. belah* that both have smooth to weakly papillate dorsolateral cuticle. *Philippipalpus agohoi* can be separated from *P. flumaquercus* by having a finely reticulate prodorsum, while the latter has a coarsely rugose prodorsum.

The host genus, *Casuarina*, is the most widespread genus in the family, and *Ca. equisetifolia* is the most widely distributed species within the genus, with a littoral distribution ranging across tropical and subtropical coastlines of northern and northeastern Australia, Burma to Vietnam, Malesia, Melanesia and Polynesia (Johnson & Wilson 1989). This plant has also been introduced to the southern United States, West Africa and Madagascar

(Johnson & Wilson 1989). The wide present day distribution of *Ca. equisetifolia* is an example of the ability of Casuarinaceae species to achieve dispersal by wind and sea (and highly likely by humans) (Steane *et al.* 2003). In a phylogenetic study by Steane *et al.* (2003), two subspecies of *Ca. equisetifolia*, subsp. *equisetifolia* and subsp. *incana*, collected from Queensland, Australia, grouped with *Casuarina* species from the Indomalaysian region, rather than with other Australian endemic species. Such a grouping suggests that *Ca. equisetifolia* is either a relatively new species that came to Australia from Indomalaysia, or it evolved in Australia (from an ancestor shared with the other Indomalaysian taxa) and then dispersed to other regions (Steane *et al.* 2003). The origin of this species is of great interest in terms of the origin of *Ph. agohei* which is the only non-Australian species in the Tegopalpinae. Records of *Ca. equisetifolia* from India, the Mascarene Islands (near Madagascar) and other tropical areas are regarded as relatively recent deliberate or accidental introductions (Johnson & Wilson 1989).

***Philippalpus flumaquercus* Beard and Seeman sp. nov.**

(Figs 98–102)

Type material examined. Holotype female ex. River She-Oak *Casuarina cunninghamiana* (Casuarinaceae), AUSTRALIA: Queensland, nr Biggenden, 3 km ENE Didcot, Didcot Creek, 25°27'54''S 151°53'47''E, 29 August 2004, coll. J.J. Beard and P.I. Forster (QM). Paratypes. 6 females, 1 deutonymph, 1 protonymph, same data as holotype (QM, ANIC, USNM).

Diagnosis. Distance between setae *v2-h1* 330–340. Distance between *e2-e2* 115–125. Prodorsal shield laterally with coarse folded sculpturing, medially with coarse reticulate sculpturing; without depressions. Cuticle between prodorsal and opisthosomal shields (sejugal region) strongly papillate-striate. Opisthosomal shield with somewhat distinct paired mesonotal shields and pygidial shield; mesonotal region distinctly separated into 2 shields by smooth cuticle with a few coarse irregular longitudinal folds mesally; mesonotal and pygidial regions separated by smooth region with irregular transverse folds between *d1-e1*. Lateral cuticle with > 80 strong papillae. Cuticle between *3a-4a* entirely transverse to wavy. Vesicle of spermatheca round, 1.5 x 1.5, without grainy appearance.

FEMALE (n = 7). *Dorsum*. (Fig. 98a) Body measurements: distance between setae *v2-h1* 330–340 [330], *sc2-sc2* 105–115 [110]; other measurements: *v2-v2* 24–33 [33], *sc1-sc1* 83–90 [89], *c1-c1* 27–32 [32], *c3-c3* 140–145 [145], *d1-d1* 15–20 [18], *d2-d2* 130–135 [129], *d3-d3* 115–125 [120], *e1-e1* 13–19 [18], *e3-e3* 100–115 [105], *f3-f3* 79–90 [84], *h1-h1* 21–30 [26], *h2-h2* 49–65 [56]. Gnathosoma concealed beneath the prodorsum. Anterior margin of prodorsum with a deep medial notch (internal depth 21–26 [25]) forming 1 pair of broad fleshy lobes, each bearing *v2* (inserted ventrally). Prodorsal shield laterally with coarse folded sculpturing, medially with coarse reticulate sculpturing; without depressions. Opisthosomal shield with somewhat distinct paired mesonotal shields and pygidial shield; mesonotal region distinctly separated into 2 shields by smooth cuticle with few coarse irregular longitudinal folds mesally; mesonotal and pygidial regions separated by smooth region with irregular transverse folds between *d1-e1*. Surrounding cuticle almost completely papillate, papillae irregular. All dorsal shield setae short, barbed, with longitudinal barbed ridges, thick, triangular in cross-section; medial setae only slightly broader than lateral setae. Setal lengths: *v2* 15–20 [20], *sc1* 14–17 [15], *sc2* 18–20 [20], *c1* 17–21 [21], *c3* 17–19 [19], *d1* 13–17 [14], *d2* 16–20 [18], *d3* 16–18 [17], *e1* 10–12 [11], *e3* 16–18 [18], *f3* 14–20 [18], *h1* 11–14 [12], *h2* 15–18 [17]. *Palps*. (Fig. 98b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 6 [6] long, ventral 8–9 [8] long; tarsal eupathidia 4 [5], 5–6 [6] long; solenidion 5–6 [6] long. *Venter*. (Fig. 99a) Cuticle smooth, with transverse striae behind cx IV, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genital area. Striae broken in small area anteromedial to *1a*. Genital setae inserted in more-or-less transverse line along posterior margin of genital shield; setae *g1* inserted slightly posterior to *g2*. Genital shield smooth, weakly developed, membranous. All coxal setae fine. Setal lengths: *1a* 35–55 [35], *1b* 13–19 [14], *2b* 15–23 [18], *2c* 18–20 [20], *3a* 35–50 [50], *3b* 11–12 [12], *4a* 31–40 [31], *4b* 14–19 [15], *ag1* 10–14 [10], *g1* 17–23 [19], *g2* 16–20 [16], *ps1* 14–15 [15], *ps2* 12–18 [18], *ps3* 7–10 [10]. *Spermatheca*. (Fig. 99b) Spermathecal tube long and narrow, ca. 100–115 [110] long. Spermatheca vesicle small, rounded to bean-shaped (1.5 x 1.5), without accessory structures, without granular appearance. Genital opening anteromedial anal setae *ps3*. *Legs*. (Fig. 100) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (10–11 [10] long) and 2 eupathidia $p\zeta''-p\zeta'''$ (6–7 [6–7] long). Leg setation as in Table 1 except: coxae I without *1c*; tr I–IV without *v'* (*l'* present on tr III); ge I–II with *d*, ge I–III without *l'*, ge I–II without *v'*; tibiae III–IV without *d*; ta I–IV without *tc''*.

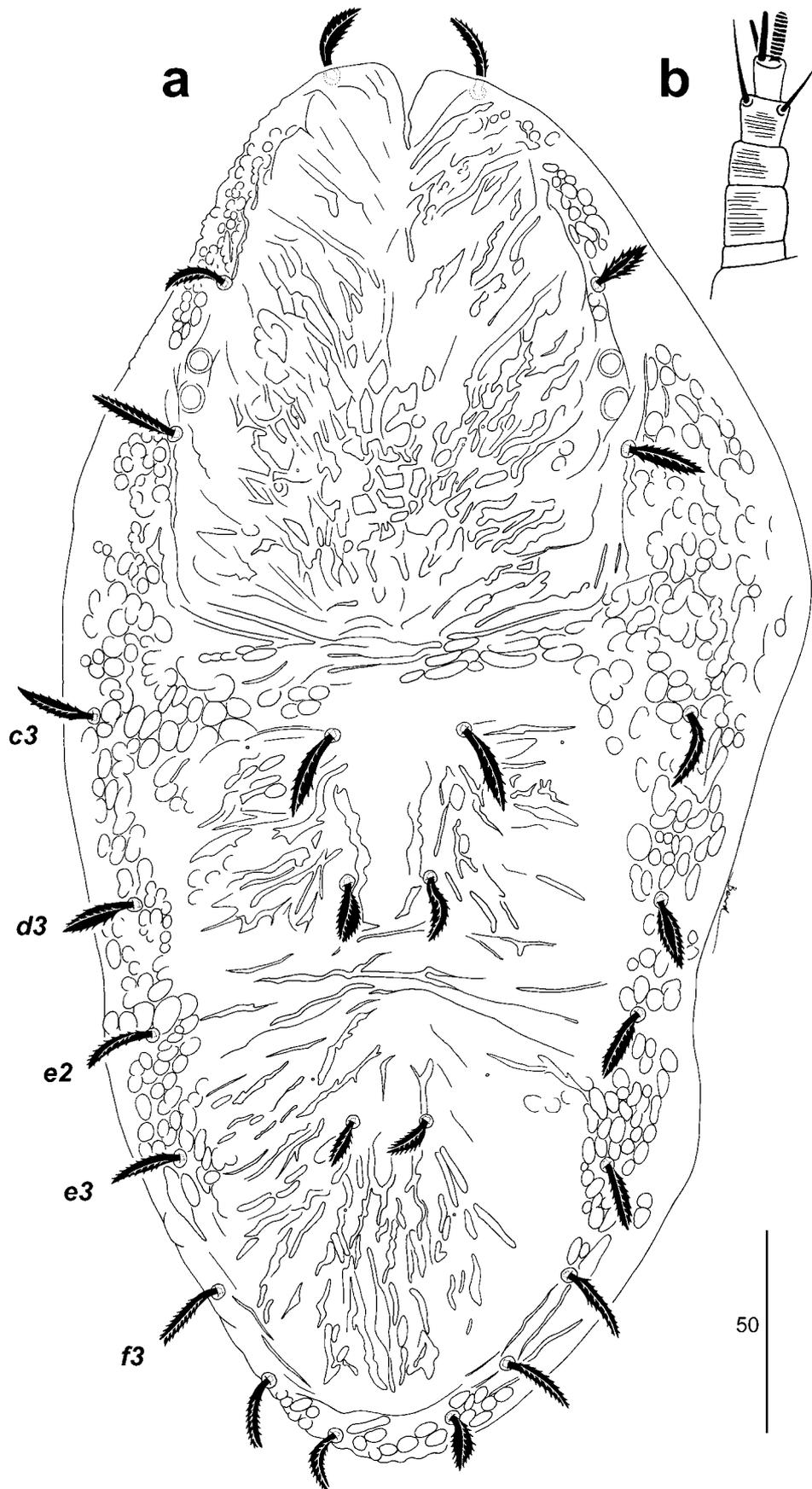


FIGURE 98. *Philippipalpus flumaquercus* Beard and Seeman, adult female, a. dorsum; b. detail of palp (scale bar for palp = 25 μm).

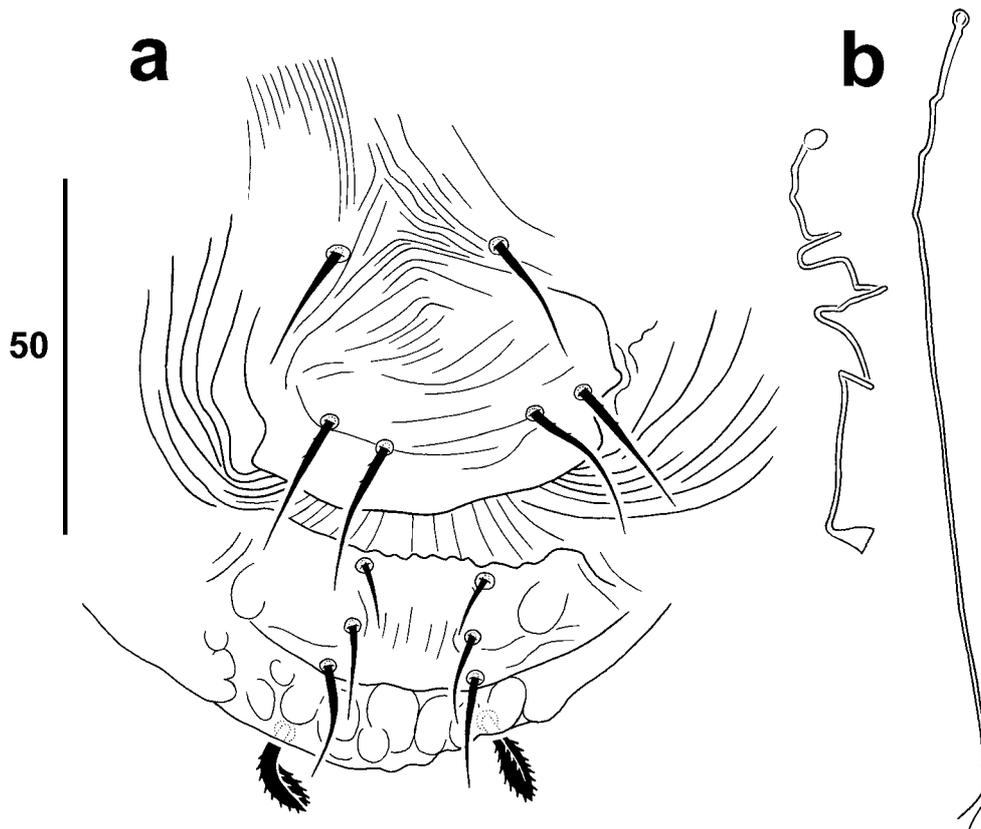


FIGURE 99. *Philippipalpus flumaquercus* Beard and Seeman, adult female, a. posterior venter; b. spermatheca.

MALE. Unknown.

DEUTONYMPH (n = 1). *Dorsum*. (Fig. 101) Body measurements: distance between setae *v2-h1* 285, *sc2-sc2* 92; other measurements: *v2-v2* 24, *sc1-sc1* 76, *c1* not expressed on left hand side, *c3-c3* 121, *d1-d1* 17, *d2-d2* 105, *d3-d3* 93, *e1-e1* 15, *e3-e3* 86, *f3-f3* 66, *h1-h1* 21, *h2-h2* 43. Anterior margin of prodorsum rounded, not incised medially; with small lobe between setae *v2* beneath margin of shield. Prodorsal shield weakly developed with weak wrinkled sculpturing in a longitudinal-oblique pattern. Opisthosomal shield appears absent, cuticle mostly folded transversely, becoming oblique-longitudinal posteriorly. Pore visible laterad *c1*. All dorsal shield setae short, barbed, with longitudinal barbed ridges, thick, triangular in cross-section. Setal lengths: *v2* 22, *sc1* broken, *sc2* 21, *c1* 15, *c3* 21, *d1* 16, *d2* 20, *d3* 19, *e1* 14, *e3* 19, *f3* 18, *h1* 13, *h2* 17. *Palps*. Palps similar to adult. Tibial setae, dorsal 4 long, ventral 5 long; tarsal eupathidia both 4 long; solenidion 4 long. *Venter*. (Fig. 102a) Cuticle mostly smooth, with transverse striae behind cx IV, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genital area. Striae broken in small area anteromedial to *1a*. All coxal setae fine. Setal lengths: *1a* 39, *1b* 8, *2b* 8, *2c* 17, *3a* 35, *3b* 8, *4a* 35, *4b* 9, *agl* 9, *gl* 14, *ps1* 12, *ps2* 8, *ps3* 7. *Legs*. (Fig. 102b) Setal formula for legs I–IV same as adult. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 6 long, ta II 5 long) and 2 eupathidia $p\zeta'-p\zeta''$ (4–5 long).

PROTONYMPH (n = 1). *Dorsum*. Body measurements: distance between setae *v2-h1* 235, *sc1-sc1* 74; other measurements: *v2-v2* 24, *sc2-sc2* 85, *c1-c1* 21, *c3-c3* 110, *d1-d1* 15, *d2-d2* 86, *d3-d3* 80, *e1-e1* 11, *e3-e3* 71, *f3-f3* 53, *h1-h1* 33, *h2-h2* 16. Anterior margin of prodorsum rounded, not incised medially, with small lobe between setae *v2*, beneath margin of shield. Prodorsal shield weakly developed with wrinkled-grooved sculpturing in a longitudinal-oblique pattern. Opisthosomal shield absent; cuticle with sparse transverse folds, becoming oblique-longitudinal posteriorly. All dorsal shield short, barbed, thick. Setal lengths: *v2* 22, *sc1* 14, *sc2* 17, *c1* 16, *c3* 16, *d1* 9, *d2* 16, *d3* 15, *e1* 9, *e3* 15, *f3* 16, *h1* 10, *h2* 15. *Palps*. Palps similar to adult. Tibial setae, dorsal 7 long, ventral 4 long; tarsal eupathidia both 4 long; solenidion 3 long. *Venter*. Cuticle smooth, with transverse striae behind cx IV, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genital-anal region. Striae broken in small area anteromedial to *1a*. All coxal setae fine. Setal lengths: *1a* 28, *1b* 10, *2c* 15, *3a* 20, *3b* 8, *agl* 7, *ps1* 4, *ps2* 4, *ps3* 4. *Legs*. (Fig. 102c) Setal formula (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-2-4, 0-

0-1-0-2-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 5, 4 long; ta II 5, 3 long). Leg setation as in Table 1 except: coxae I without $1c$; genua I–III without l' ; tibiae III–IV without d ; tarsi I–III without tc'' . Setae l' added to tr III.

LARVA. Unknown.

Etymology. The specific name derives from the latinisation of the common name “River Oak”.

Remarks. Females of *Ph. flumaquercus* have slightly smaller features than female *Ph. agohoi*, even though the body size is greater (328–340 versus 300–310 for *v2-h1*). In addition, *P. flumaquercus* can be separated from *P. agohoi* by having a coarsely rugose prodorsum, while the latter has a finely reticulate prodorsum.

These mites were collected from the needle-like stems of the host plant, which was growing in woodland with *Corymbia tessellaris* and *Eucalyptus tereticornis*, both Myrtaceae, on sandy alluvium.

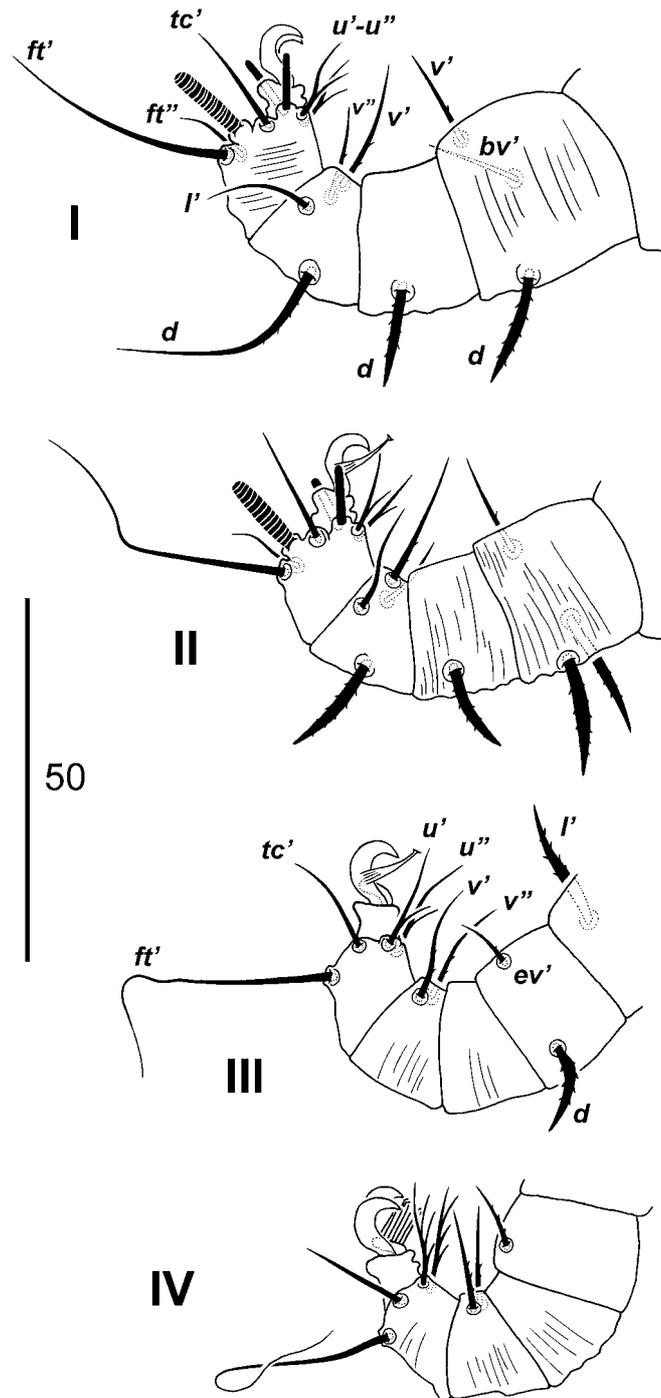


FIGURE 100. *Philippipalpus flumaquercus* Beard and Seeman, adult female, legs (left side); solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

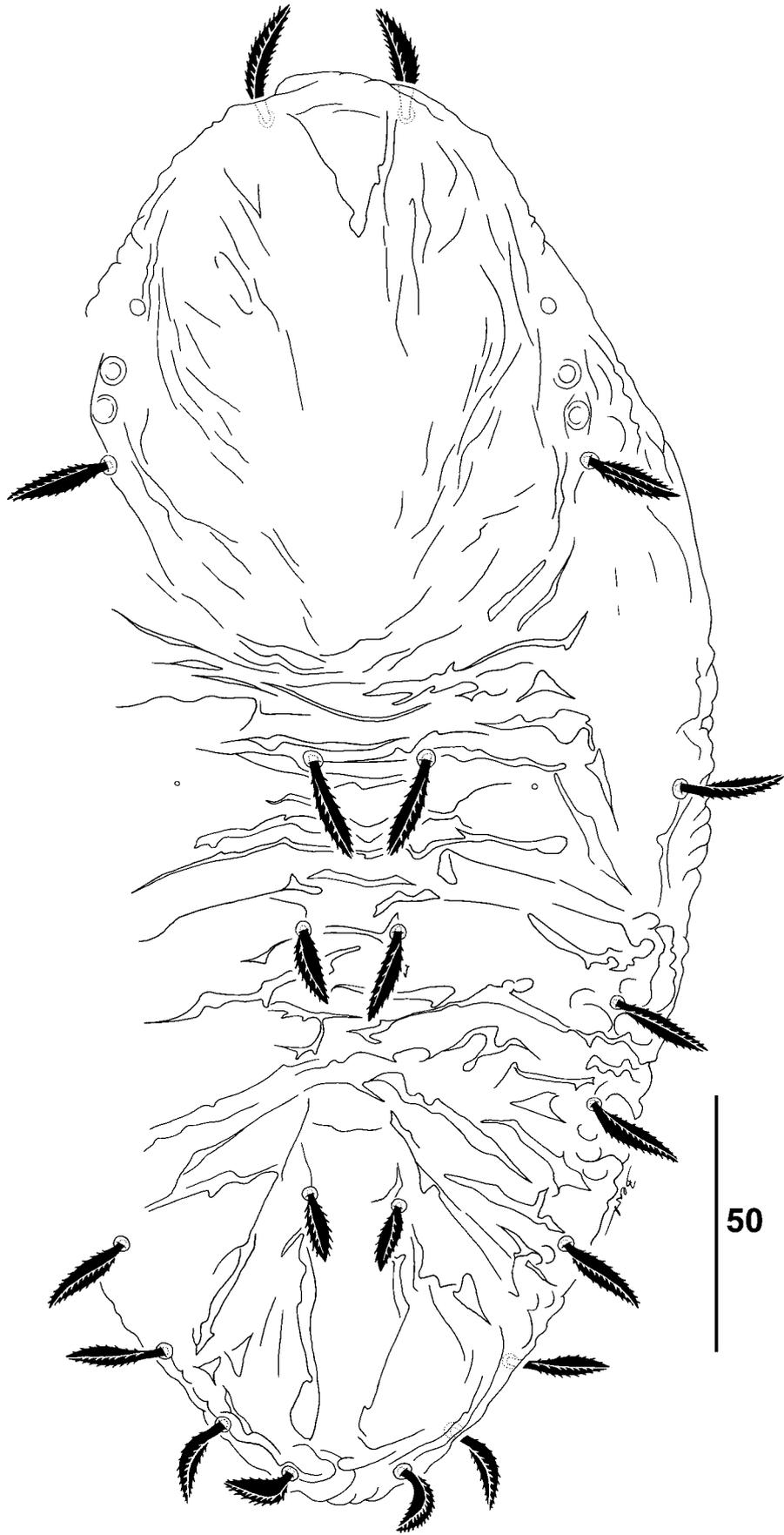


FIGURE 101. *Philippipalpus flumaquercus* Beard and Seeman, deutonymph, dorsum.



FIGURE 102. *Philippipalpus flumaquercus* Beard and Seeman, immatures, a. deutonymph posterior venter; b. deutonymph tarsus I (left side); c. protonymph tarsus I (right side). Solenidion ω'' and eupathidia ($p\zeta''-p\zeta'''$) not labelled on b. and c.

***Philippipalpus belah* Beard and Seeman sp. nov.**

(Figs 103–104)

Type material examined. Holotype female ex. *Belah Casuarina cristata* (Casuarinaceae). **AUSTRALIA:** New South Wales, Newell Highway, approx. 15 km N Moree, 86 km S Goondiwindi, 29°21'20"S 150°00'24"E, 21 August.2007, coll. J.J. Beard (QM). Paratypes. 2 females, same data as holotype (QM).

Diagnosis. Distance between setae $v2-h1$ 305–315. Distance between $e2-e2$ 115–120. Prodorsal shield laterally with irregular weak folded sculpturing in a longitudinal-oblique pattern, medially with weak folded to reticulate sculpturing; without depressions. Cuticle between prodorsal and opisthosomal shields (sejugal region) weakly striate. Opisthosomal shield with indistinct paired mesonotal regions and pygidial region; mesonotal regions indistinctly separated from each other by irregular folded cuticle; mesonotal and pygidial region not noticeably demarcated. Lateral cuticle with < 40 weak papillae primarily lateral to opisthosomal shield; cuticle lateral to prodorsal shield mostly smooth. Cuticle between $3a-4a$ entirely transverse. Spermatheca round, 2 x 2, without grainy appearance.

FEMALE (n = 3). *Dorsum.* (Fig. 103a) Body measurements: distance between setae $v2-h1$ 307–315 [315], $sc2-sc2$ 105–105 [105]; other measurements: $v2-v2$ 27–30 [29], $sc1-sc1$ 80–82 [82], $c1-c1$ 28–32 [31], $c3-c3$ 135–140 [140], $d1-d1$ 17–19 [18], $d3-d3$ 125–130 [125], $e1-e1$ 17–20 [18], $e2-e2$ 115–120 [115], $e3-e3$ 100–105 [100], $f3-f3$ 80–82 [82], $h1-h1$ 20–26 [26], $h2-h2$ 51–55 [55]. Gnathosoma concealed beneath the prodorsum. Anterior margin of prodorsum with a deep medial notch (internal depth 21–23 [23]) forming 1 pair of broad fleshy lobes, each bearing $v2$ (inserted dorsally). Prodorsal shield laterally with irregular weak folded sculpturing in a longitudinal-oblique pattern, medially with weak folded to reticulate sculpturing; without depressions. Cuticle between prodorsal and opisthosomal shields (sejugal region) weakly striate. Opisthosomal shield with indistinct paired mesonotal regions and pygidial region; mesonotal regions indistinctly separated from each other by irregular folded cuticle; mesonotal and pygidial region not noticeably demarcated; pair of strong longitudinal folds laterad $d1-d1$; irregular transverse folds between $d1-e1$; longitudinal folds to weak reticulation between $e1-h1$. Lateral cuticle with < 40 weak papillae primarily lateral to opisthosomal shield; cuticle lateral to prodorsal shield mostly smooth. All dorsal shield setae short, barbed, with longitudinal barbed ridges, thick, triangular in cross-section; medial setae only slightly broader than lateral setae: $v2$ 15 [15], $sc1$ 14 [14], $sc2$ 17–18 [18], $c1$ 17–19 [19], $c3$ 15–16 [16], $d1$ 15–16 [15], $d3$ 16–17 [17], $e1$ 13–14 [13], $e2$ 15–17 [16], $e3$ 15–17 [15], $f3$ 16–19 [17], $h1$ 12–14



FIGURE 103. *Philippipalpus belah* Beard and Seeman, adult female, a. dorsum, with details of legs I–II; b. detail of palp (scale bar for palp = 25 μ m); solenidion ω'' and eupathidia ($p\zeta'-p\zeta''$) not labelled on leg I.

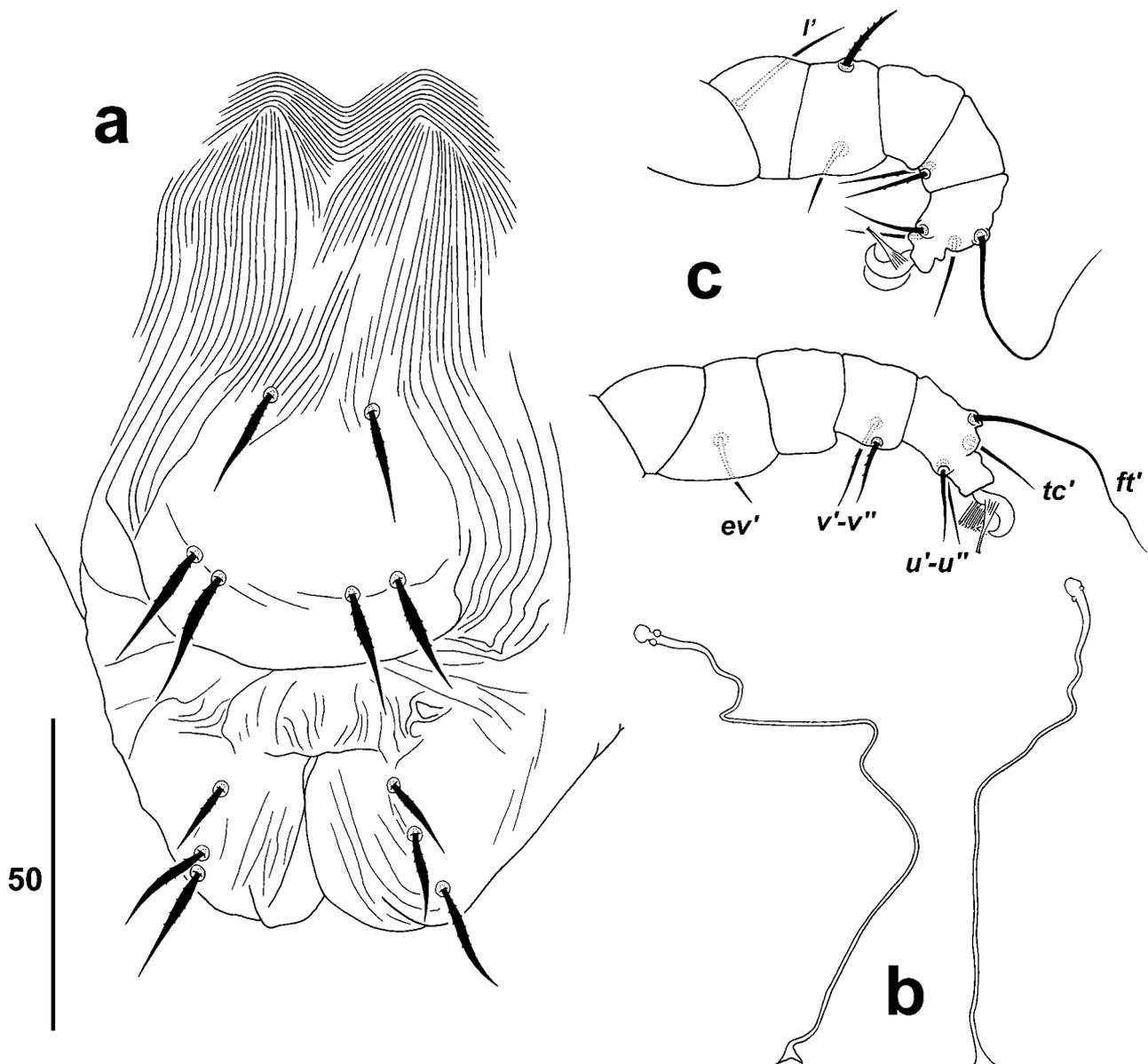


FIGURE 104. *Philippipalpus belah* Beard and Seeman, adult female, a. posterior venter; b. spermatheca; c. legs III–IV (right side).

[13], *h2* 16–18 [18]. *Palps.* (Fig. 103b) Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 6–7 [6] long, ventral 8–10 [10] long; tarsal eupathidia 5 [5], 5–7 [6] long; solenidion 6 [6] long. *Venter.* (Fig. 104a) Cuticle anterolaterad *1a* with granular appearance; *1b-1a* with longitudinal striae; *1a-4a* with transverse striae; cuticle posterior to cx IV transverse, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genital area. Genital setae inserted in more-or-less transverse row along posterior margin of genital shield, setae *g1* inserted slightly posterior to *g2*. Genital shield smooth, weakly developed, membranous. All coxal setae fine. Setal lengths: *1a* 34–44 [44], *1b* 17–18 [17], *2b* 12–13 [13], *2c* 16–18 [16], *3a* 40–48 [48], *3b* 16 [16], *4a* 29–38 [29], *4b* 13–16 [16], *ag1* 15 [15], *g1* 17–19 [19], *g2* 16–18 [18], *ps1* 14–16 [16], *ps2* 15–17 [15], *ps3* 13–14 [14]. *Spermatheca.* (Fig. 104b) Spermathecal tube long and narrow, 95–110 [95] long, ending in small rounded membranous vesicle (2 x 2), subtended by 1 pair of minute circular accessory structures. Genital opening anteromedad anal setae *ps3*. *Legs.* (Figs 103a, 104c) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (9–10 [9] long) and 2 eupathidia $p\zeta''-p\zeta'''$ (ta I 7–8 [7] long; ta II 6 [6] long). Leg setation as in Table 1 except: cx I without *1c*; tr I–IV without *v'* (*l'* present on tr III); ge I–III without *l'*, ge I–II without *v'*; ti III–IV without *d*; ta I–IV without *tc''*.

OTHER STAGES. Unknown.

Etymology. The specific name refers to the common name of the host “Belah”.

Remarks. *Philippipalpus belah* lacks the extensive papillation on the soft cuticle around both dorsal shields that is present in *Philippipalpus agohoi* and *Ph. flumaquercus*. *Philippipalpus belah* females have smoother cuticle lateral to the opisthosomal shields, and more medial wrinkles and folds between setae *c1-h1* than do females of *Ph. nigraquercus*. This species was found in association with *Pentamerismus sititoris* and *Chaudhripalpus costacola*.

***Philippipalpus nigraquercus* Seeman and Beard sp. nov.**

(Figs 105–106)

Type material examined. Holotype female ex. Black She-Oak *Allocasuarina littoralis* (Casuarinaceae), AUSTRALIA: Australian Capital Territory, Symonston, Canberra, Mugga Lane, 35°23'05"S 149°08'10"E, 25 February 2009, coll. J.J. Beard. Paratypes. 3 females, 1 male, 4 deutonymphs, 4 protonymphs, same data as holotype (QM).

Non-type material examined. 1 female ex. *Allocasuarina littoralis*, AUSTRALIA: Australian Capital Territory, Canberra, Gordon, Murrumbidgee River, Point Hut Crossing, 35°27'04"S 149°04'31"E, 27 January 2009, coll. J.J. Beard (QM).

Diagnosis. Distance between setae *v2-h1* 330–350. Distance between *e2-e2* 135–145. Prodorsal shield with coarse irregular oblique folds and narrow depressions sublaterally; medially with weaker folded to weakly reticulate sculpturing. Cuticle between prodorsal and opisthosomal shields (sejugal region) weakly striate-reticulate. Opisthosomal shield with distinct paired mesonotal regions and pygidial region; mesonotal regions separated from each other by smooth cuticle; mesonotal and pygidial region separated by band of somewhat smooth cuticle with weak irregular transverse striae; with distinct longitudinal band of smooth cuticle between *c1-h1*, cuticle finely punctate. Lateral cuticle with 20–40 weak papillae. Cuticle between *3a-4a* with mixed striae. Spermatheca elongate, 2 x 1, with grainy appearance.

FEMALE (n = 5). *Dorsum*. (Fig. 105) Body measurements: distance between setae *v2-h1* 330–350 [345], *sc2-sc2* 110–115 [115]; other measurements: *v2-v2* 26–32 [32], *sc1-sc1* 84–87 [84], *c1-c1* 29–31 [29], *c3-c3* 150–160 [150], *d1-d1* 18–20 [18], *d3-d3* 125–130 [130], *e1-e1* 13–18 [18], *e2-e2* 135–145 [145], *e3-e3* 110–120 [120], *f3-f3* 84–93 [93], *h1-h1* 28–32 [32], *h2-h2* 60–71 [71]. Gnathosoma concealed by prodorsum. Anterior margin of prodorsum with deep medial notch (internal depth 20–22 [20]) forming 1 pair of broad fleshy lobes, each bearing setae *v2*. Prodorsal shield with coarse irregular oblique folds and weak narrow depressions sublaterally; medially with weaker folded to weakly reticulate sculpturing and region of smooth cuticle with fine punctations. Cuticle between prodorsal and opisthosomal shields (sejugal region) weakly striate-reticulate. Opisthosomal shield with distinct paired mesonotal regions and pygidial region; mesonotal regions separated from each other by smooth cuticle; mesonotal and pygidial region separated by band of somewhat smooth cuticle with weak irregular transverse striae; with distinct longitudinal band of smooth cuticle between *c1-h1*, cuticle finely punctate. Lateral soft cuticle mostly smooth, with 20–40 weak papillae. All dorsal shield short, thick, barbed, with longitudinal barbed ridges, triangular in cross-section (except *e1*). Setal lengths: *v2* 16–19 [19], *sc1* 14–15 [15], *sc2* 19–21 [21], *c1* 17–20 [17], *c3* 17–19 [17], *d1* 15–19 [19], *d3* 19–21 [21], *e1* 9–12 [12], *e2* 18–21 [19], *e3* 17–18 [18], *f3* 18–20 [20], *h1* 12–14 [14], *h2* 17–19 [19]. *Palps*. Setal formula 0, 0, 0, 2, 3(1s+2e). Tibial setae, dorsal 7–8 [8] long, ventral 10–12 [12] long; tarsal eupathidia, thin 5 [5] long, thick 6–7 [7] long; solenidion 6 [6] long. *Venter*. Cuticle anterolaterad *1a* with granular appearance; cuticle between *1b-1a* with longitudinal striae; *1a-3a* with transverse striae; striae mixed between *3a-3a*; cuticle between *3a-4a* with transverse to wavy striae; *4a-4a* with mixed striae becoming transverse posterior to *4a*; *4a* to genital region with longitudinal striae. Genital setae inserted in more-or-less transverse row along posterior margin of genital shield, setae *g1* inserted slightly posterior to *g2*. Genital shield smooth, weakly developed, membranous. All coxal setae fine. Setal lengths: *1a* 38–58 [38], *1b* 20–23 [20], *2b* 16–18 [16], *2c* 17–20 [17], *3a* 35–57 [35], *3b* 9–16 [9], *4a* 26–35 [35], *4b* 13–14 [13], *agl* 15–18 [18], *g1* 22–23 [23], *g2* 22–23 [23], *ps1* 10–11 [11], *ps2* 16 [16], *ps3* 16–18 [17]. *Spermatheca*. Spermathecal tube long and narrow, 95–110 [95] long. Spermatheca vesicle small (2 x 2 µm), rounded, subtended by 1 pair of circular accessory structures. Genital opening anteromedial anal setae *ps3*. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-1-4-8(1), 2-0-3-1-4-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (9–11 [10] long) and 2 eupathidia *pζ'-pζ''* (6–7 [6] long). Leg setation as in Table 1 except: coxae I without *1c*; tr I–IV without *v'* (*l'* present on tr III); ge I–III without *l'*, ge I–II without *v'*; ti III–IV without *d*; ta I–IV without *te''*.



FIGURE 105. *Philippipalpus nigraquercus* Seeman and Beard, adult female dorsum.

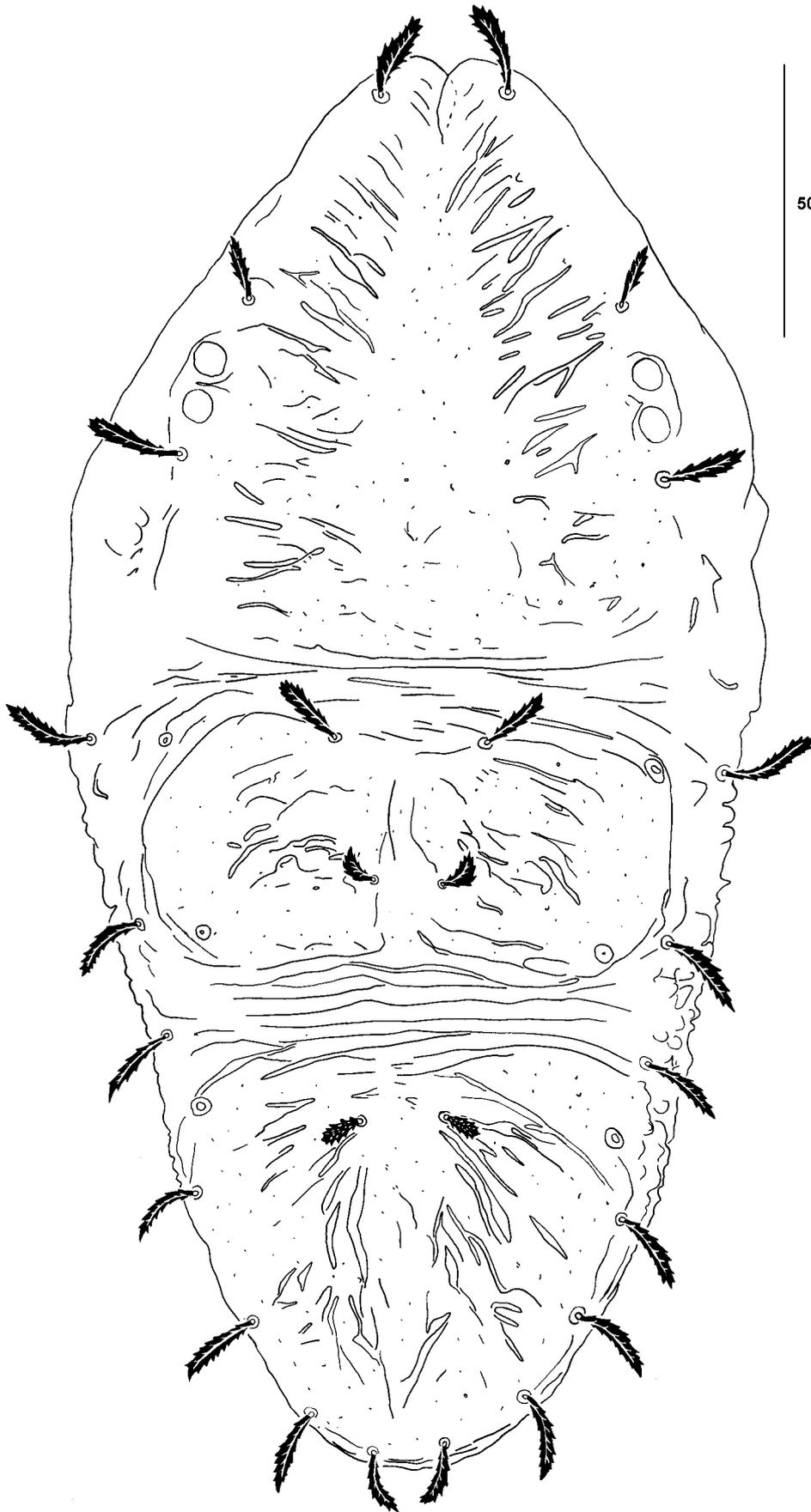


FIGURE 106. *Philippipalpus nigraquercus* Seeman and Beard, adult male dorsum.

MALE (n = 1). *Dorsum*. (Fig. 106) Body measurements: distance between setae *v2-h1* 245, *sc2-sc2* 86; other measurements: *v2-v2* 20, *sc1-sc1* 65, *c1-c1* 25, *c3-c3* 113, *d1-d1* 11, *d2-d2* 94, *d3-d3* 85, *e1-e1* 13, *e3-e3* 76, *f3-f3* 58, *h1-h1* 10, *h2-h2* 36. Gnathosoma concealed beneath prodorsum. Anterior margin of prodorsum with deep medial notch (internal depth 20) forming 1 pair of broad fleshy lobes, each bearing setae *v2*. Prodorsal shield with wrinkled oblique ridge-like sculpturing sublaterally; medial cuticle mostly smooth with minute punctations. Opisthosoma with well developed mesonotal and pygidial shields; cuticle on shields with wrinkled or folded sculpturing and fine punctations. Three pairs of large pores visible, 1 pair each medad *c3*, medad *d3*, between *e2-e3*. Cuticle between shields with strong widely separated folds. Lateral soft cuticle mostly smooth, with some papillae laterad setae *d3-e3*. All dorsal shield short, lanceolate, barbed, with longitudinal barbed ridges; medial setae broader than lateral setae: *v2* 16, *sc1* 15, *sc2* 16, *c1* 14, *c3* 17, *d1* 10, *d2* 14, *d3* 17, *e1* 9, *e3* 15, *f3* 17, *h1* 11, *h2* 17. *Palps*. Palps similar to female. Tibial setae, dorsal 6 long, ventral 7 long; tarsal eupathidia both 6 long; solenidion 5 long. *Venter*. Cuticle between *1a-1a* with longitudinal striae, all remaining striae transverse, becoming coarse on opisthosoma. Coxal setae fine, except *2c* slightly thicker than other setae. Setae *agl*, *g1*, *g2*, *ps2*, *ps3* slightly thickened, with few barbs; setae *ps1* modified to form thick blades (sexually dimorphic). Setal lengths: *1a* 50, *1b* 17, *2b* 15, *2c* 15, *3a* 26, *3b* 13, *4a* 35, *4b* 11, *agl* 13, *g1* 12, *g2* 13, *ps1* 16, *ps2* 4, *ps3* 4. *Aedeagus*. Narrow, sclerotised, tapering; straight for 35, then curved for 33, apically bent and fine for ca. 40. Membranous duct runs from inside aedeagus, becoming indistinguishable. *Legs*. Setal formula same as female. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 13 long, ta II 12 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 8 long; ta II 7 long). Solenidia slightly thicker and longer than in female.

DEUTONYMPH (n = 4). *Dorsum*. Body measurements: distance between setae *v2-h1* 240–290, *sc2-sc2* 83–98; other measurements: *v2-v2* 22–27, *sc1-sc1* 69–80, *c1-c1* 22–28, *c3-c3* 110–133, *d1-d1* 14–18, *d2-d2* 88–110 (1 specimen with 2 setae in *d2* position on left hand side only), *d3-d3* 85–110, *e1-e1* 13–14, *e3-e3* 73–90, *f3-f3* 58–69, *h1-h1* 17–24, *h2-h2* 27–48. Anterior margins of prodorsum rounded, not incised medially. Prodorsal shield weakly developed with few wrinkles or folds. Opisthosomal shields not developed, cuticle mostly folded transversely, becoming oblique-longitudinal posteriorly. All dorsal setae short, lanceolate, barbed, with longitudinal barbed ridges. Setal lengths: *v2* 18–22, *sc1* 69–80, *sc2* 16–21, *c1* 17–21, *c3* 20–22, *d1* 11–18, *d2* 18–21, *d3* 18–20, *e1* 9–13, *e3* 17–21, *f3* 17–20, *h1* 11–17, *h2* 18–20. *Palps*. Palps similar to adult. Tibial setae, dorsal 7 long, 4–5 long; tarsal eupathidia 5, 3 long; solenidion 3 long. *Venter*. Cuticle smooth, with transverse striae behind cx IV, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genital area. Striae broken in small area anteromedial to *1a*. All coxal setae fine. Setal lengths: *1a* 35–40, *1b* 10–16, *2b* 11–13, *2c* 17–20, *3a* 29–30, *3b* 9–12, *4a* 26–30, *4b* 8–12, *agl* 8–11, *g1* 13–15, *ps1* 9–10, *ps2* 7–9, *ps3* 6–7. *Legs*. Setal formula for legs I–IV same as adult. Tarsi I and II each with 1 antiaxial solenidion ω'' (4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (5, 4 long).

PROTONYMPH (n = 4). *Dorsum*. Body measurements: distance between setae *v2-h1* 180–205, *sc1-sc1* 65–66; other measurements: *v2-v2* 16–22, *sc2-sc2* 73–78, *c1-c1* 18–22, *c3-c3* 95–105, *d1-d1* 13–15, *d2-d2* 74–79, *d3-d3* 67–74, *e1-e1* 6–8, *e3-e3* 58–70, *f3-f3* 45–50, *h1-h1* 10–14, *h2-h2* 28–32. Prodorsal shield weakly developed with few wrinkles or folds. Opisthosomal shields absent; cuticle with sparse wrinkles or folds and coarse striae. All dorsal shield short, lanceolate, barbed. Setal lengths: *v2* 17–18, *sc1* 14–16, *sc2* 17–19, *c1* 15–18, *c3* 15–18, *d1* 14–16, *d2* 17, *d3* 18–20, *e1* 9–10, *e3* 15–17, *f3* 15–17, *h1* 11–14, *h2* 13–17. *Palps*. Palps similar to adult. Tibial setae, dorsal 6 long, ventral 4 long; tarsal eupathidia 4, 3 long; solenidion 3 long. *Venter*. Cuticle smooth, with transverse striae behind cx IV, abruptly becoming longitudinal to genital area; fine striae become coarse lateral to genitoanal region. Striae broken in small area anteromedial to *1a*. All coxal setae fine. Setal lengths: *1a* 30, *1b* 11–12, *2c* 12–15, *3a* 20–25, *3b* 8, *agl* 6, *ps1* 4–5, *ps2* 3–5, *ps3* 3–5. *Legs*. Setal formula (coxae to tarsi) 1-0-3-0-4-8(1), 1-0-3-0-4-8(1), 1-1-2-0-2-4, 0-0-1-0-2-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3 long) and 2 eupathidia $p\zeta'-p\zeta''$ (ta I 4 long; ta II 4, 3 long). Leg setation as in Table 1 except: cx I without *1c*; ge I–III without *l'*; ti III–IV without *d*; ta I–III without *te''*.

LARVA. Unknown.

Etymology. The specific name derives from the latinisation of the common name of the host “Black Oak”.

Remarks. *Philippipalpus nigraquercus* lacks the extensive papillation of soft cuticle around both dorsal shields that is present in *Philippipalpus agohei* and *Ph. flumaquercus*. *Philippipalpus nigraquercus* females have more papillate cuticle lateral to the opisthosomal shields, smoother cuticle between setae *c1-h1* than do females of *Ph. belah*. Regarding the latter difference, female of *Ph. nigraquercus* have a medial longitudinal band of smooth

cuticle between *c1-h1*, whereas the cuticle in this region on *Ph. belah* is wrinkled and folded similar to the lateral opisthosoma.

***Tegopalpus* Womersley, 1940**

Type species. *Tegopalpus conicus* Womersley, 1940, by monotypy.

Diagnosis. *All life stages:* dorsal opisthosoma with 9 pairs of short broadly lanceolate setae; *c2*, *d2*, *e2* and *f2* absent; setae *h2* similar in size and form to other dorsal setae; palps 3-segmented, palp setal formula 0, 0, 2(1); immature stages with anterior of prodorsum smoothly rounded, without projections/notches; ventral plate absent; 3 pairs of pseudanal setae (*ps1-3*) on weakly developed membranous anal plates. *Adult female:* gnathosoma completely concealed by prodorsum; cuticle between gnathosoma and prodorsum produced into 1 pair of blunt, broadly triangular membranous lobes (with median notch formed between the lobes), anterior to and folded under anterior margin of prodorsum and setae *v2*, often appear slightly retracted back into body; genital plate weakly developed, membranous; metapodal plates not developed; coxae I without *Ic*; trochanters I–IV 0-0-1-0 (*v'* absent on tr I–IV); femora I–IV 3-3-2-1; genua I–IV nude; tibiae I–IV 3-3-2-2 (*v''* absent on ti I–IV); tarsi I–IV without *tc''*. Solenidia of male of similar thickness and length as in female.

Remarks. This monotypic genus is close to *Chaudhripalpus*, differing only in having a three-segmented palp (instead of four) and tibiae I–IV lacking setae *v''*. Here, we tentatively retain *Chaudhripalpus* as a separate genus, as the three-segmented palp of *Tegopalpus* is autapomorphic within the Tegopalpinae and mites found on Casuarinaceae.

***Tegopalpus conicus* Womersley, 1940**

(Figs 107–123)

Tegopalpus conicus Womersley, 1940: 242, fig. 4.

Tegopalpus conicus, Smiley *et al.* 2009: 168, figs 1–6.

Type material examined. Holotype female ex. *Casuarina* sp. (Casuarinaceae), **AUSTRALIA:** New South Wales, Avalon Beach, 26 August 1934, coll. Womersley (SAM, N1970401). Paratypes. 1 male and 1 larva, same data as holotype (1 slide; SAM, N1970400).

Non-type material examined. 10 females, 2 deutonymphs, 2 protonymphs, and 4 larvae ex. Swamp She-Oak *Casuarina glauca* (Casuarinaceae), **AUSTRALIA:** New South Wales, Des Creagh Reserve, 35 km N of Sydney, Avalon Beach, 33°37'59"S 151°19'56"E, 24 January 2012, coll. J.J. Beard (QM, SAM, ANIC, USNM; many more in alcohol); 1 female ex. same host, **AUSTRALIA:** New South Wales, Dee Why, 18 km N of Sydney, Hawkesbury Avenue, 33°45'00"S 151°17'37"E, 24 January 2012, coll. J.J. Beard (QM); 4 females, 2 males, 2 deutonymphs, 1 protonymph, and 1 larva, ex. same host, **AUSTRALIA:** Queensland, Beachmere, Bayside Drive, 27°05'50"S, 153°05'20"E, 15 February 2009, coll. O.D. Seeman (QM); 3 females, 1 male, 1 protonymph, and 1 larva ex. same host, **AUSTRALIA:** Dutton Park State School, 27°29'38"S 153°01'43"E, 16 June 2011, coll. O.D. Seeman (QM).

Diagnosis. Prodorsal shield with fine longitudinal to oblique folds centrally, with weak reticulate pattern posterolaterally. Opisthosomal shield with fine oblique folds sublaterally; with fine longitudinal folds posterior *e1-e1*; with stronger transverse folds just anterior *d1-d1* and between *d1-e1*. Lateral cuticle weakly to coarsely papillate. Dorsal cuticle finely punctate. Dorsal setae concave in shape (scoop-shaped).

FEMALE (n = 19). *Dorsum.* (Figs 107a, 108, 109, 110b, 111a) Body measurements: distance between setae *v2-h1* 305–335 [320]; *sc2-sc2* 105–125 [115]; other measurements: *v2-v2* 26–36 [32], *sc1-sc1* 88–100 [89], *c1-c1* 15–25 [20], *c3-c3* 130–145 [140], *d1-d1* 18–24 [21], *d3-d3* 115–125 [115], *e1-e1* 19–28 [21], *e3-e3* 105–120 [107], *f3-f3* 83–97 [87], *h1-h1* 21–34 [21], *h2-h2* 54–67 [54]. Gnathosoma completely concealed beneath anterior margin of prodorsum (Figs 109, 110a, 111). Cuticle between gnathosoma and prodorsum produced into 1 pair of blunt, broadly triangular membranous lobes (Figs 110, 111) (with median notch formed between lobes); median notch anterior and ventral to setae *v2* (notch internal depth 19–26); lobes can sometimes be retracted beneath anterior

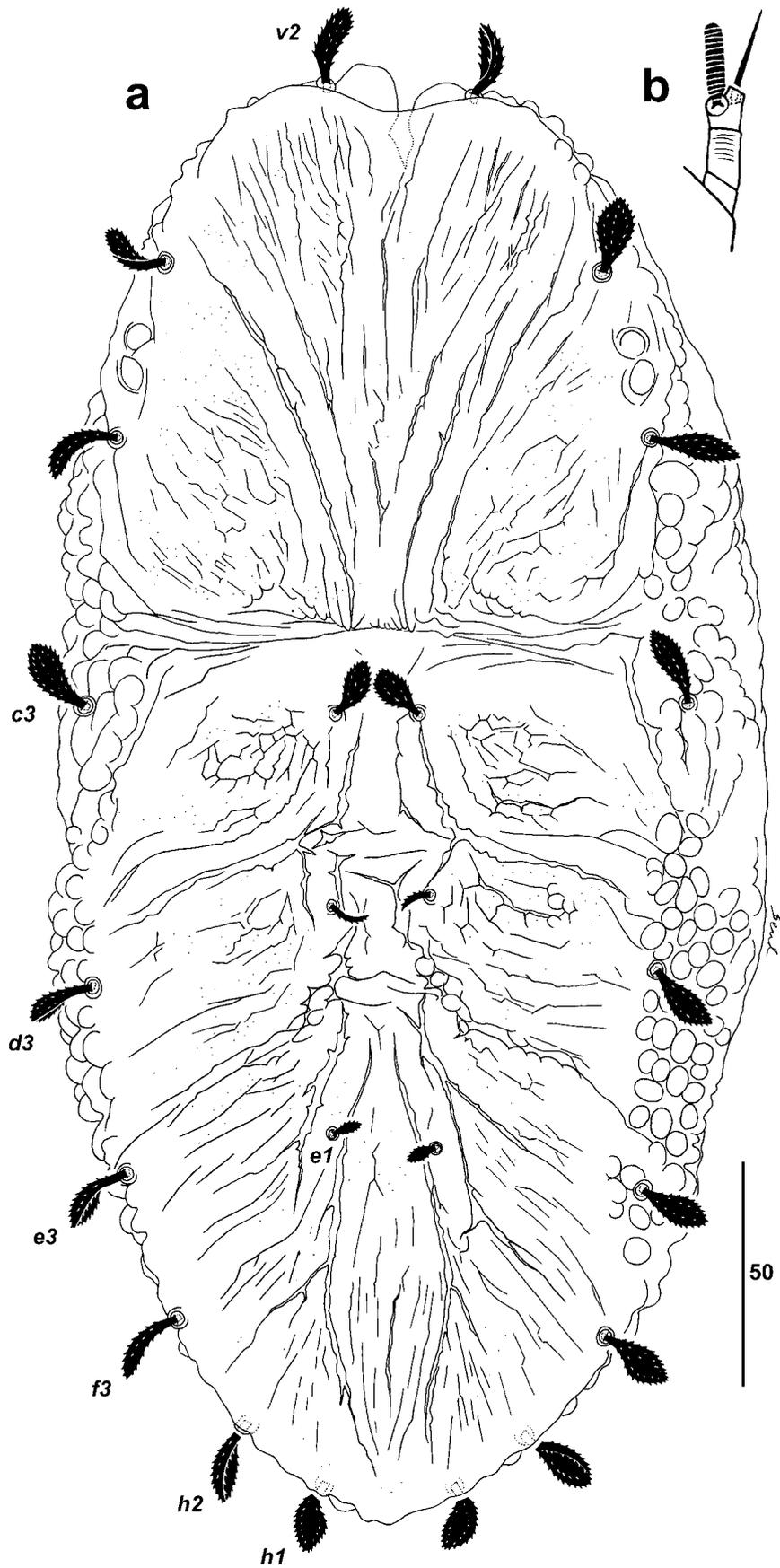


FIGURE 107. *Tegopalpus conicus* Womersley, adult female from type locality, a. dorsum; b. detail of palp (scale bar for palp = 25 μm).

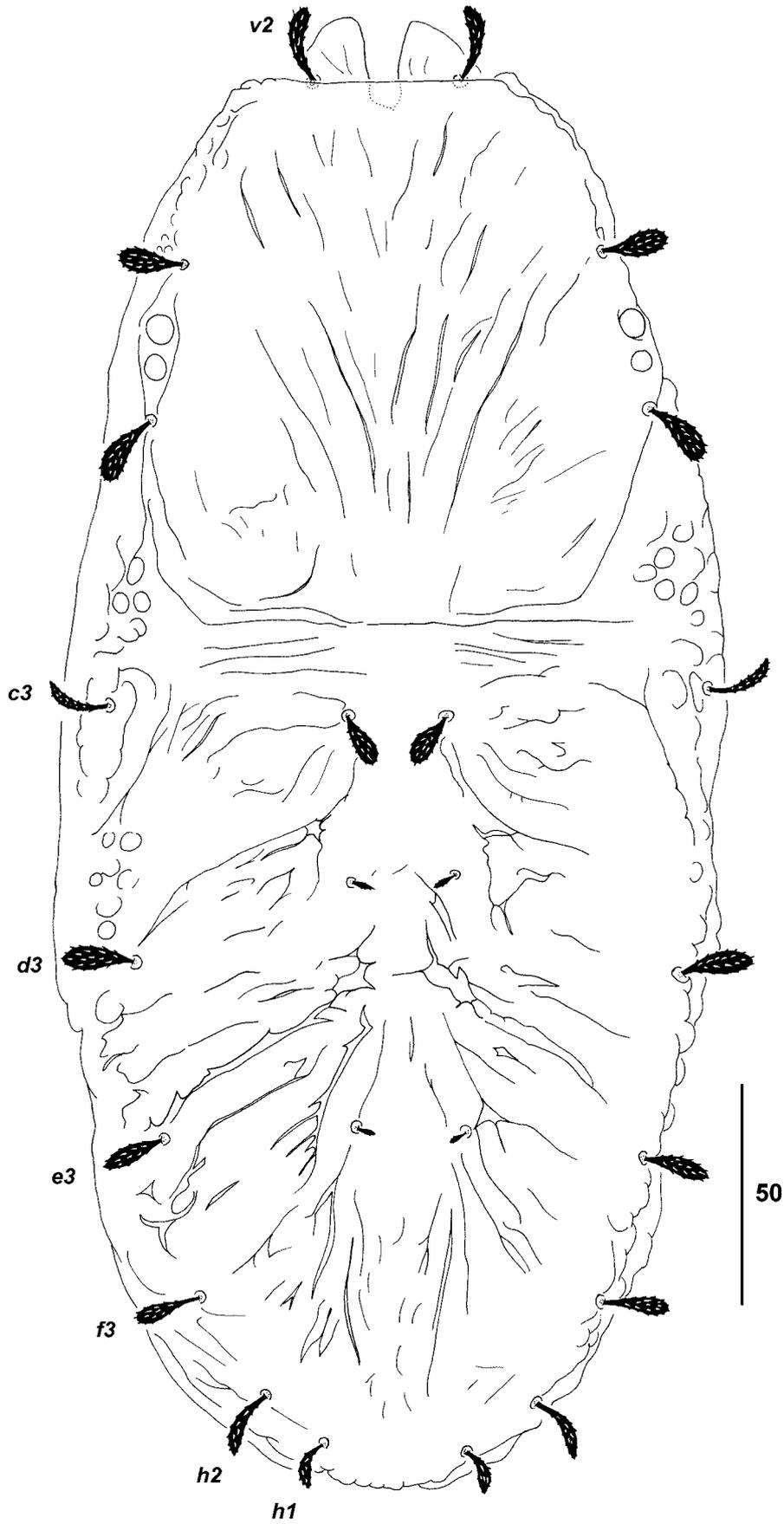


FIGURE 108. *Tegopalpus conicus* Womersley, adult female from northern population, dorsum.



FIGURE 109. *Tegopalpus conicus* Womersley, adult female, type locality, in habitat.

margin of prodorsum (Figs 110, 111a); setae *v2* inserted just ventral to, or on edge of, anterior margin of prodorsum (Figs 107a, 108, 110a, 111a). Prodorsum with 6–8 strong longitudinal to oblique folds running almost entire length of shield centrally; cuticle with many fine folds and finely punctate, with some fine folds and weak reticulation in posterior lateral corner. Opisthosoma finely punctate with 2 transverse to oblique folds across shield, between *c1-d1* and *d1-e1*; cuticle laterad *c1-c1* and *d1-d1* finely reticulate and folded; cuticle in general with many fine oblique folds and wrinkles, becoming longitudinal posteriorly. Soft cuticle laterad shield strongly colliculate-papillate (sculpturing on Queensland material much weaker than material from type locality). All dorsal setae short, weakly spatulate, barbed; dorsal setae with distinctly concave ventral surface, forming a scoop (Figs 107, 113b, 119b); setae *d1* and *e1* much smaller than other dorsal setae. Setal lengths: *v2* 16–20 [17], *sc1* 14–18 [not measurable], *sc2* 15–20 [not measurable], *c1* 10–16 [not measurable], *c3* 15–20 [16, 18], *d1* 6–9 [not measurable], *d3* 15–19 [17], *e1* 4–8 [not measurable], *e3* 15–18 [18], *f3* 15–19 [17], *h1* 11–16 [not measurable], *h2* 13–19 [16, 17]. *Palps.* (Figs 107b, 110a) Setal formula 0, 0, 2 (1s+1e); seta-like tarsal eupathidium 5–12 long [not measurable]; solenidion 6–9 long [not measurable]. *Venter.* (Figs 110a, 112a, 113) Cuticle between *1b-1b* with transverse striae; *1b-1a* with longitudinal striae; *1a-3a* with transverse striae; *3a-4a* with longitudinal striae; cuticle posterior to *4a* with small area of transverse to mixed striae becoming longitudinal to *ag* and coarse around genital region; cuticle on anal plates with weak oblique striae. Genital setae inserted in more-or-less transverse row on genital flap, with *g1* slightly posterior to *g2*. Anal setae *ps1-3* short, fine, inserted along medial margin of anal plates in more-or-less longitudinal line. Coxal setae fine; setae *1a*, *3a*, *4a* finely tapered. Setal lengths: *1a* 35–62 [56], *1b* 12–22 [19], *2b* 11–24 [21], *2c* 11–21 [21], *3a* 31–61 [31], *3b* 12–21 [15], *4a* 21–59 [42], *4b* 14–20 [16], *ag1* 6–15 [15], *g1* 12–20 [20], *g2* 11–20 [20], *ps1* 8–13 [11], *ps2* 8–12 [10], *ps3* 5–11 [9, 10]. *Spermatheca.* (Fig. 112b) Not visible in holotype. Spermathecal tube narrow, coiled, maximum 1 wide, ca. 75–100 long, ending in small rounded vesicle 2 long, 2 wide, subtended by small sac 1 long, 1 wide. Genital opening just anterior to setae *ps3*. *Legs.* (Fig. 114) Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-3-8(1), 2-0-3-0-3-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 8–11 [8, 9] long, ta II 9–12 [9] long) and 2 eupathidia $p\zeta''-p\zeta'''$ (6–8 [6] long). Solenidia are of similar size to the male (Fig. 115). One specimen with an aberrant setal count of 3 on 1 ge III. Leg setation as in Table 1 except: cx I without *1c*; tr I–IV without *v'* (*l'* present on tr III); ge I–IV nude; ti I–IV without *v''*; ta I–IV without *tc''*.

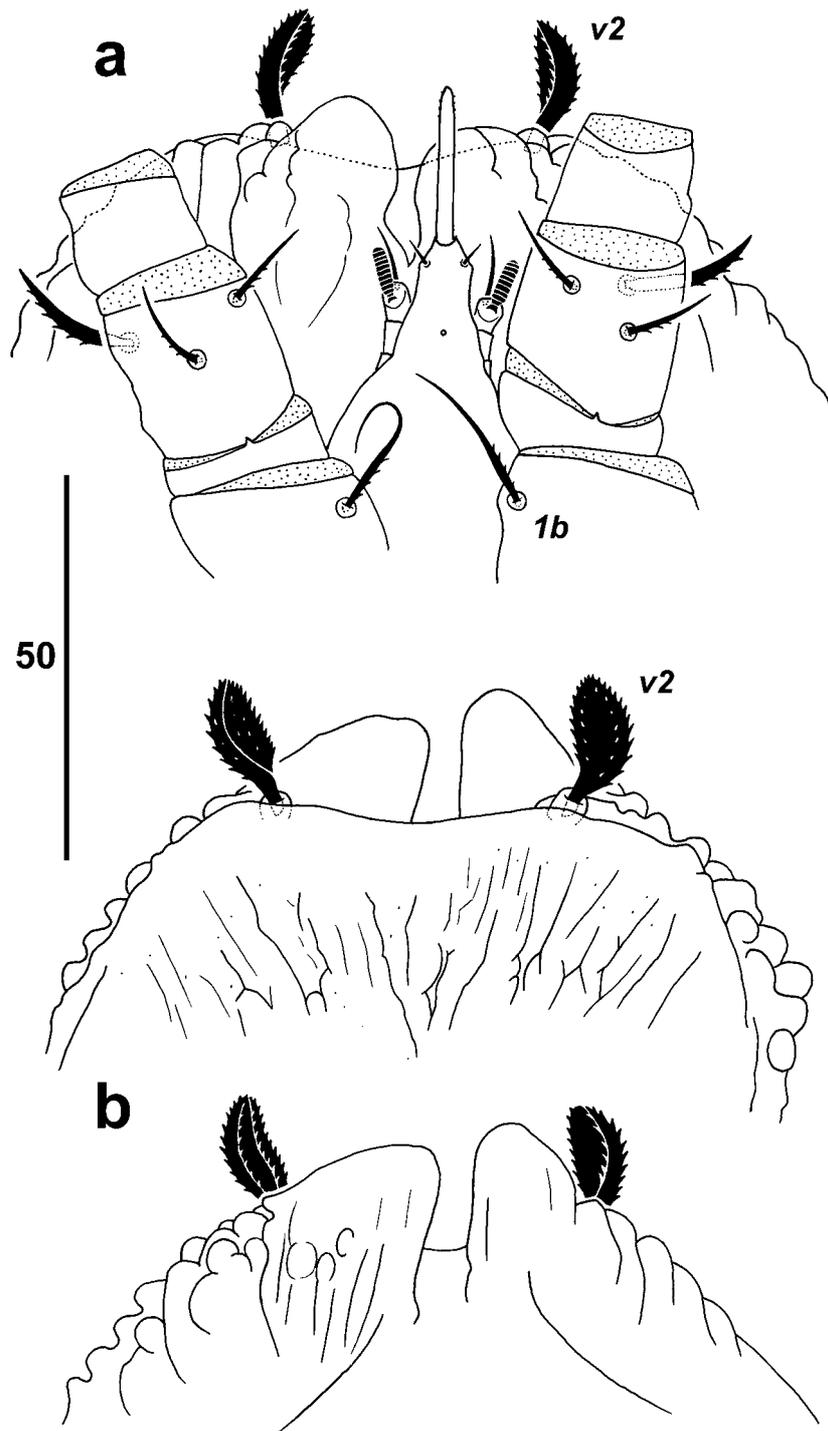


FIGURE 110. *Tegopalpus conicus* Womersley, adult female, type locality, anterior margin of prodorsum, a. ventral view, with detail of palps; b. dorsal and ventral view of same individual.

MALE (n = 2). *Dorsum*. (Figs 116, 117, 119a). Paratype measurements in brackets. Body measurements: distance between setae *v2-h1* 220–230 [230]; *sc2-sc2* 80–91 [91]; other measurements: *v2-v2* 22–25 [25], *sc1-sc1* 63–72 [72], *c1-c1* 14–16 [14], *c3-c3* 95–98 [98], *d1-d1* 10–11 [10], *d3-d3* 73–79 [79], *e1-e1* 14–17 [17], *e3-e3* 70–76 [76], *f3-f3* 56–63 [63], *h1-h1* 11–15 [15], *h2-h2* 34–42 [42]. Gnathosoma completely concealed beneath anterior margin of prodorsum. Anterior margin of prodorsum with a deep medial notch forming 1 pair of blunt, broadly triangular lobes as in female, can appear to be retracted beneath anterior margin of prodorsum; setae *v2* inserted just ventral to, or on edge of, anterior margin of prodorsum (Figs 116, 117, 119a). Prodorsal cuticle with multiple longitudinal to oblique folds running along almost entire length of shield. Opisthosoma with mesonotal and

pygidial shields, separated by a band of transversely folded soft cuticle; shields with weak reticulate and folded cuticle. Soft cuticle laterad shield strongly colliculate-papillate (sculpturing on Queensland material much weaker than material from type locality). All dorsal setae short, weakly spatulate, barbed; dorsal setae with distinctly concave ventral surface forming a scoop (Fig. 119b); setae *dl* and *el* much smaller than other dorsal setae. Setal lengths: *v2* 15–20 [18, 20], *sc1* 13–15 [14, 15], *sc2* 15–18 [17, 18], *c1* 13–14 [13], *c3* 14–15 [14, 15], *dl* 5–8 [6], *d3* 14–15 [15], *e1* 5–6 [4, 5], *e3* 14–16 [15, 16], *f3* 14–15 [14, 15], *h1* 12–14 [12, 13], *h2* 11–15 [15]. *Palps*. Palps similar to female. Solenidion 8–11 [11] long, seta-like eupathidium 7–13 [13] long. *Venter*. (Figs 118a, 119b) Cuticle mostly with fine striae between *1a-4a*; broadly separated transverse striae between *4a-ag*; weak, broadly separated transverse striae between *ag-g1-2*. Genital setae inserted in more-or-less transverse row. Anal setae *ps2-3* fine, inserted in transverse row laterad *ps1*; *ps1* modified into thick, straight, spur-like setae (Figs 118a, 119b). Coxal, genital and anal setae fine; setae *1a*, *3a*, *4a* finely tapered and difficult to determine total length. Setal lengths: *1a* 45–63 [50, 65], *1b* 14–19 [19], *2b* 11–18 [18], *2c* 13–16 [16], *3a* 30–53 [50, 53], *3b* 8–17 [17], *4a* 37–67 [67], *4b* 10–18 [18], *ag1* 9–10 [9, 10], *g1* 7–10 [10], *g2* 8–13 [12, 13], *ps1* 5–13 [13], *ps2* 7–11 [7], *ps3* 5–8 [7, 8]. *Aedeagus*. (Fig. 118b) Narrow, sclerotised, tapering to a point, 41–42 [42] long (bent tip is possibly artefact of slide mounting). Membranous duct runs from inside aedeagus for about 55, reaching partially distinguishable membranous sac, at least 10 wide, 10 long (not visible in paratype). *Legs*. Setal formula for legs I–IV (coxae to tarsi) same as female: 1-0-3-0-3-8(1), 2-0-3-0-3-8(1), 1-1-2-0-2-4, 1-0-1-0-2-4. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 8–10 [10] long, ta II 8–10 [9, 10] long) and 2 eupathidia $p\zeta'-p\zeta''$ (5–7 [7] long). Solenidia similar in size to female (Fig. 115).

DEUTONYMPH (n = 4). *Dorsum*. Body measurements: distance between setae *v2-h1* 210–245, *sc2-sc2* 75–100; other measurements: *v2-v2* 17–23, *sc1-sc1* 68–87, *c1-c1* 17–21, *c3-c3* 87–125, *dl-dl* 16–21, *d3-d3* 67–99, *e1-e1* 19–23, *e3-e3* 61–97, *f3-f3* 53–82, *h1-h1* 15–21, *h2-h2* 41–54. Prodorsal shield with 7–9 longitudinal creases; setae *v2* inserted on anterior margin of prodorsal shield. Opisthosoma with setae *c1* on paired, weak, irregular platelets, *dl-d3* on paired, weak, irregular platelets; pygidial shield weak, including setae *e1*, *f3*, *h1*, *h2*. Otherwise coarse transverse striae between areas of smooth to wrinkled cuticle. At least 6 small pores present on dorsum, 2 pairs on prodorsal shield mesad *sc2*, pair between *c1-c3*, pair between *dl-d3*, pair anterolaterad *e1*, pair posterior *e1*. Setal lengths: *v2* 15–21, *sc1* 12–18, *sc2* 12–17, *c1* 9–11, *c3* 12–17, *dl* 4–7, *d3* 15–19, *e1* 2–6, *e3* 14–19, *f3* 14–20, *h1* 7–13, *h2* 14–19. 1 specimen lacks setae *c1*, *e1* and *h2* on the right hand side. *Palps*. Palps similar to adult. Solenidion 3–5 long, seta-like eupathidium 5–8 long. *Venter*. Cuticle between *1b-1a* with longitudinal striae; *1a* to level with leg III with transverse striae; between legs III–IV with longitudinal striae; cuticle posterior to leg IV transverse becoming longitudinal and broader in genital region. Coxal setae fine. Setae *ag1*, *g1*, *ps1-3* smooth. Setal lengths: *1a* 22–44, *1b* 9–16, *2b* 9–13, *2c* 9–16, *3a* 26–38, *3b* 8–18, *4a* 25–34, *4b* 10–13, *ag1* 6–8, *g1* 9–14, *ps1* 4–6, *ps2* 4–6, *ps3* 5–7. *Legs*. Setal formula for legs I–IV same as adult female. Tarsi I and II each with 1 antiaxial solenidion ω'' (3–5 long) and 2 eupathidia $p\zeta'-p\zeta''$ (4–6 long).

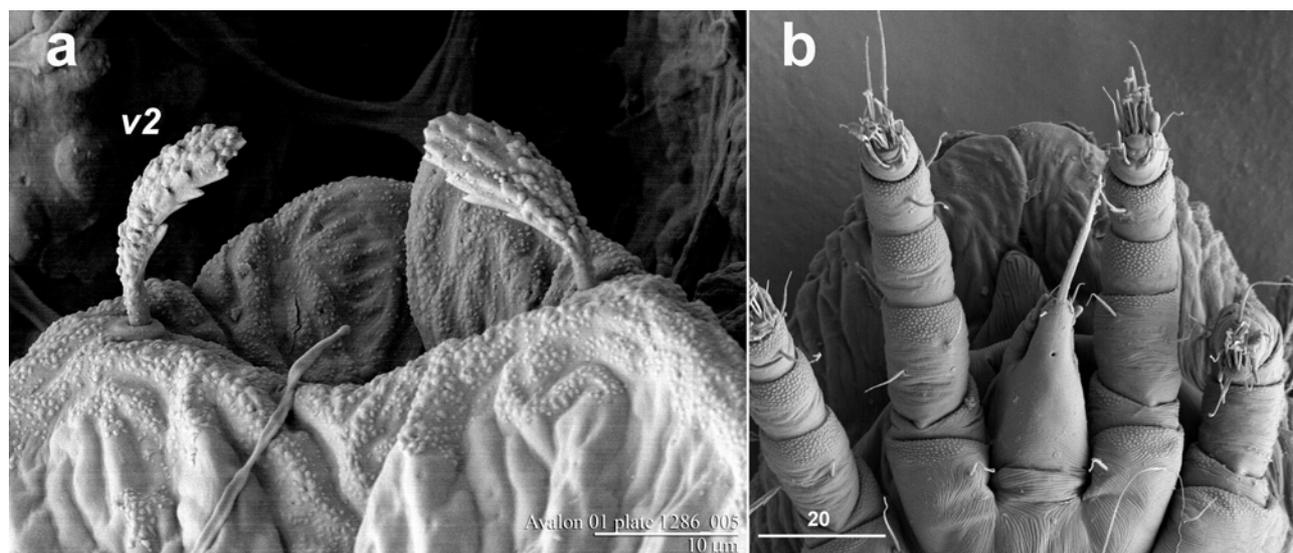


FIGURE 111. *Tegopalpus conicus* Womersley, adult female, type locality, anterior margin of prodorsum, a. dorsal aspect; b. ventral aspect.

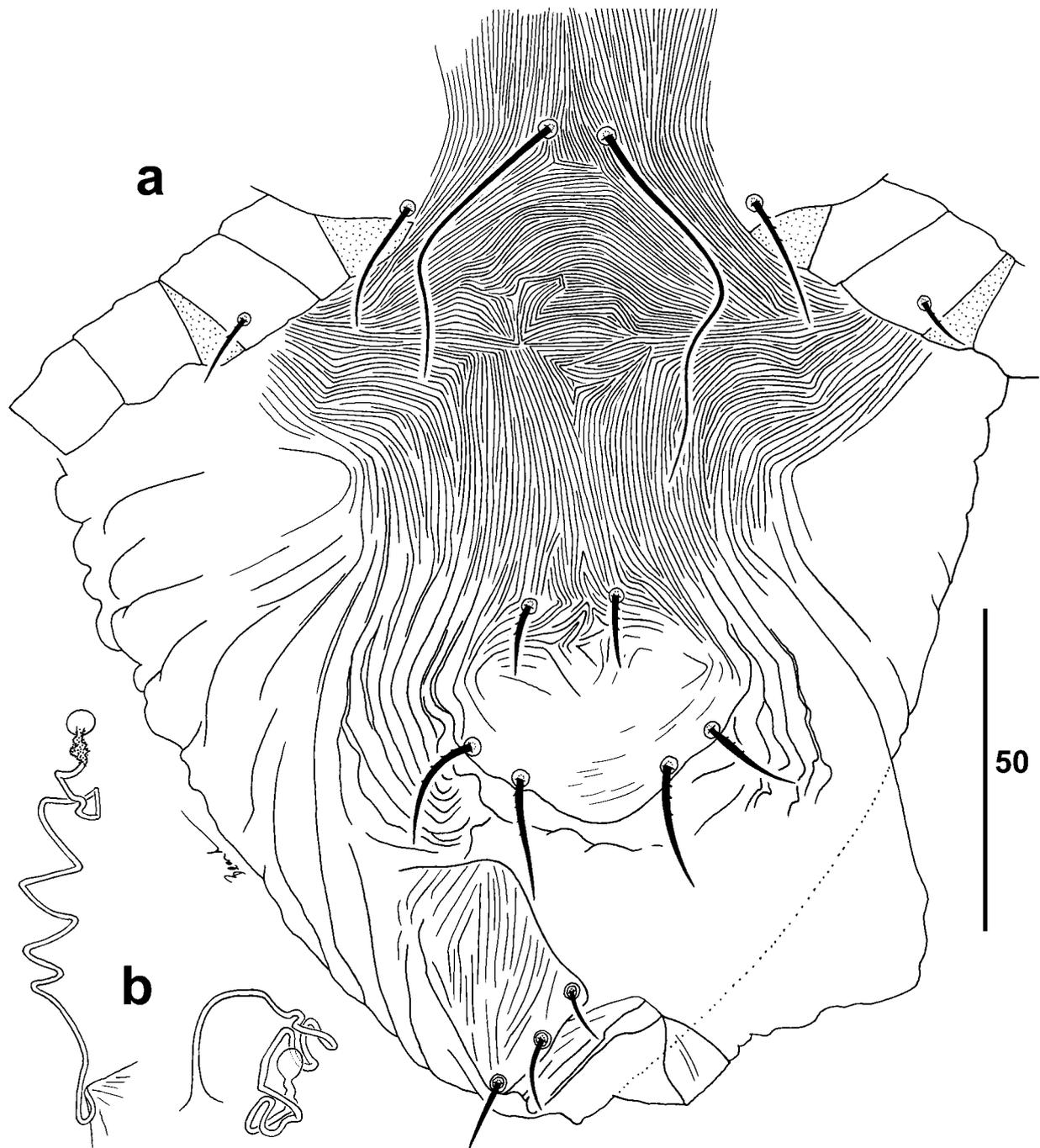


FIGURE 112. *Tegopalpus conicus* Womersley, adult female, type locality, a. posterior venter; b. spermatheca.

PROTONYMPH (n = 4). *Dorsum*. Body measurements: distance between setae *v2-h1* 185–200, *sc2-sc2* 69–77; other measurements: *v2-v2* 18–20, *sc1-sc1* 62–67, *c1-c1* 15–16, *c3-c3* 82–89, *d1-d1* 15–16, *d3-d3* 66–71, *e1-e1* 12–15, *e3-e3* 63–68, *f3-f3* 50–52, *h1-h1* 7–14, *h2-h2* 27–33. Dorsum similar to deutonymph. Prodorsal shield with 6–7 longitudinal creases; setae *v2* inserted just ventral to anterior margin of prodorsal shield. Opisthosomal shields similar to deutonymph except pygidial shield excludes *f3*. At least 5 small pores present on dorsum, pair on prodorsal shield mesad *sc2*, pair between *c1-c3*, pair between *d1-d3*, pair anterolaterad *e1*, pair posterior *e1*. Setal lengths: *v2* 14–20, *sc1* 11–14, *sc2* 14–16, *c1* 6–8, *c3* 13–15, *d1* 4–5, *d3* 13–15, *e1* 3–5, *e3* 13–16, *f3* 13–16, *h1* 5–10, *h2* 13–16. *Palps*. Palps similar to adult. Solenidion 3 long, seta-like eupathidium 5–7 long. *Venter*. Cuticle and setae similar to deutonymph. Setal lengths: *1a* 25–32, *1b* 10–16, *2b* 10–12, *3a* 22–31, *3b* 8–12, *agl* 3–6, *ps1* 3–5, *ps2* 3–5, *ps3* 3–5. *Legs*. Setal formula for legs I–IV (coxae to tarsi) 1-0-3-0-3-8(1), 1-0-3-0-3-8(1), 1-1-2-0-2-4, 0-0-1-0-2-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (3–4 long) and 2 eupathidia $p\zeta'-p\zeta''$ (4–5 long). Leg

setation as in deutonymph, except: setae *2c*, *4b* absent; tarsi IV without seta *tc'*. Setae *l'* added to tr III.

LARVA (n = 8). **Dorsum.** (Fig. 120a) Body measurements: distance between setae *v2-h1* 120–180 [paratype: 165], *sc2-sc2* 57–69 [63]; other measurements: *v2-v2* 16–22 [19], *sc1-sc1* 51–61 [54], *c1-c1* 13–17 [17], *c3-c3* 71–95 [83], *d1-d1* 15–18 [15], *d3-d3* 50–69 [61], *e1-e1* 9–13 [11], *e3-e3* 36–60 [50], *f3-f3* 27–41 [38], *h1-h1* 4–7 [4], *h2-h2* 14–18 [17]. Anterior margin of prodorsum smoothly rounded without medial notch. Prodorsal shield smooth, weak with few oblique folds; opisthosomal dorsum with a few transverse folds and striations between *c1-e1*. Lateral cuticle mesad *c3* with oblique folds and striations. At least 5 pairs of pores present on dorsum, pair mesad *sc2*, pair between *c1-c3* and *d1-d3*, 2 pairs laterad *e1*. Setae *h1*, *h2* inserted posteroventrally. Setal lengths: *v2* 13–23 [19], *sc1* 10–14 [12, 13], *sc2* 11–16 [13], *c1* 4–7 [5, 6], *c3* 9–15 [12], *d1* 3–5 [4, 5], *d3* 11–18 [16, 18], *e1* 2–4 [4], *e3* 11–17 [15], *f3* 12–18 [16], *h1* 4–7 [6, 7], *h2* 12–19 [17, 19]. **Palps.** (Fig. 120b) Palps 3-segmented; seta-like tarsal eupathidium 3–8 [7, 8] long; solenidion 2–3 [3] long. **Venter.** Ventral cuticle finely striate, similar to deutonymph. Pseudanal setae *ps1–3* on smooth cuticle. Coxal setae fine. Setal lengths: *1a* 15–36 [36], *1b* 10–18 [12], *3a* 19–35 [24], *ps1* 2–4 [4], *ps2* 2–4 [4], *ps3* 2–4 [4]. **Legs.** Setal formula for legs I–III (coxae to tarsi) 1-0-3-0-3-7(1), 0-0-3-0-3-7(1), 0-0-2-0-2-3. Tarsi I and II each with 1 antiaxial solenidion ω'' (ta I 2–4 [3, 4], ta II 2–3 [2, 3]) and 2 eupathidia *pζ'-pζ''* (3–5 [5] long). Leg setation as in protonymph, except: setae *2b*, *3b* absent; tr III without *l'*; ta I–III without seta *tc'*.

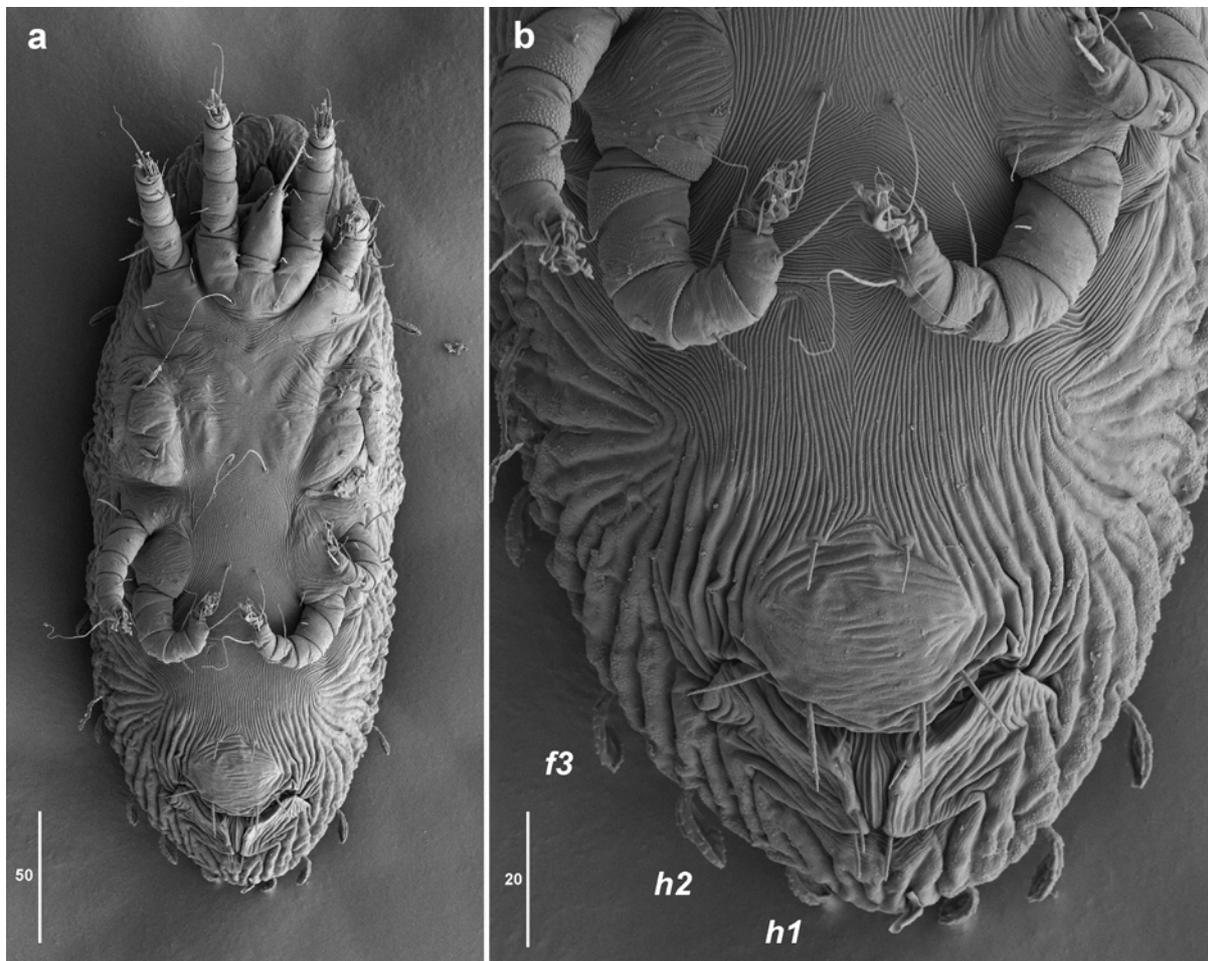


FIGURE 113. *Tegopalpus conicus* Womersley, adult female, type locality, a. venter; b. detail of ventral opisthosoma, note scoop-like dorsal setae *f3*, *h1–2*.

Remarks. Individual mites are found wedged within the natural grooves present on the stems and branchlets of the host plant (Fig. 122), where they feed and moult. Eggs are also laid within these grooves, lined up in a row (Fig. 121). The eggs have a short stipe and thick sculptured outer coating (Fig. 121b).

Although Womersley (1940) stated the sex as “probably female”, the original description and illustrations of *T. conicus* were unquestionably based on a male. Womersley stated that there were four specimens; however, to date

only three specimens have been located (on two slides, in poor condition). Even though Womersley technically never designated a holotype, the female slide is marked with the traditional red indicative of a holotype specimen, and the male slide (with larva) is marked with the traditional blue of a paratype. There is no indication of when this was done, or by whom. The female was described much later by Smiley *et al.* (1996) from what they stated was the holotype. The 'type' slides are now supplemented by new material collected on the type host plant from both the type locality and an additional locality further north along the eastern Australian coastline.

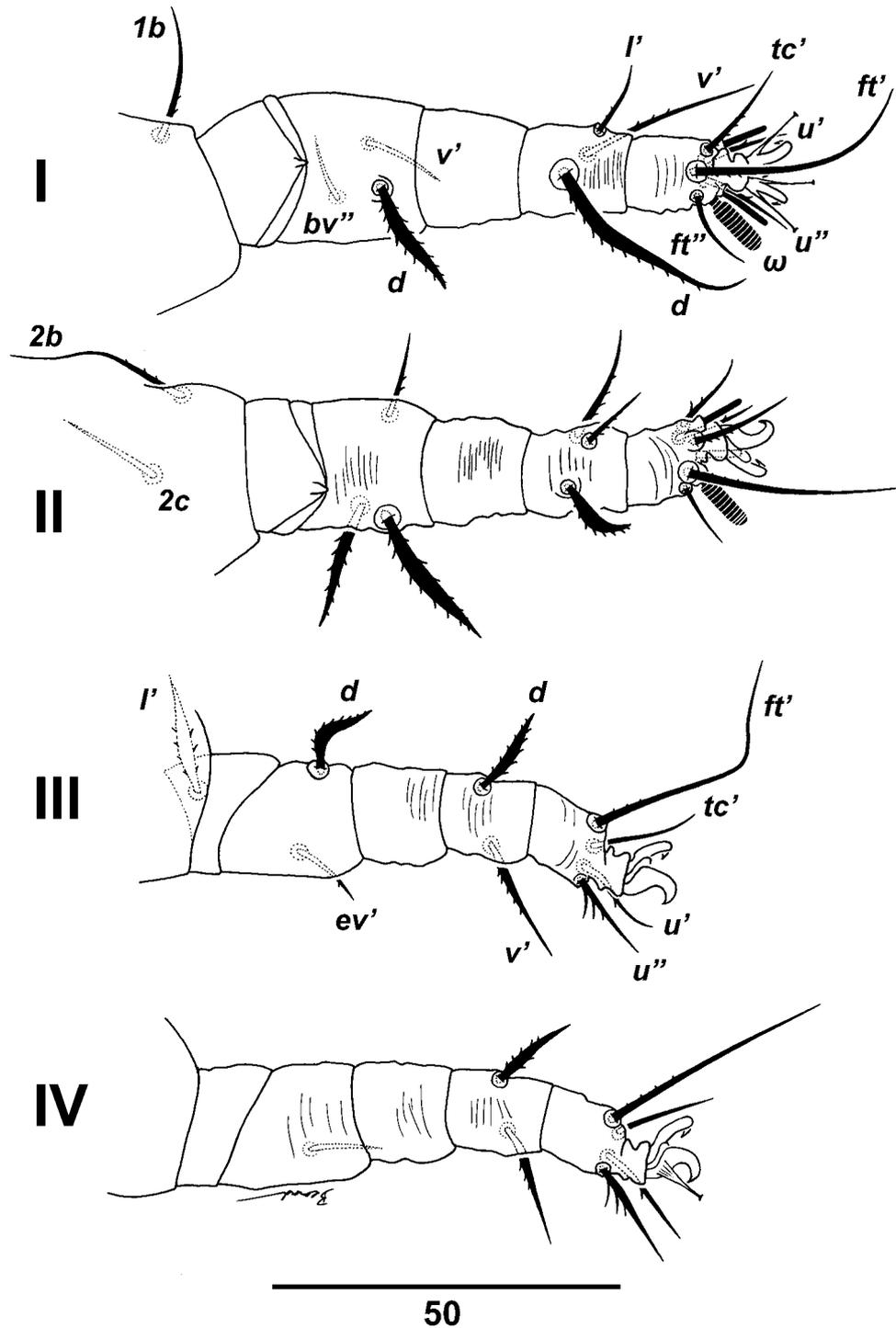


FIGURE 114. *Tegopalpus conicus* Womersley, adult female, type locality, legs (right side), eupathidia ($p\zeta'$ - $p\zeta''$) not labelled on leg I.

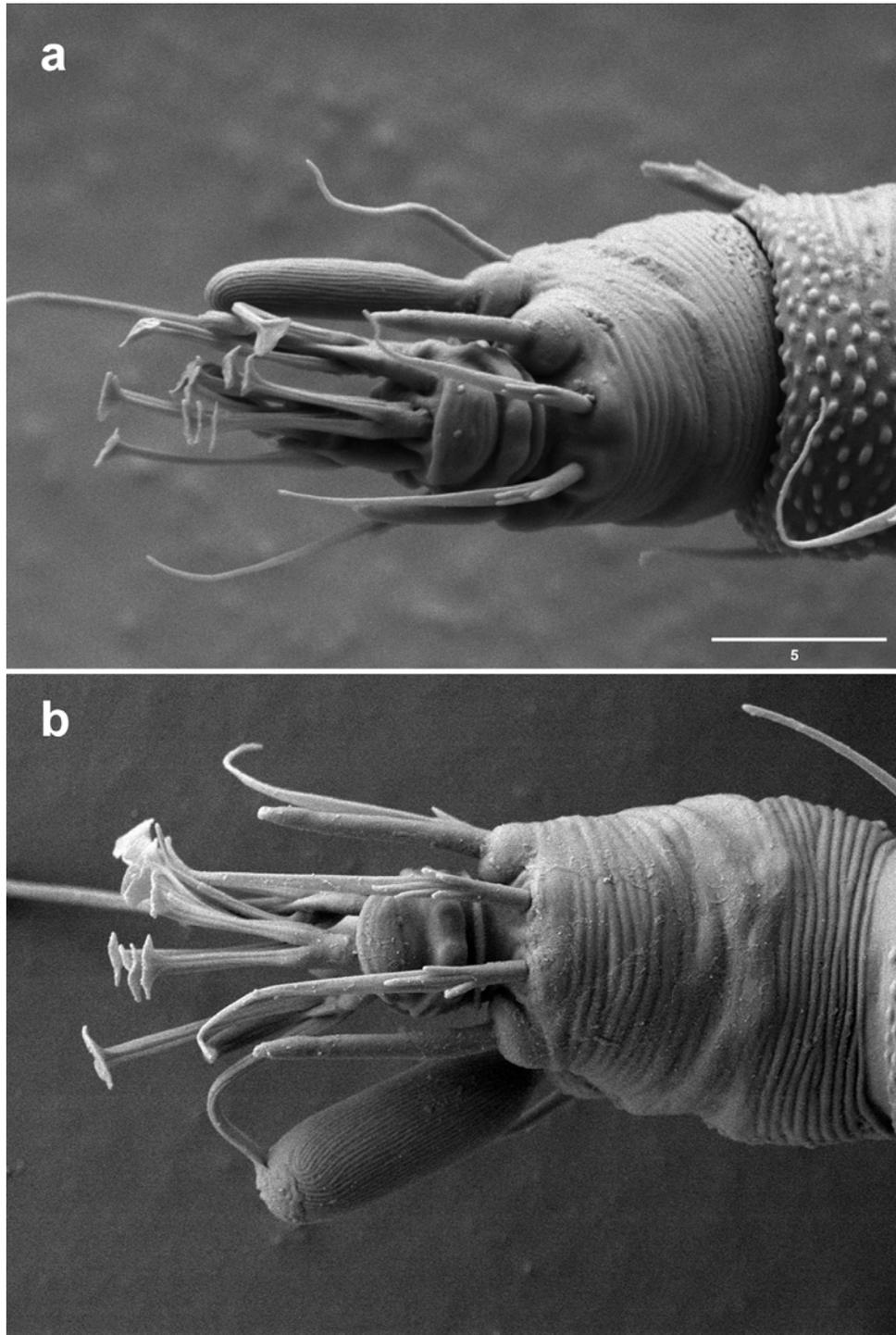


FIGURE 115. *Tegopalpus conicus* Womersley, type locality, tarsus I with detail of solenidion ω' , a. adult female; b. adult male.

Both the original description (Womersley 1940) and re-description (Smiley *et al.* 1996) were lacking several key details, due to the poor preservation of the type specimens. However, after close examination of the types, we were able to discern certain key characters, e.g. setae *e1* and three pairs of pseudanal (*ps*) setae, in addition to details of the leg setation. We also note, with the help of the new material, that the palp is three-segmented, not two-segmented as originally described.

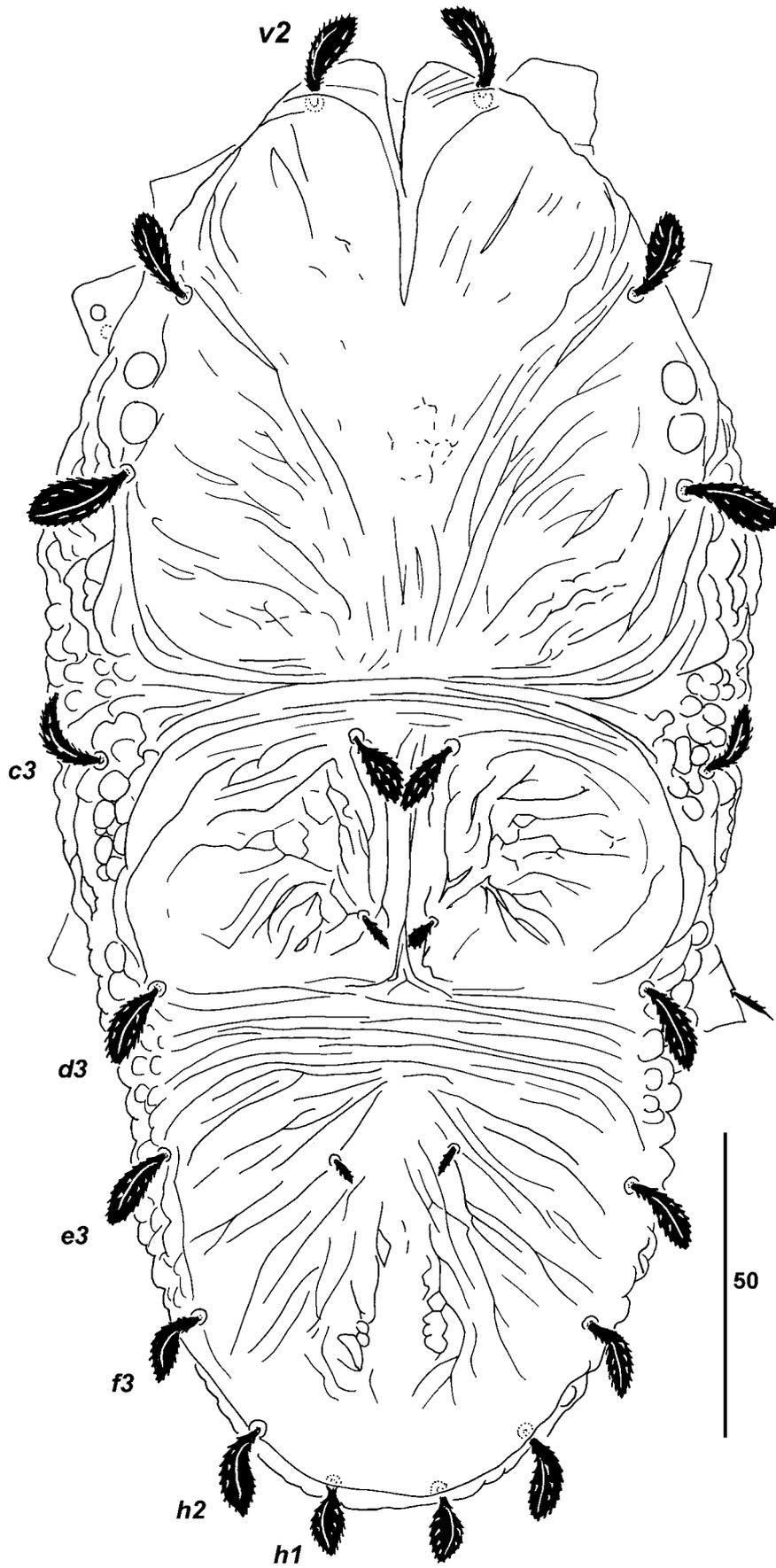


FIGURE 116. *Tegopalpus conicus* Womersley, type male, dorsum.

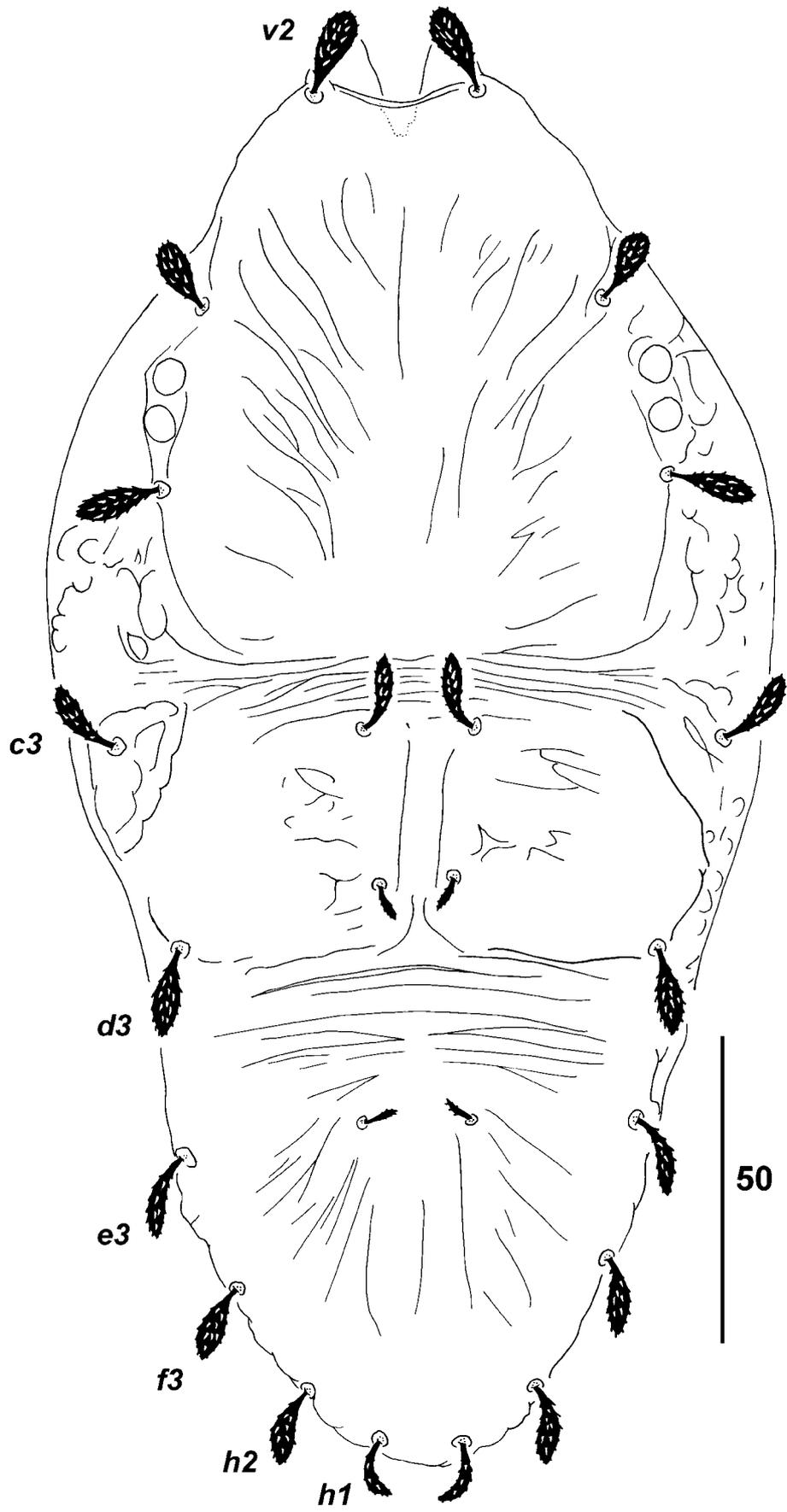


FIGURE 117. *Tegopalpus conicus* Womersley, adult male from northern population, dorsum.

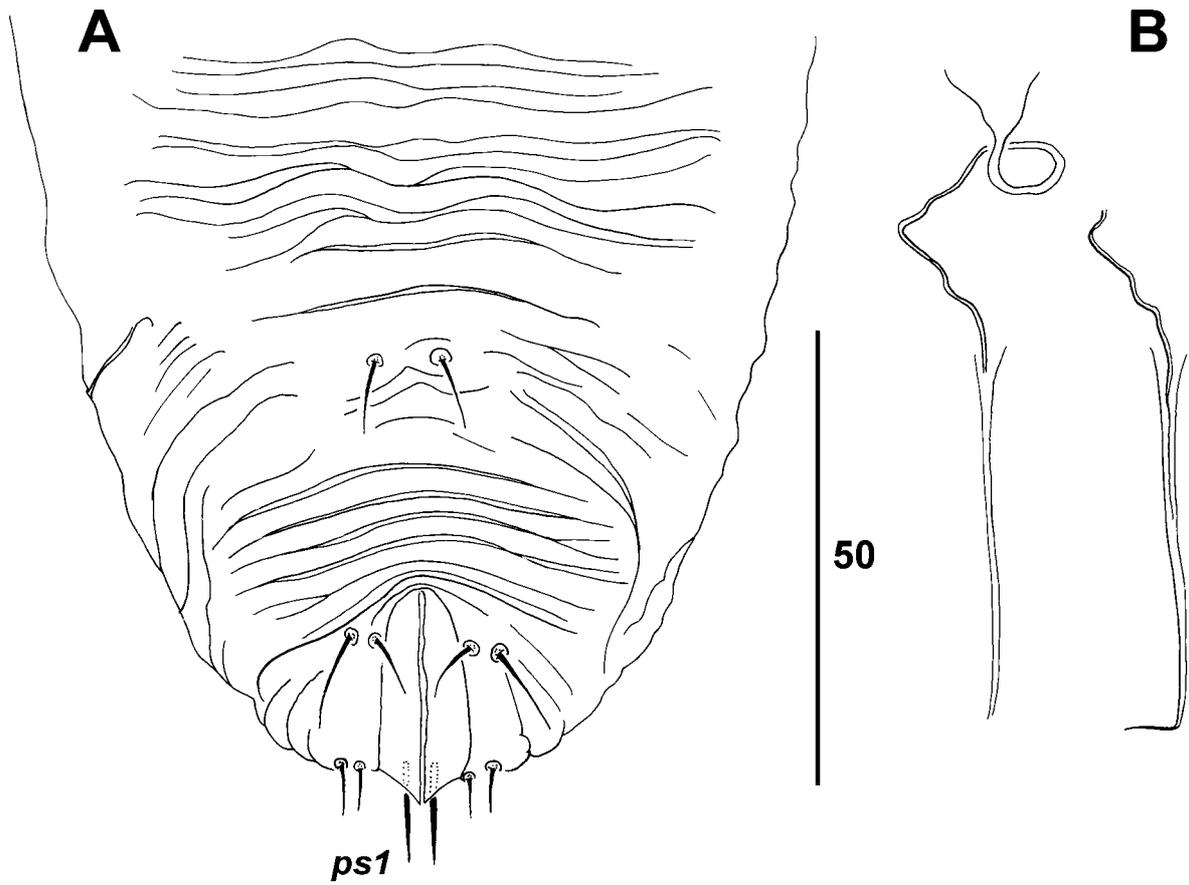


FIGURE 118. *Tegopalpus conicus* Womersley, adult male, northern population, a. posterior venter; b. aedeagus.

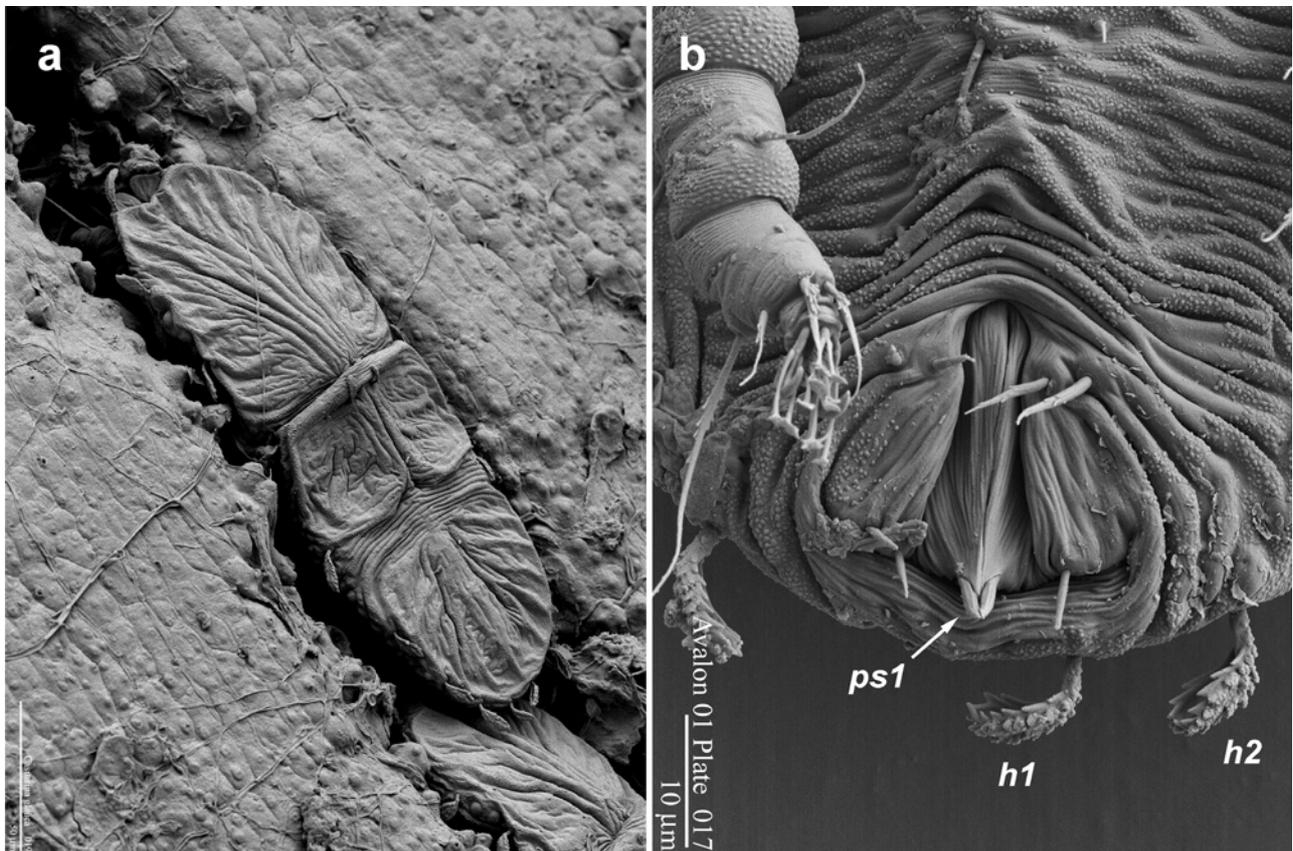


FIGURE 119. *Tegopalpus conicus* Womersley, adult male, type locality, a. in habitat; b. detail of posterior opisthosoma, note scoop-like dorsal setae *h1*–*2* and thickened setae *ps1*.

The Queensland specimens have some minor differences to the specimens from the type locality: the dorsal sculpturing is weaker, there are fewer lateral papillae (ca. 25 vs 50) and most ventral, genital and anal setae are shorter. There is a chance that they may represent another species, but because they came from the same host plant, and without an assessment of variation from several populations or genomic analysis, we tentatively consider them the same species. The use of low temperature scanning electron microscopy (LT-SEM) revealed that the specimens from both localities have very similar pattern of “microplate” (sensu Welbourn *et al.* 2003) development on the cuticle (Fig. 123).

Key to adult female Tenuipalpidae from Casuarinaceae

This key is based partially on that of Mesa *et al.* (2009). *Tenuipalpus* and *Brevipalpus* are included because these common genera are likely to be encountered occasionally from samples, and *Ultratenuipalpus* is included because we have collected several undescribed species from Casuarinaceae (unpublished data). This genus will be subjected to a future revision encompassing species on numerous host plants.

1. Posterior dorsal opisthosomal setae *h2* long, flagellate, usually more than twice as long as distance *h2-h2*. *Tenuipalpus*
 - Posterior dorsal opisthosomal setae *h2* not markedly long and flagellate, usually similar in shape and size to other dorsal setae 2
2. Dorsal opisthosomal setae *c2* present (Fig. 54). 7
 - Dorsal opisthosomal setae *c2* absent (Fig. 95) 3
3. Venter with well defined ventral and genital plates; 2 pairs of *ps* setae present. *Brevipalpus*
 - Venter without developed ventral plate (region membranous), genital plate or flap weakly developed, membranous; 3 pairs of *ps* setae present 4
4. Setae on posterior margin of dorsal opisthosoma with 4–5 pairs of large leaf-like setae (*e3*, *f2*, *f3*, *h1*, *h2*)
 *Ultratenuipalpus* sensu stricto (*meekeri* group)
 - Posterior margin of opisthosoma without such setae; anterior margin of prodorsum partially or fully covering gnathosoma/inf-
 racapitulum; anterior margin of prodorsum with median notch forming pair of lobes (lobes may be under anterior margin of
 prodorsum) 5
5. Opisthosomal setae *e2* present; palp tarsus with 2 eupathidia and 1 solenidion (e.g. Fig. 95) *Philippipalpus* 19
 - Opisthosomal setae *e2* absent (Fig. 1); palp tarsus with 1 eupathidium and 1 solenidion (Figs 2b, 107b) 6
6. Palp with 3 segments (Fig. 107b); setal formula for tibiae I–IV 3-3-2-2 (seta *v''* absent) (Fig. 114) *Tegopalpus conicus*
 - Palp with 4 segments (basal segment can be difficult to see) (Fig. 2a, c); setal formula for tibiae I–IV 4-4-3-3 (seta *v''* present)
 (Fig. 4). *Chaudhrupalpus* 11
7. 2 pairs of *ps* setae present (Fig. 15a). 8
 - 3 pairs of *ps* setae present (Fig. 58b). 9
8. Dorsal opisthosomal setae *f2* present (Fig. 67a); genua I–II with 2 setae (setae *d* and *l''* present) (Fig. 70); anterior margin of
 prodorsum with 2 rounded median lobes, anterior to setae *v2* (Fig. 67a) *Palpipalpus hesperius*
 - Dorsal opisthosomal setae *f2* absent (Fig. 13a); genua I–II with 1 seta (seta *l* or *d''* present) (Figs. 16, 28); anterior margin of
 prodorsum rounded, without lobes/notches (Figs 13a, 14) *Crossipalpus*... 12
9. Anterior margin of prodorsum with median notch anterior to setae *v2*; setae *v2* inserted posterior to lobes that form notch (Figs
 54, 55); coxal seta *lc* usually present; trochanters I–IV usually with setal formula usually 1-1-2-1 (*v'* present) 10
 - Anterior margin of prodorsum with median notch level with or between setae *v2*; setae *v2* inserted either side of notch, or on
 lobes formed by notch (Figs. 38, 42, 48) *Magdalenapalpus*... 17
10. Dorsal opisthosomal setae *e2* and *f2*, when present, inserted in submarginal position, aligned with *c2*, *d2* (Fig. 54).
 *Meyeraepalpus delfinadae*
 - Dorsal opisthosomal setae *e2* and *f2*, when present, inserted on lateral margin, aligned with setae *c3*, *d3*, *e3*, *f3* (Fig. 75)
 *Pentamerismus*... 15
11. Trochanters I–II with seta *v'* present (setal formula tr I–IV 1-1-1-0) (Fig. 4); ventral setae *ps1–2* broadly lanceolate, strongly
 barbed; setae *ps3* setiform, thin, smooth to weakly barbed (Fig. 3); dorsal opisthosomal setae *c1*, *d1*, *e1* (15–18, 13–16, 13–15

- long, respectively) subequal in size to *c3*, *d3*, *e3* (16–21, 16–21, 15–21 respectively) (Fig. 1). *Chaudhripalpus creelae*
- Trochanters I–II with seta *v'* absent (setal formula tr I–IV 0-0-1-0) (Fig. 9); ventral setae *ps1–2* narrow, setiform, barbed; setae *ps3* setiform, smooth to weakly barbed (Fig. 8b); dorsal opisthosomal setae *c1*, *d1*, *e1* (13–16, 10–11, 9–10 long, respectively) slightly smaller than *c3*, *d3*, *e3* (18–19, 16–19, 16–18 long, respectively) (Fig. 7) *Chaudhripalpus costacola*
 - 12. Genua I–II with seta *l''* present and seta *d* absent (setal formula ge I–IV 1-1-0-0) (Fig. 21) 13
 - Genua I–II with seta *l''* absent and seta *d* present (setal formula ge I–IV 1-1-0-0) (Fig. 28) 14
 - 13. Tarsi I–IV with seta *tc''* present (setal formula ta I–IV 9(1)-9(1)-5-5) (Fig. 16); prodorsal setae *v2* obviously longer than *sc1* (21–26, 8–13 long, respectively); palp segments longer than wide; anterior lateral opisthosomal setae *c3*, *d3*, *e2* 10–16 long (Fig. 13a) *Crossipalpus muellerianae*
 - Tarsi I–IV with seta *tc''* absent (setal formula ta I–IV 8(1)-8(1)-4-4) (Fig. 21); prodorsal setae *v2* subequal in length to *sc1* (15–20, 17–20 long, respectively); palp segments as long as wide; anterior lateral opisthosomal setae *c3*, *d3*, *e2* 19–24 long (Fig. 19a) *Crossipalpus verticillatae*
 - 14. Femora and genua I–II with *d* seta spatulate (Fig. 28); ventral setae *ag*, *gl–2*, *ps1–2* thick, broadly lanceolate, strongly barbed (Fig. 27a); dorsal setae broadly lanceolate (Fig. 25a) *Crossipalpus gersoni*
 - Femora and genua I–II with *d* seta lanceolate (Fig. 34); ventral setae *ag*, *gl–2*, *ps1–2* thin, setiform, weakly barbed (Fig. 33a); dorsal setae narrowly lanceolate (Fig. 32a) *Crossipalpus raveni*
 - 15. Ventral setae *gl–2* and *ps1–2* thick, broadly lanceolate, strongly barbed; setae *ag* palmate, strongly barbed (Fig. 76a); femora and genua I–II with *d* seta palmate (Fig. 75) *Pentamerismus sititoris*
 - Ventral setae *gl–2* fine, setiform, weakly barbed; *ps* setae fine, setiform; *ps1* thicker than *ps2–3*; setae *ag* setiform to lanceolate (Fig. 89a); femora and genua I–II with *d* seta lanceolate to weakly spatulate (Fig. 90) 16
 - 16. Palp tibia with 1 seta (Fig. 88b); ventral setae *ag* fine, setiform (Fig. 89a); dorsal cuticle with broad rounded folds (Figs 88a, 94) *Pentamerismus hicklingorum*
 - Palp tibia with 2 setae (Fig. 82b); ventral setae *ag* lanceolate (Fig. 83); dorsal cuticle weakly reticulate (Fig. 82a) *Pentamerismus wardo*
 - 17. Dorsal opisthosomal setae *f2* present (Fig. 38) *Magdalenapalpus strandtmanni*
 - Dorsal opisthosomal setae *f2* absent (Fig. 42) 18
 - 18. Distance between dorsal opisthosomal setae *d1–d1* 26–30, *e1–e1* 23–25; dorsal setae broadly lanceolate (Fig. 42) *Magdalenapalpus caperatus*
 - Distance between dorsal opisthosomal setae *d1–d1* 11–16, *e1–e1* 9–13; dorsal setae narrowly lanceolate (Fig. 48a) *Magdalenapalpus forsteri*
 - 19. Dorsal lateral cuticle smooth to moderately papillate; sejugal zone smooth or weakly striate (Fig. 105) 20
 - Dorsal lateral cuticle strongly papillate; sejugal zone coarsely striate to papillate (Fig. 98a) 21
 - 20. Dorsal lateral cuticle moderately and irregularly papillate; medial opisthonotum smooth or with few coarse striae (Fig. 105) *Philippipalpus nigraquercus*
 - Dorsal lateral cuticle smooth anteriorly, becoming more papillate posteriorly; medial opisthosoma with coarse striae (Fig. 103a) *Philippipalpus belah*
 - 21. Prodorsum coarsely rugose, forming polygons medially; opisthonotum with coarse striations (Fig. 98a) *Philippipalpus flumaquercus*
 - Prodorsum finely reticulate, forming network of small cells medially; opisthonotum rugose-papillate medially with patches of reticulation sublaterally (Fig. 95a) *Philippipalpus agohoi*

Discussion

Host specificity. Nineteen species of flat mites are now known from she-oaks, all of which are host-specific (Table 2). Three host species, *Allocasuarina luehmannii*, *Casuarina cristata* and *C. equisetifolia* harbour the greatest diversity of flat mites of all she-oaks sampled to date, each with three species in three different genera. Although the high host specificity of these mites might imply potential on their behalf as biological control agents, any impact these mites have on their hosts is not known. We also caution that our samples are based on a limited survey and further collecting may, of course, reveal polyphagous species.

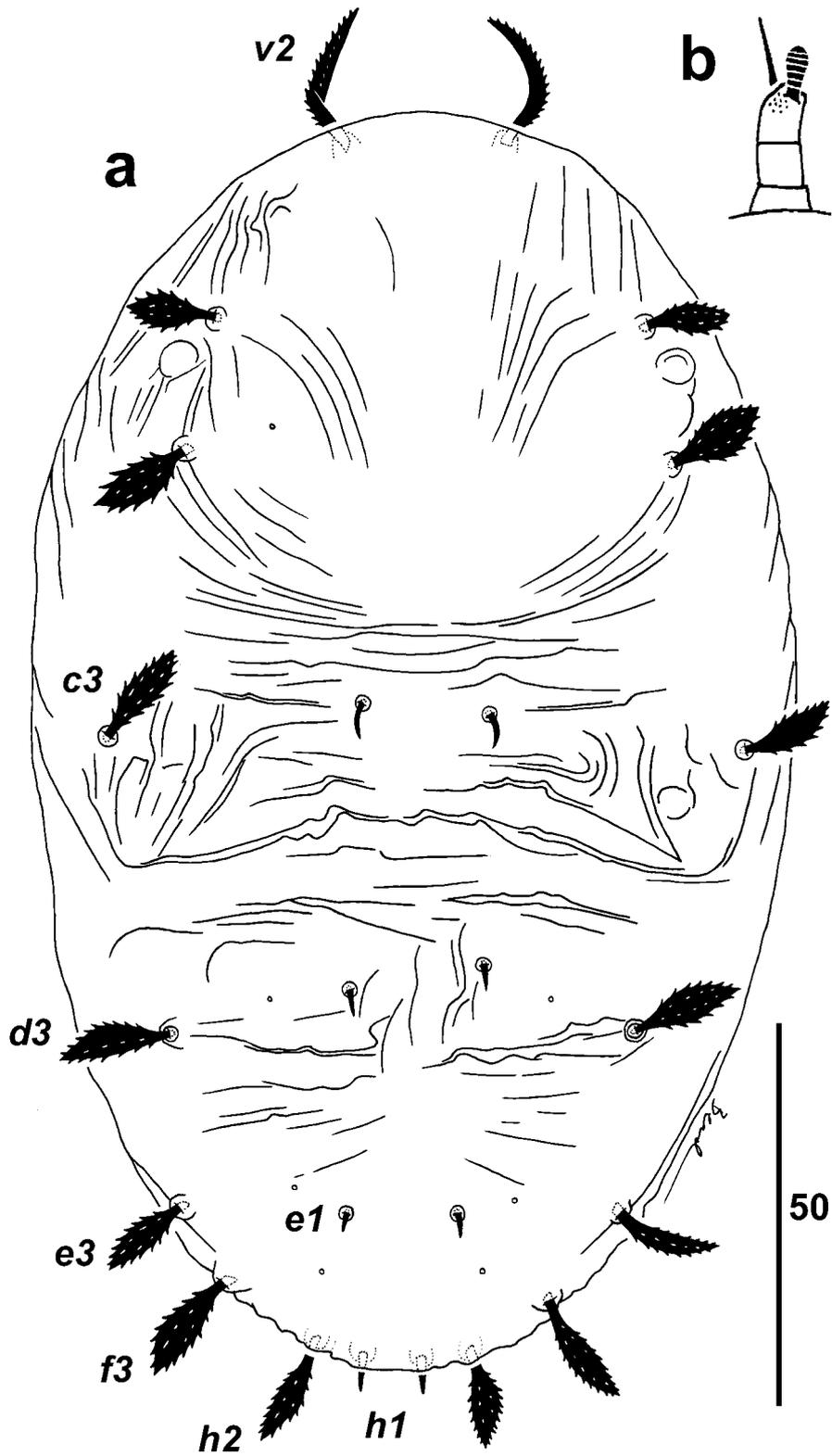


FIGURE 120. *Tegopalpus conicus* Womersley, larva, type locality, a. dorsum; b. detail of palp (scale bar for palp = 25 μ m).

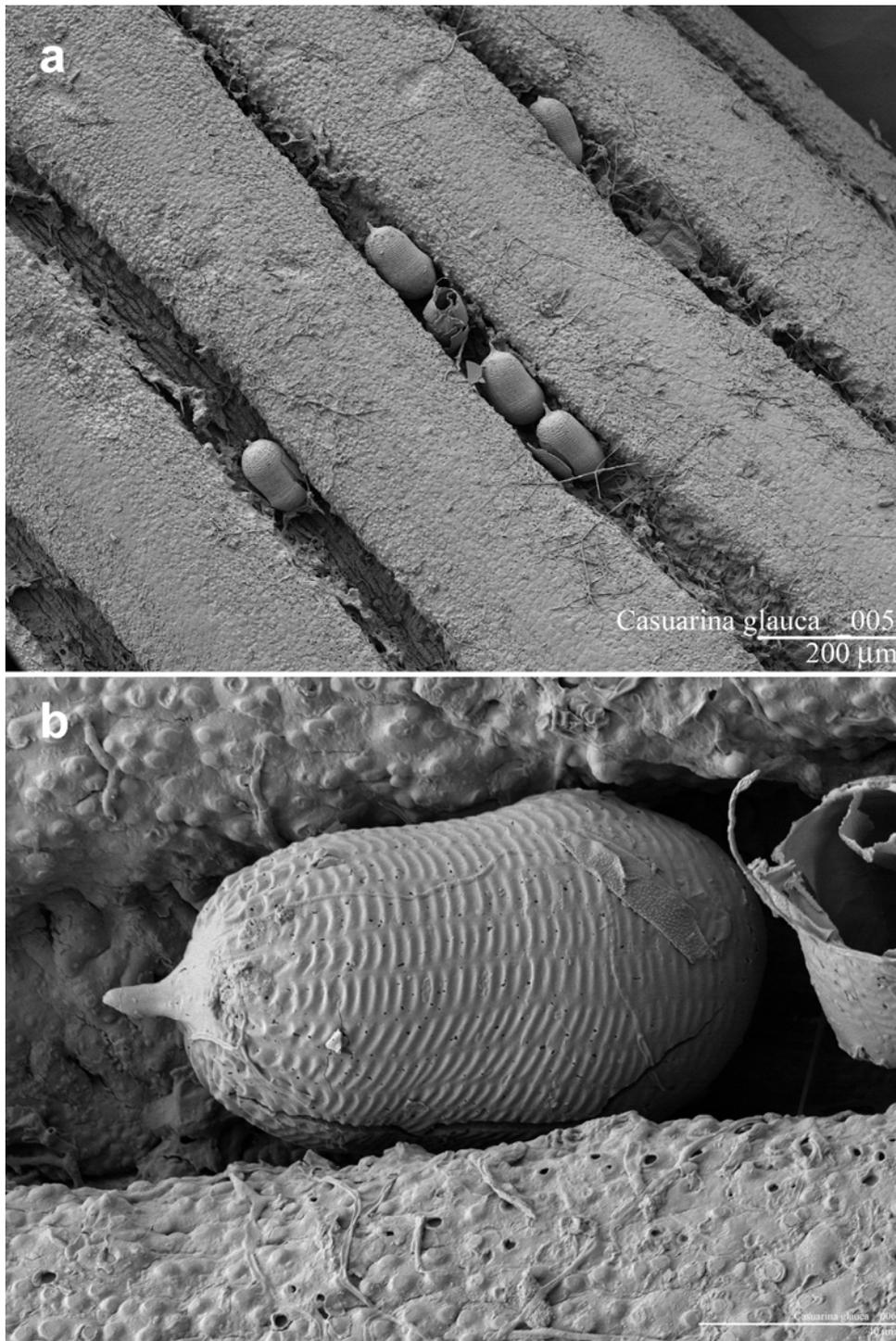


FIGURE 121. *Tegopalpus conicus* Womersley, eggs, type locality, a. in habitat; b. detail of egg, note stipe.

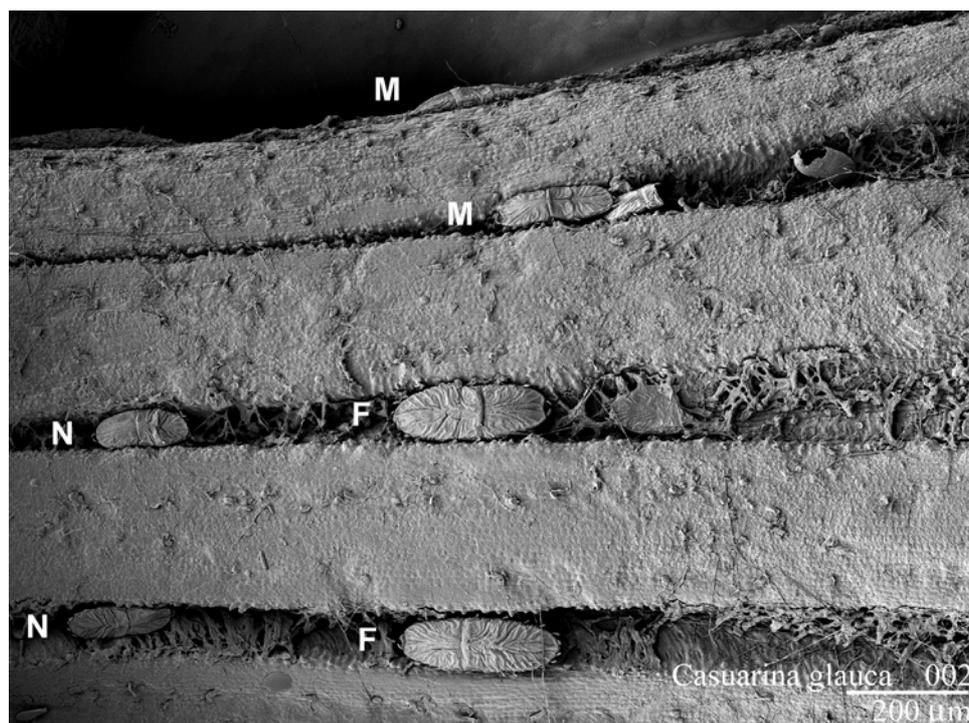


FIGURE 122. *Tegopapulus conicus* Womersley, type locality, in habitat (F = adult female, M = adult male, N = nymph).

TABLE 2. Host and region records for Tenuipalpidae from Casuarinaceae.

Mite species	Host species	Locality
<i>Chaudhripalpus costacola</i> Beard & Seeman	<i>Casuarina cristata</i>	Northern New South Wales
<i>Chaudhripalpus creelae</i> (Smiley <i>et al.</i> 1996)	<i>Allocasuarina luehmannii</i>	South Australia
<i>Crossipalpus gersoni</i> Beard & Seeman	<i>Allocasuarina luehmannii</i>	Middle-eastern Queensland
<i>Crossipalpus muellerianae</i> Smiley <i>et al.</i> 1996	<i>Allocasuarina muelleriana</i>	South Australia
<i>Crossipalpus raveni</i> Beard & Seeman	<i>Allocasuarina inophloia</i>	Southern Queensland
<i>Crossipalpus verticillatae</i> Smiley <i>et al.</i> 1996	<i>Allocasuarina verticillata</i>	South Australia
<i>Magdalenapalpus strandtmanni</i> (Smiley <i>et al.</i> 1996)	<i>Allocasuarina luehmannii</i>	South Australia
<i>Magdalenapalpus caperatus</i> Beard & Seeman	<i>Casuarina equisetifolia</i>	Northern Territory
<i>Magdalenapalpus forsteri</i> Seeman & Beard	<i>Allocasuarina torulosa</i>	Southeast Queensland
<i>Meyeraepalpus delfinadae</i> Smiley <i>et al.</i> 1996	<i>Allocasuarina muelleriana</i>	South Australia
<i>Palpipalpus hesperius</i> Beard & Seeman	<i>Allocasuarina sp.</i>	Southwest Western Australia
<i>Pentamerismus hicklingorum</i> Seeman & Beard	<i>Casuarina equisetifolia</i>	Southeast Queensland
<i>Pentamerismus sititoris</i> Beard & Seeman	<i>Casuarina cristata</i>	Central-western New South Wales
<i>Pentamerismus wardo</i> Seeman & Beard	<i>Allocasuarina scleroclada</i>	Western Australia
<i>Philippipalpus agohoi</i> Corpuz-Raros 1978	<i>Casuarina equisetifolia</i>	The Philippines
<i>Philippipalpus belah</i> Beard & Seeman	<i>Casuarina cristata</i>	Central-northern New South Wales
<i>Philippipalpus flumaquercus</i> Beard & Seeman	<i>Casuarina cunninghamiana</i>	Southeast Queensland
<i>Philippipalpus nigraquercus</i> Seeman & Beard	<i>Allocasuarina littoralis</i>	Australian Capital Territory
<i>Tegopalpus conicus</i> Womersley 1940	<i>Casuarina glauca</i>	Coastal New South Wales, Southeast Queensland

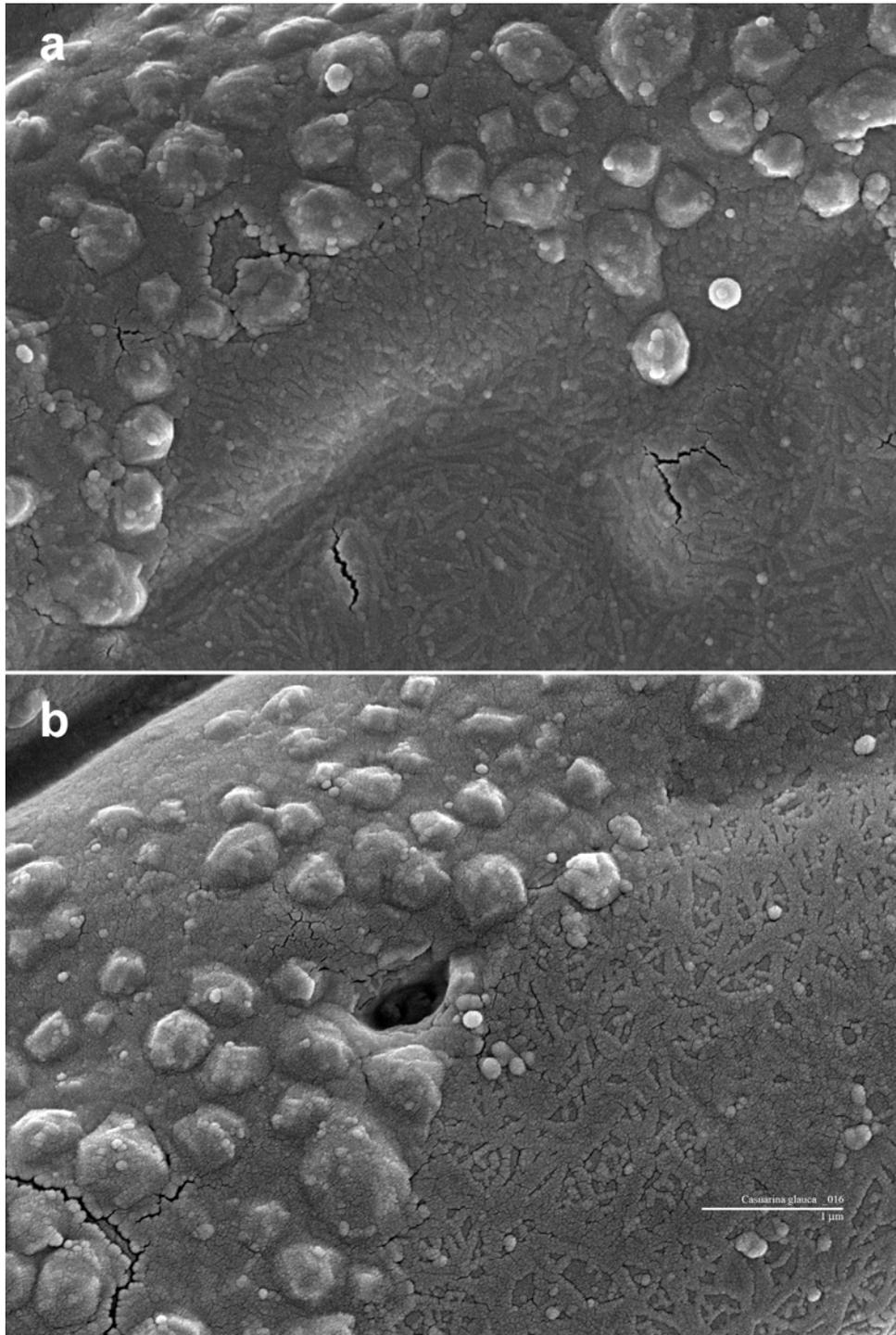


FIGURE 123. *Tegopalpus conicus* Womersley, detail of microplate formation (*sensu* Welbourn *et al.* 2003), a. adult female from type locality; b. adult female from northern locality.

This high host-specificity is almost matched by the trioqid plant lice (Hemiptera: Triozidae), where the genera *Aacanthocnema*, *Acanthocasuarina* and *Casuarinicola* are monophagous or oligophagous parasites of she-oaks (Taylor *et al.* 2010, 2011). The former two genera are found only on *Allocasuarina* and the latter genus only on *Casuarina*, and all but one or two of the 17 species in these genera are host specific. Unlike the trioqid plant lice, she-oak associated flat mite genera utilise both *Allocasuarina* and *Casuarina*, with the exception of *Crossipalpus*, whose four known species have been collected from *Allocasuarina* only. The she-oak *Gymnostoma australianum* from North Queensland was sampled on two occasions, but no flat mites were found.

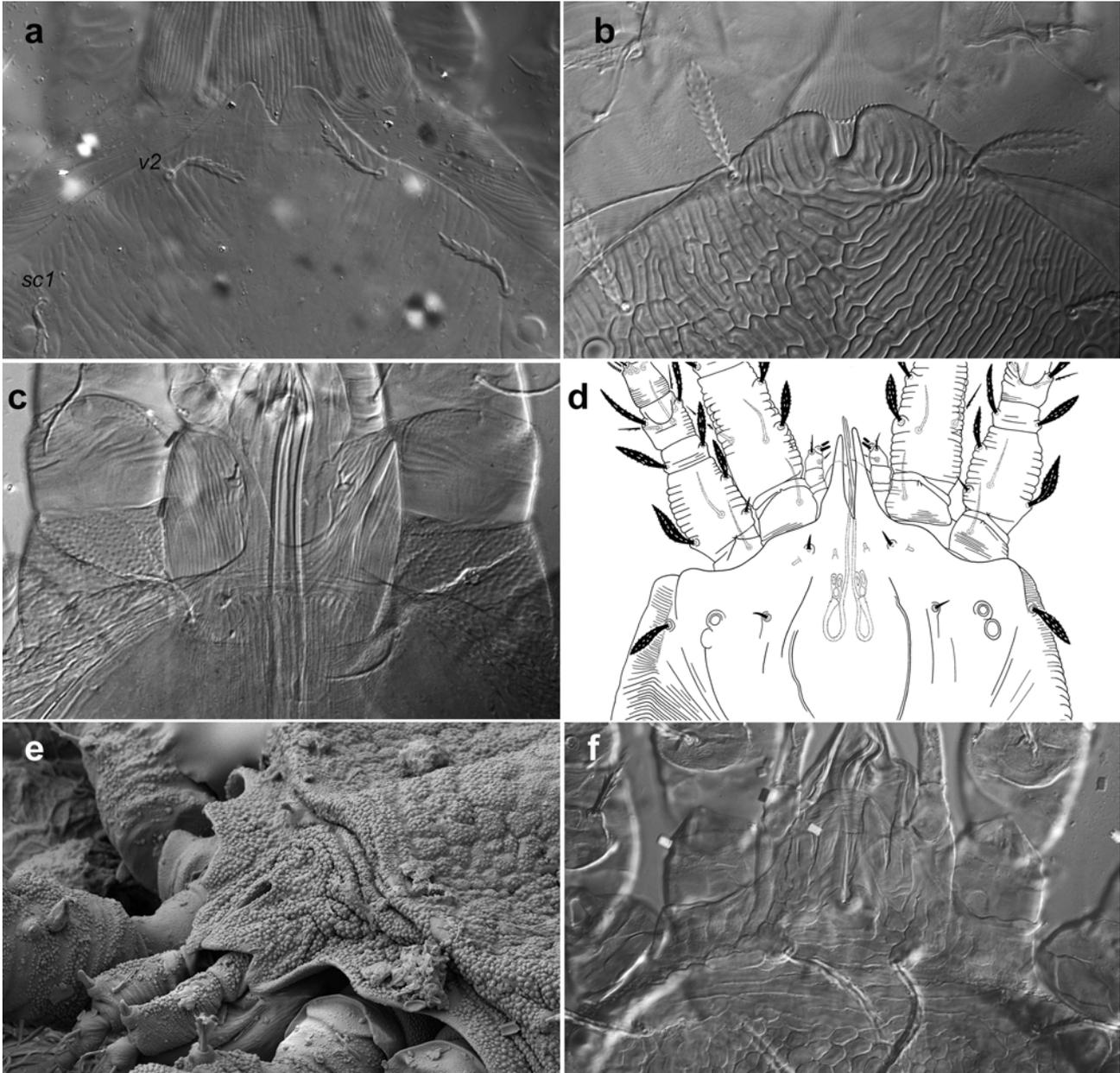


FIGURE 124. Anterior margin of prodorsum, a. *Aegyptobia alpinensis* Baker and Tuttle; b. *Pentamerismus* sp.; c. *Pseudoleptus arechavaletae* Bruyant; d. *Acaricis plana* Beard and Gerson; e. *Brevipalpus obovatus* Donnadieu; f. *Cenopalpus spinosus* (Donnadieu).

Dorsal setation and ontogeny. Ontogeny is one possible source of additional information on setal nomenclature. Immature life stages, especially larvae, can express ancestral setal positions, which helps designate these setae in later stages (e.g. Beard & Walter 2010). However, all the taxa dealt with here have larval setal positions approximately matching those in the adult stage. For example, in taxa where dorsal opisthosomal seta *e2* is lateral (and could be interpreted as *e3*), such as *Crossipalpus* and *Magdalenapalpus*, this seta is also lateral in the larva. Providing descriptions of immature stages also offers important information on ontogenetic additions to the legs, while allowing species-level identifications from all active life stages.

Leg setation, ontogeny and phylogeny. Naming setae on leg segments can be complicated by shifts in setal positions, as setal homologues often compensate for reductions or additions of other setae on the same segment (Lindquist 1985a). As Lindquist (1985a) indicates, the few previous attempts to apply Grandjean's (1958) notation to the Tetranychoidae have been clouded by this problem of position, whereby setae were named based on the actual position instead of taking into account the positional shifts of setal homologues in different species.

TABLE 3. Trochantal and femoral setae in the Tenuipalpidae from Casuarinaceae and other Tegopalpinae. Note: *Australopalpus alphitoniae* also has seta *l''* on femur I-II, which is atypical for the Tenuipalpidae.

	Tr I-II		Tr III		TrIV		Fe I-II			Fe III		FeIV
	v'	l'	v'	v'	d	v'	bv''	d	ev'	ev'		
<i>Australopalpus alphitoniae</i>	+	+	-	-	+	+	+	-	+	+		
<i>Chaudhripalpus costacola</i>	-	+	-	-	+	+	+	+	+	+		
<i>Chaudhripalpus creelae</i>	+	+	-	-	+	+	+	+	+	+		
<i>Crossipalpus gersoni</i>	+	+	+	+	+	+	+	+	+	+		
<i>Crossipalpus muellerianae</i>	+	+	+	+	+	+	+	+	+	+		
<i>Crossipalpus raveni</i>	+	+	+	+	+	+	+	+	+	+		
<i>Crossipalpus verticillatae</i>	+	+	+	+	+	+	+	+	+	+		
<i>Magdalenapalpus caperatus</i>	-	+	-	-	+	+	+	+	+	+		
<i>Magdalenapalpus forsteri</i>	-	+	-	-	+	+	+	+	+	+		
<i>Magdalenapalpus strandtmanni</i>	-	+	-	-	+	+	+	+	+	+		
<i>Meyeraepalpus delfinadae</i>	+	+	+	+	+	+	+	-	+	+		
<i>Palpipalpus hesperius</i>	+	+	+	+	+	+	+	+	+	+		
<i>Pentamerismus hicklingorum</i>	+	+	+	+	+	+	+	+	+	+		
<i>Pentamerismus sititoris</i>	+	+	+	+	+	+	+	+	+	+		
<i>Pentamerismus wardo</i>	+	+	+	+	+	+	+	+	+	+		
<i>Philippipalpus</i> spp.	-	+	-	-	+	+	+	+	+	+		
<i>Tegopalpus conicus</i>	-	+	-	-	+	+	+	+	+	+		

TABLE 4. Genual and tibial setae in the Tenuipalpidae from Casuarinaceae and other Tegopalpinae.

	Ge I-II			Ge III		Ti I-II			Ti III-IV		
	l'	l''	d	l'	d	l'	v'	v''	d	v'	v''
<i>Australopalpus alphitoniae</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Chaudhripalpus creelae</i>	-	-	-	-	+	+	+	+	+	+	+
<i>Chaudhripalpus costacola</i>	-	-	-	-	+	+	+	+	+	+	+
<i>Crossipalpus gersoni</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Crossipalpus muellerianae</i>	-	+	-	-	+	+	+	+	+	+	+
<i>Crossipalpus raveni</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Crossipalpus verticillatae</i>	-	+	-	-	+	+	+	+	+	+	+
<i>Magdalenapalpus caperatus</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Magdalenapalpus forsteri</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Magdalenapalpus strandtmanni</i>	-	-	+	-	+	+	+	+	+	+	+
<i>Meyeraepalpus delfinadae</i>	+	+	+	+	+	+	+	+	+	+	+
<i>Palpipalpus hesperius</i>	-	+	+	-	+	+	+	+	+	+	+
<i>Pentamerismus sititoris</i>	+	+	+	+	+	+	+	+	+	+	+
<i>Pentamerismus wardo</i>	+	+	+	+	+	+	+	+	+	+	+
<i>Pentamerismus hicklingorum</i>	+	+	+	+	+	+	+	+	+	+	+
<i>Philippipalpus</i> spp.	-	-	+	-	+	+	+	+	-	+	+
<i>Tegopalpus conicus</i>	-	-	-	-	+	+	+	-	+	+	-

TABLE 5. Tarsal setae in the Tenuipalpidae from Casuarinaceae and other Tegopalpinae.

	Ta I-II					Ta III-IV								
	u'	u''	p'	p''	tc'	tc''	ft'	ft''	ω''	u'	u''	tc'	tc''	ft'
<i>Australopalpus alphonsoniae</i>	+	+	+	+	+	-	+	+	+	+	+	+	+	+
<i>Chaudhripalpus creelae</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Chaudhripalpus costacola</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Crossipalpus gersoni</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Crossipalpus muellerianae</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Crossipalpus raveni</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Crossipalpus verticillatae</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Magdalenapalpus caperatus</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Magdalenapalpus forsteri</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Magdalenapalpus strandtmanni</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Meyeraepalpus delfinadae</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Palpipalpus hesperius</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pentamerismus hicklingorum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pentamerismus sititoris</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pentamerismus wardo</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Philippipalpus</i> spp.	+	+	+	+	+	-	+	+	+	+	+	+	-	+
<i>Tegopalpus conicus</i>	+	+	+	+	+	-	+	+	+	+	+	+	-	+

The basic pattern of setae on trochanters I–IV for the Tenuipalpidae and Tuckerellidae is 1-1-2-1, in which seta v' is present on all trochanters and a second seta, l' , is present on tr III (l' is also present in Linotetranidae, though v' is absent on tr III–IV). The general pattern found on Tetranychidae is more derived, being 1-1-1-1, with v' present on each segment. In general, seta v' is added to tr I–III in the deutonymph, but is suppressed on tr IV until the adult, and this ontogenetic pattern of expression of v' is shared by Tenuipalpidae and Tetranychidae. Tuckerellidae and Linotetranidae share a more derived pattern of expression of seta v' , in which v' is suppressed on tr I–IV of both the protonymph and deutonymph (Lindquist 1985a). The suppression of deutonymphal seta v' on trochanter IV until the adult represents an intermediate state towards the complete suppression of the seta on tr IV, as Lindquist (1985b) noted occurs in both the Tetranychidae and Linotetranidae. A similar pattern also occurs in some of the tenuipalpid genera considered here. Seta v' is fully suppressed on tr IV in the tenuipalpid genus *Chaudhripalpus*, additionally v' is suppressed on all trochanters of *Ch. costacola*, and is suppressed on tr I–II until the adult and completely on tr III–IV of *Ch. creelae*. Similarly, v' is suppressed on all trochanters of the genera *Magdalenapalpus*, *Philippipalpus* and *Tegopalpus*; while *Palpipalpus* adds v' to tr I and III in the deutonymph but suppresses seta v' on both tr II and IV until the adult stage.

There are no ontogenetic additions made to the femora or tibiae of the Tenuipalpidae in general. The basic tenuipalpid pattern of femoral setae, 3-3-2-1, almost matches that for the larva/protonymph of the Tetranychidae, 3-3-2-2, with the former having seta d absent on fe IV. The Tenuipalpidae and other tetranychoid families are more derived than the Tetranychidae in this manner, with the widespread absence of d on fe IV (Lindquist 1985b). The basic larval pattern of d , v' and bv'' on fe I–II, is shared across all tetranychoid families. There is a general suppression of setal additions on fe III–IV after the protonymph in tetranychoid families other than Tetranychidae. The typical presence of only ev' on fe IV in the adult of Tenuipalpidae, Linotetranidae and Tuckerellidae represents the suppression of a protonymphal setae and is a possible synapomorphy for the three families (Lindquist 1985b).

The Tetranychidae have the richest complement of setae on the larval and protonymphal genera of all tetranychoid families, with 4-4-2-2 (Lindquist 1985a). The basic Tenuipalpidae pattern is 1-1-1-0 (with l' being the seta present on each segment). The addition of seta d to ge I–II in the deutonymph is shared across the Tetranychoidae (except for Bryobiinae), and the usual suppression of d on ge III–IV in the deutonymph of all families except Tetranychidae is a shared apomorphy. Setae d and l' are added to ge I–II, and no additions are made to ge III–IV, in the basic tenuipalpid deutonymph pattern. Likewise, there are no additions made to the genera in adult Tenuipalpidae and Linotetranidae.

The basic larval/protonymphal pattern for the tibiae in the Tetranychidae is 6-5-5-5, compared with 4-4-3-3 for the Tenuipalpidae. Many ontogenetic additions are made to the tibiae of the Tetranychidae, however there are no post-larval additions made to any tibiae for the species of Tenuipalpidae examined herein and many others. In fact, there is a complete lack of additions in the deutonymph and a near complete lack of additions in the adult, for all tetranychoid families except the Tetranychidae. With this in mind, the condition present in the Tetranychidae may represent apomorphic trends in setal additions rather than the condition in the other families being seen as apomorphic trends in setal suppression (Lindquist 1985b).

The only additions made to the tarsi in the basic Tenuipalpidae pattern are the tectals, *tc'* and *tc''*. The Tetranychidae are unique among tetranychoids for adding setae to all tarsi in the deutonymph and the adult, and for retaining primiventral setae *pv'-pv''* (Lindquist 1985a).

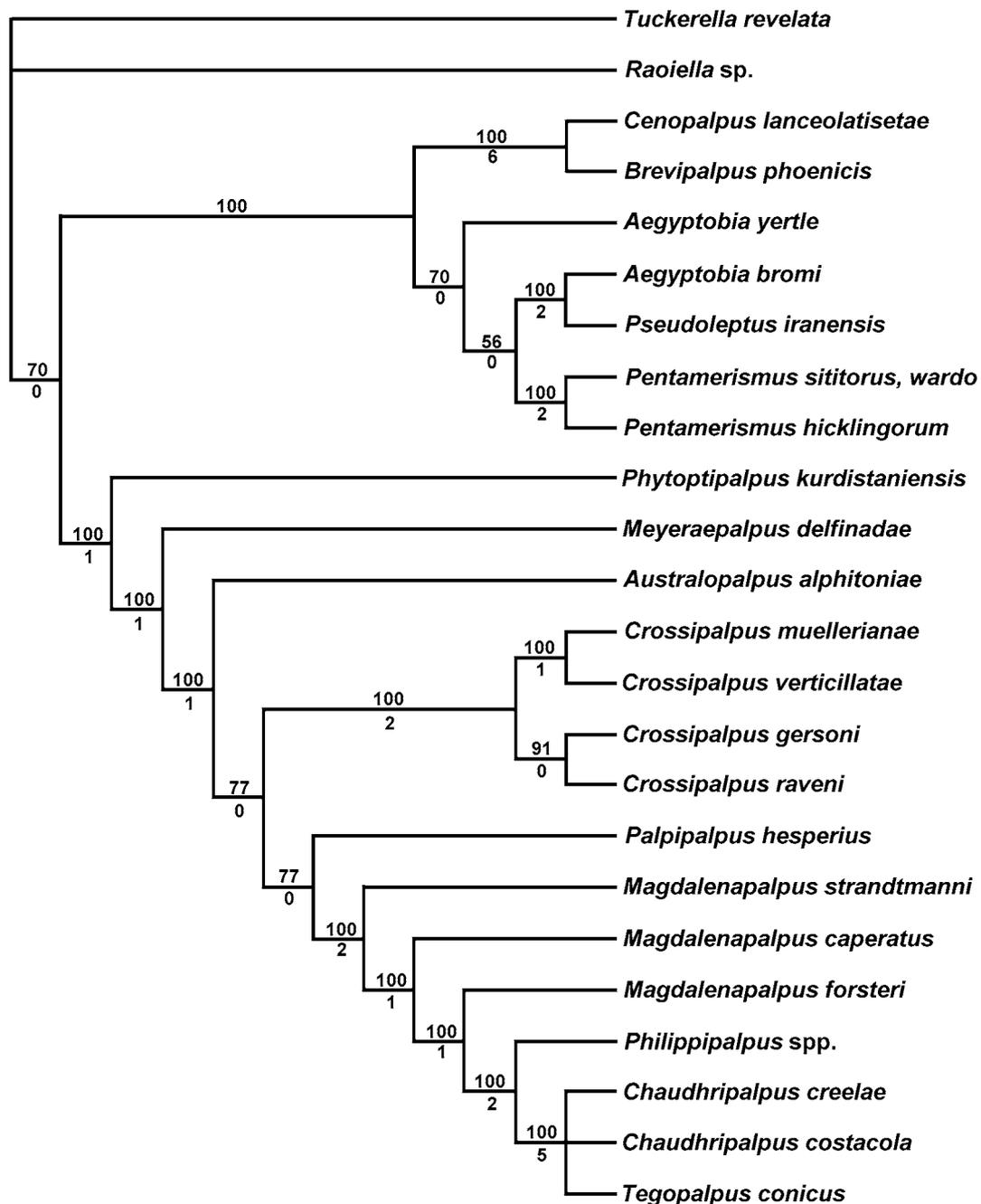


FIGURE 125. Majority-rule consensus tree (135 trees) of the mites found on Casuarinaceae and, with the inclusion of *Australopalpus alphitoniae*, the subfamily Tegopalpinae (Tenuipalpidae). Tenuipalpid mites included in the analysis not from the Tegopalpinae, and not from Casuarinaceae host plants, are: *Aegyptobia bromi*, *Ae. yertle*, *Brevipalpus phoenicis*, *Cenopalpus lanceolatisetae*, *Phytoptipalpus kurdistaniensis*, and *Raoiella* sp. The species *Tuckerella revelata* (Tuckerellidae) was selected as an outgroup. Bremer support values are shown below branches.

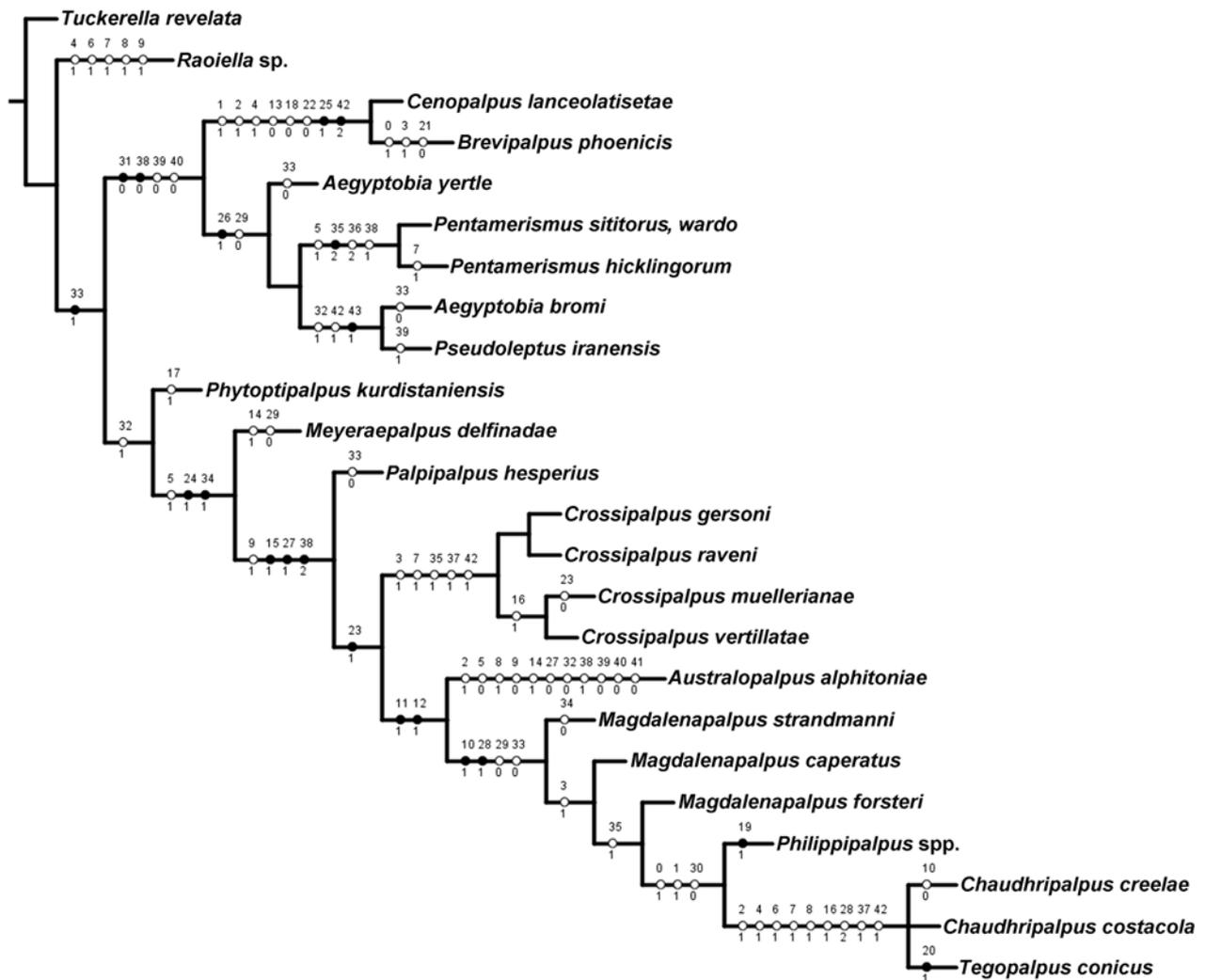


FIGURE 126. Selected most-parsimonious tree (from 135 trees) of the mites found on Casuarinaceae and, with the inclusion of *Australopalpus alphitoniae*, the subfamily Tegopalpinae (Tenuipalpidae). Character state changes are shown by filled (unique) or open (homoplasious) circles, with character number above and character state below the circle.

Phylogenetic analysis. The analysis of the character matrix (Table 7) found 135 trees (CI = 51; RI = 78) (Fig. 125). Branch support was generally poor, although the strong relationship between *Chaudhripalpus* and *Tegopalpus* was obvious, as was the close relationship of *Brevipalpus* and *Cenopalpus* (Fig. 126). *Aegyptobia* was paraphyletic (Fig. 125), confirming the reinstatement of *Meyeraepalpus*. The placement of *Ae. bromi* indicated that the *macswaini*-group of *Aegyptobia* could be moved to *Pseudoleptus*, as noted by Khanjani *et al.* (2012b). However, without a thorough analysis of these taxa no firm conclusions can be made. Indeed, the unusual placement of *Phytoptipalpus*—usually considered to be close to *Aegyptobia*, *Pentamerismus* and *Pseudoleptus* (e.g., Meyer & Van Dis 1993)—reflects that *Phytoptipalpus* lacks the shields found in the taxa coded for *Aegyptobia*, *Brevipalpus*, *Cenopalpus*, *Pentamerismus* and *Pseudoleptus* (characters 31, 38, 39, 40) (Table 7, Fig. 126).

Crossipalpus was monophyletic, being defined by five homoplasious characters (3, 7, 35, 37, 42). *Magdalenapalpus* and *Chaudhripalpus* were paraphyletic, but in each case their species are sister taxa. The position of *Australopalpus*, *Crossipalpus* and *Palpipalpus* was ambiguous, but in all trees *Meyeraepalpus* was the sister group to one of these taxa. *Australopalpus*, *Crossipalpus* or *Palpipalpus* was the sister group of the clade *Magdalenapalpus* (*Philippipalpus* (*Chaudhripalpus* + *Tegopalpus*)), which was recovered in all trees (Fig. 125), being defined by characters 10, 28, 29, and 33 (Table 7, Fig. 126).

TABLE 6. Characters used in the phylogenetic analysis of the mites found on Casuarinaceae and, with the inclusion of *Australopalpus alphonsoniae*, the subfamily Tegopalpinae. Characters 43–52 pertain to the outgroup *Tuckerella revelata* (Tuckerellidae). All characters designated "?" are inapplicable or unknown.

-
0. Seta *c2*: (0) present; (1) absent.
 1. Seta *d2*: (0) present (1) absent.
 2. Seta *e2*: (0) present; (1) absent.
 3. Seta *f2*: (0) present; (1) absent.
 4. Palp femur-genu: (0) separate; (1) fused (palp 3–4 segmented; 3-segmented palp is an autapomorphy of *Tegopalpus*).
 5. Palp femoral seta: (0) present; (1) absent.
 6. Palp tibial seta *l'*: (0) present; (1) absent.
 7. Palp tibial seta *l''*: (0) present; (1) absent.
 8. Palp tarsus: (0) 3 phaneres; (1) 2 phaneres (seta/eupathidium lost).
 9. Coxa I seta *lc*: (0) present; (1) absent.
 10. Trochanter I–II seta *v'*: (0) present; (1) absent.
 11. Trochanter III seta *v'*: (0) present; (1) absent.
 12. Trochanter IV seta *v'*: (0) present; (1) absent.
 13. Femur I–II seta *l'*: (0) present; (1) absent.
 14. Femur III seta *d*: (0) present; (1) absent.
 15. Genu I–III seta *l'*: (0) present; (1) absent.
 16. Genu I–II seta *d*: (0) present; (1) absent.
 17. Genu I–II seta *l''*: (0) present; (1) absent.
 18. Tibia I–II seta *l''*: (0) present; (1) absent.
 19. Tibia I–IV seta *v'*: (0) present; (1) absent. (autapomorphy in matrix for *Philippipalpus*)
 20. Tibia III–IV seta *d*: (0) present; (1) absent. (autapomorphy in matrix for *Tegopalpus*)
 21. Tarsus I, ω' : (0) present; (1) absent.
 22. Tarsus II, ω : (0) present; (1) absent.
 23. Tarsus I–IV seta *tc''*: (0) present; (1) absent.
 24. Gnathosoma concealment by prodorsum: (0) exposed; (1) partially to entirely covered (purported apomorphy for the Tegopalpinae).
 25. Rostral shield: (0) present; (1) absent.
 26. Prodorsal notch or fork: (0) absent; (1) present.
 27. Seta *v2*: (0) submarginal; (1) marginal, usually off prodorsal shield.
 28. Anterior prodorsal lobes: (0) absent; (1) fleshy lobes bearing setae *v2*; (2) fleshy lobes below prodorsal margin, anterior to setae *v2*.
 29. Pseudanal seta *ps3*: (0) present; (1) absent.
 30. Male solenidia: (0) similar in size to female; (1) much larger than female.
 31. Metapodal platelets: (0) present; (1) absent.
 32. Well defined dorsal shields: (0) present; (1) absent.
 33. Seta *c2*: (0) closer or equidistant to *c1*; (1) closer to *c3*.
 34. Seta *d2*: (0) well removed from *d3*; (1) close to *d3*.
 35. Seta *e2*: (0) submarginal; (1) almost marginal; (2) marginal.
 36. Seta *f2*: (0) submarginal; (1) almost marginal; (2) marginal.
 37. Dorsal longitudinal fissures: (0) absent; (1) present.
 38. Ventral shield: (0) differentiated by patterned or punctate cuticle; (1) with transverse or irregular striae; (2) longitudinal striae.
 39. Genital shield: (0) differentiated by patterned or punctate cuticle; (1) weakly sclerotised to transverse or irregular striae.
 40. Anal shield: (0) entirely well defined; (1) posterior margin poorly defined.
 41. Male genital shield: (0) present; (1) absent.
 42. Striae between setae *3a* and *4a*: (0) transverse; (1) longitudinal.
 43. Tarsal claw: (0) uncinat; (1) pad-like.
 44. Seta *v1*: (0) present; (1) absent.
 45. Seta *c4*: (0) present; (1) absent.
 46. Setae *c5-c7*: (0) present; (1) absent.
 47. Setae *d4-d6*: (0) present; (1) absent.
 48. Setae *h3*: (0) present; (1) absent.
 49. Setae *h4*: (0) present; (1) absent.
 50. Setae *h5-h8*: (0) present; (1) absent.
 51. Setae *g3*: (0) present; (1) absent.
 52. Palp tibial claw: (0) present; (1) absent.
-

TABLE 7. Character matrix for the data in Table 6. Genus abbreviations: *Tu.* (*Tuckerella*), *Ae.* (*Aegyptobia*), *Ph.* (*Phytoptipalpus*), *Ps.* (*Pseudoleptus*), *Ce.* (*Cenopalpus*), *B.* (*Brevipalpus*), *Au.* (*Australopalpus*), *Ch.* (*Chaudhripalpus*), *Cr.* (*Crossipalpus*), *Ma.* (*Magdalenapalpus*), *Me.* (*Meyeraepalpus*), *Pa.* (*Palpipalpus*), *Pe.* (*Pentamerismus*), *Te.* (*Tegopalpus*).

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
<i>Tu. revelata</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<i>Ae. bromi</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1
<i>Ae. yerle</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1
<i>Ph. kurdistanensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	0	0	0	0
<i>Ps. iranensis</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1
<i>Raoiella</i> spp.	0	0	0	0	1	0	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0
<i>Ce. lanceolatisetae</i>	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
<i>B. phoenicis</i>	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
<i>Au. alphonitoniae</i>	0	0	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	0	0
<i>Ch. creelae</i>	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	0
<i>Ch. costacola</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	0
<i>Cr. muellerianae</i>	0	0	0	1	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1	0	0	1	1	0	1	0	0	0
<i>Cr. verticillatae</i>	0	0	0	1	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1	0	0	1	1	1	1	1	0	0
<i>Cr. gersoni</i>	0	0	0	1	0	1	0	1	0	1	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	0	0
<i>Cr. raveni</i>	0	0	0	1	0	1	0	1	0	1	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	0	0
<i>Ma. strandmanni</i>	0	0	0	0	0	1	0	0	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	1	1	0	0
<i>Ma. caperatus</i>	0	0	0	1	0	1	0	0	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	1	1	0	0
<i>Ma. forsteri</i>	0	0	0	1	0	1	0	0	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	1	1	0	0
<i>Me. delfinadae</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0	0	0
<i>Pa. hesperius</i>	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	1	1	0	1	0	0	0
<i>Pe. sitorius, wardo</i>	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1
<i>Pe. hicklingorum</i>	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	1
<i>Philippipalpus</i> spp.	1	1	0	1	0	1	0	0	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	0	0
<i>Te. conicus</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0

..... continued on the next page

TABLE 7. (continued)

	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
<i>Tu. revelata</i>	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
<i>Ae. bromi</i>	0	0	0	?	0	1	0	0	0	0	0	0	0	0	?	1	1	1	1	1	1	1	1	1	1	1
<i>Ae. yertle</i>	0	0	0	?	0	0	0	0	0	0	0	0	0	0	?	0	0	1	1	1	1	1	1	1	1	1
<i>Ph. kurdistanensis</i>	0	0	1	?	1	1	1	0	0	0	0	1	1	1	?	0	0	1	1	1	1	1	1	1	1	1
<i>Ps. iranensis</i>	0	0	0	?	0	1	1	0	0	0	0	0	1	0	?	1	1	1	1	1	1	1	1	1	1	1
<i>Raoiella</i> spp.	0	0	1	0	1	0	0	0	0	0	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
<i>Ce. lanceolatisetae</i>	0	0	1	0	0	0	1	?	?	2	0	0	0	0	1	2	0	1	1	1	1	1	1	1	1	1
<i>B. phoenicis</i>	0	0	1	?	0	0	?	?	?	?	0	0	0	0	?	2	0	1	1	1	1	1	1	1	1	1
<i>Au.alphitoniae</i>	0	0	1	1	1	0	1	1	?	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1
<i>Ch. creetae</i>	1	2	0	?	1	1	?	?	?	?	1	2	1	1	?	1	0	1	1	1	1	1	1	1	1	1
<i>Ch. costacola</i>	1	2	0	?	1	1	?	?	?	?	1	2	1	1	?	1	0	1	1	1	1	1	1	1	1	1
<i>Cr. muelleriana</i>	1	0	1	?	1	1	1	1	1	?	1	2	1	1	1	1	0	1	1	1	1	1	1	1	1	1
<i>Cr. verticillatae</i>	1	0	1	1	1	1	1	1	1	?	1	2	1	1	1	1	0	1	1	1	1	1	1	1	1	1
<i>Cr. gersoni</i>	1	0	1	1	1	1	1	1	1	?	1	2	1	1	1	1	0	1	1	1	1	1	1	1	1	1
<i>Cr. raventi</i>	1	0	1	1	1	1	1	1	1	?	1	2	1	1	1	1	0	1	1	1	1	1	1	1	1	1
<i>Ma. strandmanni</i>	1	1	0	?	1	1	0	0	0	0	0	2	1	1	?	0	0	1	1	1	1	1	1	1	1	1
<i>Ma. caperatus</i>	1	1	0	?	1	1	0	1	0	?	0	2	1	1	?	0	0	1	1	1	1	1	1	1	1	1
<i>Ma. forsteri</i>	1	1	0	1	1	1	0	1	1	?	0	2	1	1	1	0	0	1	1	1	1	1	1	1	1	1
<i>Me. delphinadae</i>	0	2	0	1	1	1	1	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
<i>Pa. hesperius</i>	1	2	1	1	1	1	0	1	0	1	0	2	1	1	1	0	0	1	1	1	1	1	1	1	1	1
<i>Pe. sittiorus, wardo</i>	0	0	0	0	0	0	1	0	2	2	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1
<i>Pe. hicklingorum</i>	0	0	0	0	0	0	1	0	2	2	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1
<i>Philippipalpus</i> spp.	1	1	0	0	1	1	?	?	1	?	0	2	1	1	1	0	0	1	1	1	1	1	1	1	1	1
<i>Te. conicus</i>	1	2	0	0	1	1	?	?	?	?	1	2	1	1	1	1	0	1	1	1	1	1	1	1	1	1

The analysis recovered the Tegopalpinae in all trees, as defined by the gnathosoma being partially or completely covered by the gnathosoma, which is a synapomorphy for the Tegopalpinae. The tegopalpine branch was also supported by the loss of the palp femoral setae (retained in *Au. alphonitoniae* only) and the close proximity of seta *d2* to *d3*. However, these characters are found in other non-tegopalpine taxa not included in this analysis, and seem less significant. The clade including all tegopalpines except *Me. delfinadae* was also recovered in all trees and was supported by the loss of seta *1c* (retained in *Au. alphonitoniae* only) and the loss of *l'* on genera I–III. This branch was also supported by the marginal position of seta *v2* (likely associated with the anterior propodosomal modifications of lobes or incisions) and the ventral shield being represented by longitudinal striae, which also occurs in some soft-bodied flat mites not included in this analysis

Coxal seta *1c* is absent in all Tegopalpinae except *Au. alphonitoniae* and *Me. delfinadae*, and is otherwise present in many Tenuipalpidae (Kane 2003; Beard, personal observations). Likewise, seta *l'* on genera I–III is absent in all Tegopalpinae except *Me. delfinadae*, but is usually present in other Tenuipalpidae—although we note it is absent in a few species of *Aegyptobia*, *Pentamerismus* and *Phytoptipalpus* (Kane 2003; Seeman & Beard 2011; personal observation by authors). The unusual genera *Krugeria*, *Obdulia* and *Obulooides* all lack seta *l'* on genera I–III, as does *Tenuipalpus pacificus* Baker 1945, but these genera do not seem at all closely related to the Tegopalpinae.

Australian Tenuipalpidae. Prior to this study, a total of 32 species (approx. 1,100 spp. world wide) in 19 genera (36 world wide) of Tenuipalpidae had been recorded from Australia, six species of which are assumed to be exotic (*): *Acaricis* (2 spp.), *Aegyptobia* (1 spp.), *Australopalpus* (1 sp.), *Brevipalpus* (4* spp.), *Chaudhripalpus* (1 sp.), *Crossipalpus* (2 spp.), *Cyperacarus* (2 spp.), *Dolichotetranychus* (2 spp.; including 1*), *Gahmiacarus* (2 spp.), *Lisaepalpus* (1 sp.), *Macfarlaniella* (1 sp.), *Magdalenapalpus* (1 sp.), *Meyeraepalpus* (1 sp.), *Prolixus* (2 spp.), *Raoiella* (1 sp.), *Tegopalpus* (1 sp.), *Tenuipalpus* (5 spp.; including 1*), *Ultratenuipalpus* (1 sp.), *Urigeronnis* (1 sp.) (Hirst 1924; Baker & Pritchard 1962; Smiley & Gerson 1995; Beard *et al.* 2005; Beard & Gerson 2009; Mesa *et al.* 2009; Beard & Ochoa 2011). Our work brings the total number of Tenuipalpidae species in Australia to 44 species in 22 genera (and 38 world wide). Although the Australian fauna represents only 4.6% of the total world fauna, more than half of the known genera are found in Australia (22/38), and over a third of these genera are Australian endemics (14/38). This gives Australia the highest generic level endemicity in the world and indicates an extraordinarily high diversity in this region. The family Casuarinaceae alone harbours nine genera, *Chaudhripalpus*, *Crossipalpus*, *Magdalenapalpus*, *Meyeraepalpus*, *Palpipalpus*, *Pentamerismus*, *Philippipalpus*, *Tegopalpus* and *Ultratenuipalpus* (22% of world genera), and seven of these are not known from any other host.

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