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An amazing sub-cambium flat mite from South Africa (Acari: Trombidiformes: Tenuipalpidae)

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Original research

ABSTRACT

An unusual sub-cambium flat mite, *Phytoptipalpus occultuae* **sp. n.**, first found under the bark in blisters on stems of *Senegalia caffra* in Pretoria, South Africa is described and illustrated herein. This is a unique species in the genus *Phytoptipalpus* because of the presence of reduced legs IV, a possible link between those with 4 pairs and 3 pairs of legs. A key to all of the *Phytoptipalpus* species is given.

Keywords flat mites; *Phytoptipalpus ceridium* group; *Senegalia caffra*; blisters; new taxa; plant feeding mite; Leguminosae
Zoobank http://zoobank.org/6DC9C238-56F5-48F2-BAE9-4CE08694D518

Introduction

The genus *Phytoptipalpus* (Acari: Tenuipalpidae) comprises 21 species (Mesa *et al*., 2009, Khanjani *et al.*, 2012, Khanjani *et al.*, 2013, Alatawi *et al.* 2015 and Kamran *et al*., 2017). Mesa *et al*. (2009) listed 17 species in the genus. Since then, Khanjani *et al*. (2012) described *P. kurdistaniensis* and moved *Aegytobia salicicola* Al-Gboory *to Phytoptipalpus*, but later Khanjani *et al*. (2013), synonymised *P. kurdistaniensis* with *P. rosae* (Mitrofanov and Strunkova). Alatawi *et al*. (2015) described *P. phoenicis* and Kamran *et al*. (2017) transferred *Aegyptobia eupharatica* Al-Gboory, 1987 and *A. populus* Papaioannou-Souliotis, 1986 to the genus *Phytoptipalpus*.

This very interesting *Phytoptipalpus* species was discovered under the bark in blisters on younger branches of *Senegalia caffra* (Thunb.) Hurter and Mabb. (Leguminosae) in 2009 in Pretoria, South Africa. Though all *Senegalia* species contain cyanogenic glycosides which are potentially poisonous, it obviously has no effect on these mites (Conn, 2008). These small, bright red, flat mites were found in groups in small waxy, clam shell-shaped structures under the bark of the tree, typically in closed blisters with a soft, green, cellular base with a raised centre. The type species *P. paradoxus* Trägårdh, a 3-legged species, cause galls on *Acacia nilotica* (L.) Delile, Sayed (1942). Symptoms caused by other *Phytoptipalpus* spp. are not clear from literature. The species belongs to the *P. ceridium* species group which has setae *f2* present (Baker and Tuttle, 1987, Meyer and Van Dis, 1993). However, asymmetrical variations in the number of sub lateral or lateral opisthosomal setae occur in this species. It is also one of four species in the genus in which the adult females have three pairs of legs, though in this case leg IV is much reduced leaving a setae-bearing remnant. Adult males of this species have four pairs of legs.

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Material and methods

Samples of bark and stems with slight swellings were removed from a *Senegalia caffra* (Common Hookthorn) tree found on the Rietondale campus, of the then ARC-Plant Protection Research Station, Gauteng Province, Pretoria, South Africa. Shoots were also collected from the same host in Schoemansville, North West Province, South Africa, and placed in a bag. The mites were exposed by slicing off the dome-shaped roof of the cavities and examined in the laboratory with a Zeiss Stereomicroscope and immediately collected with a 00 camel hair paintbrush and placed in 70 % and 96 % ethanol for mounting on microscope slides in PVA and for SEM studies. Mites mounted on microscope slides were dried in an oven at 45-50 degrees Celsius for 24 hours. Line drawings were made with the aid of a drawing tube and from photographs of the specimens taken with a Zeiss Axioskop TM Research microscope equipped with a Zen Soft Imaging System and measuring tools. All illustrations were edited using Adobe Illustrator C5. Specimens and bark fragments in 70 % ethanol were studied under the Low Temperature SEM (LTSEM), following the technique delineated by Bolton *et al*. (2014). Specimens were secured to 15 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 brass bar whose lower half was seating in liquid nitrogen (-196 °C). After ~30 seconds, the holder containing the frozen sample was transferred to 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 sample was etched inside the cryotransfer system to remove any surface contamination (condensed water vapor) by raising the temperature of the stage to -90°C for ~15 min. Following etching, the temperature inside the chamber was lowered to -130 °C, and the bark and 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 SEM for observation. An accelerating voltage of 5 kV was used to view the specimens. Images were captured using a 4pi Analysis System (Durham, NC, USA). Some specimens were mounted in different positions to capture their venter and mouth parts for imaging.

All measurements are given in micrometres (µm) as a range (paratype measurements) followed by the holotype measurements in square brackets. Setae were measured from the centre of the setal base to the tip of the seta. Body length was measured between setae *v2* to *h1* and width at level of *sc2–sc2* (Saito, *et al*., 1999). Leg setal numbers are written as the total number of phaneres followed by number of solenidia in parentheses.

Taxonomy

Family Tenuipalpidae Berlese

Phytoptipalpus Trägårdh, 1904

Smith Meyer and Van Dis (1993) and as updated by Alatawi *et al*., (2015) defined the genus as having, palpus 5-segmented, with or without setae on second segments and 3 phaneres on distal segment (except *P. salicicola* with one); propodosoma with 3 pairs of setae; opisthosoma with 12 or 13 pairs of setae with *f2* absent or present (not *e3* as in Smith Meyer and Van Dis, 1993); genital shield well defined with 2 pairs of genital setae; intercoxal setae *3a* and *4a* present (*4a* can be absent), one pair of aggenital and 2 pairs of anal setae (ps1-ps2). Leg IV can be absent. However, this study revealed the following additional characters for the genus: Tarsi I and II bear either eight setae and a solenidion or six setae and a solenidion (in species with three legs) and setae *m* on the venter of the gnathosoma can be absent or present. Leg IV can also be reduced.

Phytoptipalpus occultuae sp. nov. Ueckermann, Ochoa and Bauchan

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Material examined (Fig. 1A) — Holotype. Female, 32 paratype females, 13 paratype males, 5 paratype deutonymphs, 2 paratype protonymps and 9 paratype larvae, from *Senegalia caffra* (Thunb.) Hurter and Mabb. (Leguminosae), from twigs with irregular bumps and lifted bark, Gauteng, Rietondale, Pretoria, S 25°43'42", E 28°14'01", South Africa, 6 March 2008, S. Neser; 39 paratype females and 2 paratype nymphs from *Senegalia caffra*, same symptoms, North-West Province, Schoemansville, S 25°43′14″, E 27°53'10", South Africa, 29 June 2015, S. Neser.

Type deposition — The holotype and some paratypes will be deposited in the National Collection of Arachnida, ARC-Plant Health and Protection Research (NCA-PPRI), Pretoria, South - Africa and some of the other paratypes in the British Museum (BMNH), London, England, and the National Insect and Mite Collection of the National Museum of Natural History, Smithsonian Institution, located at the Systematic Entomology Laboratory (SEL), USDA, Beltsville, Maryland, USA (USNM).

Diagnosis — Opisthosomal setae varying between 13-27 in length; 16 pairs of setae uniform and plumose. Femora I–II with four setae (*d, l', v', bv"*); genua I–III without setae; coxae I with two setae; coxae II–III each with one seta (setae *3b* present, *4b* present or absent). Leg IV reduced with 0 to 4 setae.

Description. Female (n=18) — **Dorsum**. (Figs.2, 4B, 6A-B) Natural colour of mites red. Body measurements: length between setae *v2–h1* 282–343 [286], width between setae *sc2–sc2* 191–238 [204]. Propodosoma irregularly striate medially, longitudinally sublaterally and again irregularly laterally, with two pairs of small eyes and setae *v2, sc1* and *sc2* short and plumose (Fig. 6B); opisthosoma also striate, mostly transverse but with irregular patches, with 13 pairs of short plumose setae gradually becoming longer caudally; asymmetry in the number of dorsal setae is prominent; in 70 females examined one member of the following setal pairs: *v2, sc1, sc2, c1, c2, c3, e2, e3, f2, f3* and *h1* is absent in: two, three, one, one, one, two, three, four, two, seven and four specimens, respectively, rest was normal. Both members of setae *e2* are absent in one specimen. Dorsal setal measurements: *v2* 11–20 [18], *sc1* 13–20 [17], *sc2* 17–22 [19], *c1* 12–16 [15], *c2* 15–20 [18], *c3* 18–25 [21], *d1* 12–17 [15], *d2* 16–20 [18], *d3* 18–24 [20], *e1* 12–18 [15], *e2* 17–22 [21], *e3* 19–26 [22], *f2* 16–21 [17], *f3* 18–27 [20], *h1* 16–21 [18], *h2* 18–25 [20]. Eyes present.

Venter. (Fig. 3) Cuticle completely covered with mostly transverse striae, including coxal fields but, anterior to coxal setae it is granulate. Setae *g1* and *g2* (some forked) inserted almost in transverse row on genital flap. Setae *1a* (with forked apices in some specimens), *3a* and *ag* smooth and flagellate (sometimes short, forked and serrate), with *4a* usually absent, however, some specimens with one or both *4a* setae. Setae *1b, 1c, 2c* (one member can be absent) present, *2b* absent, *3b* setae sometimes forked on one side and absent on the other, *4b* mostly absent, but when present is smooth; setae *g1, g2, ps1* and *ps2* serrate. Setal measurements: *1a* 41–66 [40], *1b*, 22-31 [23], *1c* 20–30 [24], *2*c 31–49 [29], *3a* 42–78 [34], *3b* 20–40 [32], *4a* 31–64 [absent], *4b* 21–28 [31], *ag* 12–52 [52], *g1* 11–20 [14], *g2* 11–15 [13], *ps1* 8–12 [12], *ps2* 10–13 [10].

Gnathosoma. (Figs. 3, 7A-D) Length of gnathosoma 77-90 [88]. Palps five-segmented. Setal formula: 0-1-0-1-3(ω). Palp tarsus with one solenidion 4–5 [4] and one eupathidium with tapered tip 7–8 [6] distally, one serrate seta 7–9 [7]; palp tibia with one smooth seta 11–14 [11], palp genu and trochanter without setae and palp femur with one serrate seta 7-10 [8]. Palp coxa with dorsal spine. Cheliceral stylets distally with lateral serrations (Fig. 7C-D). Oesophagus well sclerotised. Seta *m* on venter of gnathosoma absent (Fig. 7B).

Spermatheca. (Fig. 4A) Proximally a slender tube but distal half with coils and creases (40-50) and a smooth oval ending.

Legs. (Figs. 4C-D, 5A-K, 7E-F) Lengths of legs (trochanter to tip of empodium): I: 87 - 114 [105], II: 75 - 104 [97], III: 75 - 97 [91]. Setal formula for legs I–III (coxae to tarsi): 2-1-4-0-4-6(1); 1-1-4-0-4-6(1); 1-1-2-0-3-3, respectively. Leg IV reduced with zero to three

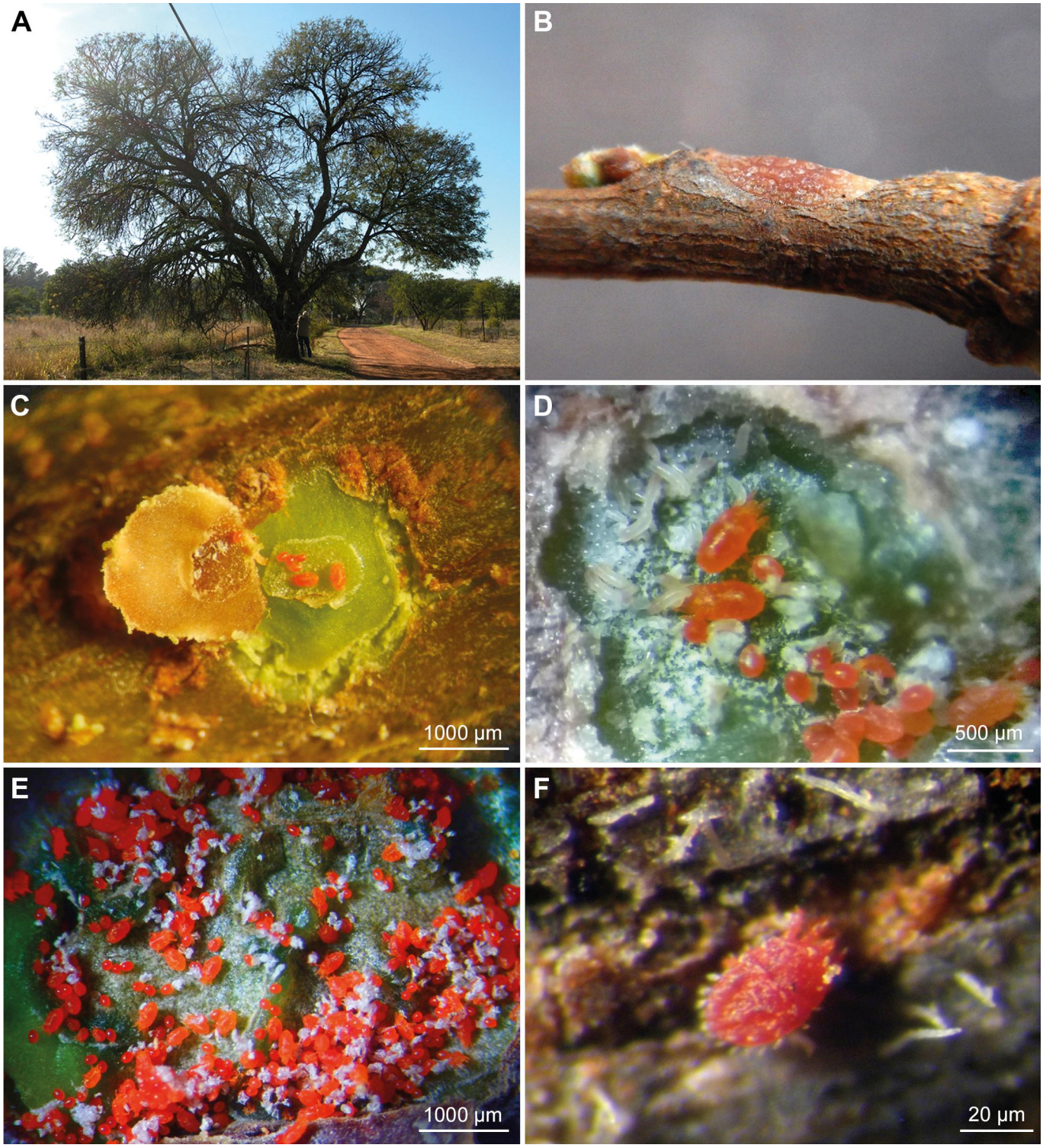


Figure 1 A – *Senegalia caffra*, Rietondale, Pretoria South Africa; B – Blister on stem; C – Founder specimens either larvae or protonymphs of *Phytoptipalpus occultuae* **sp. n.** in blister; D – *P. occultuae* **sp. n.** with eggs and unkown eriophyid; E – Large population in blister; F – *Phytoptipalpus multistriatum* on surface of host tree.

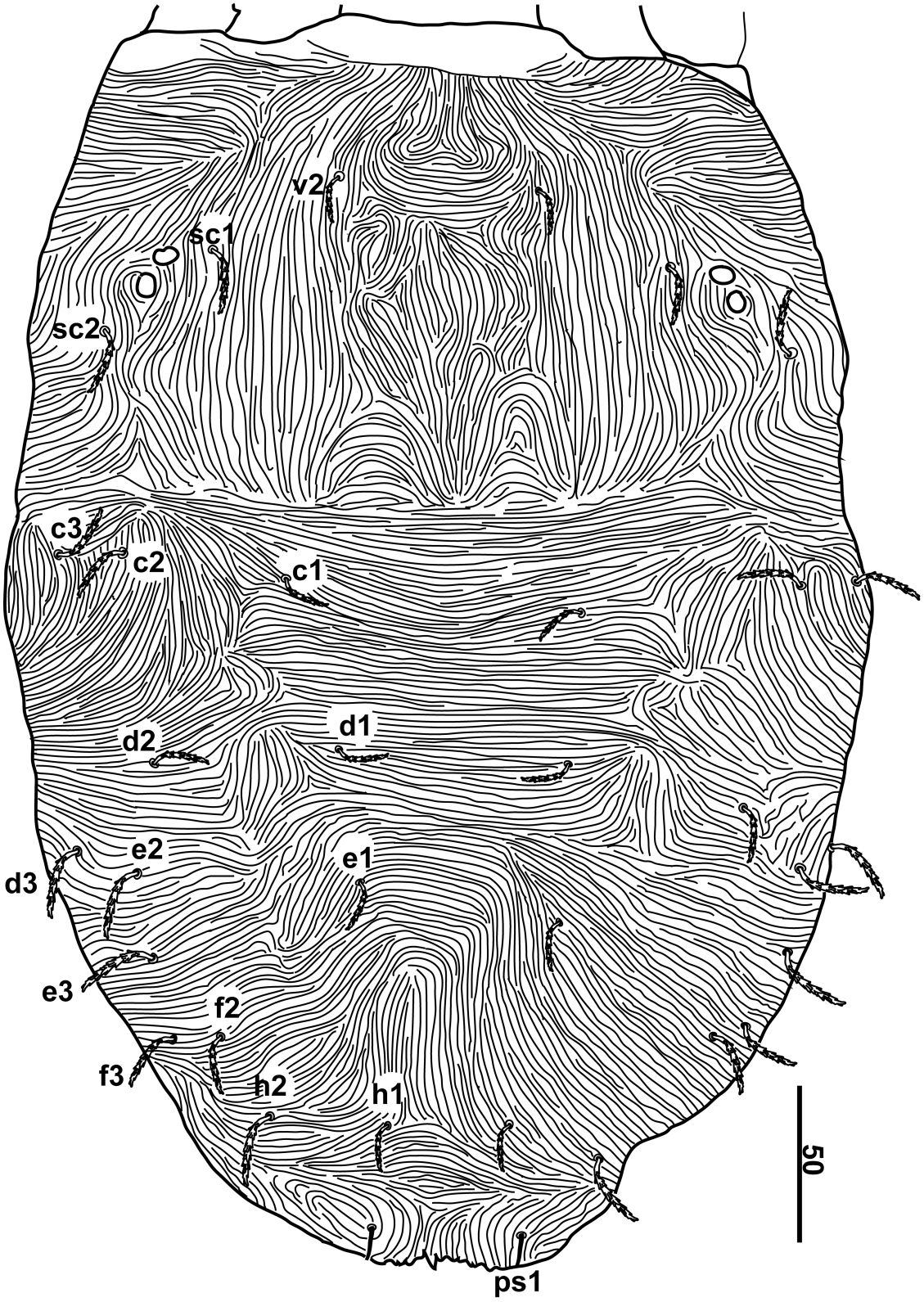


Figure 2 *Phytoptipalpus occultuae* **sp. n.**, female. Dorsal view.

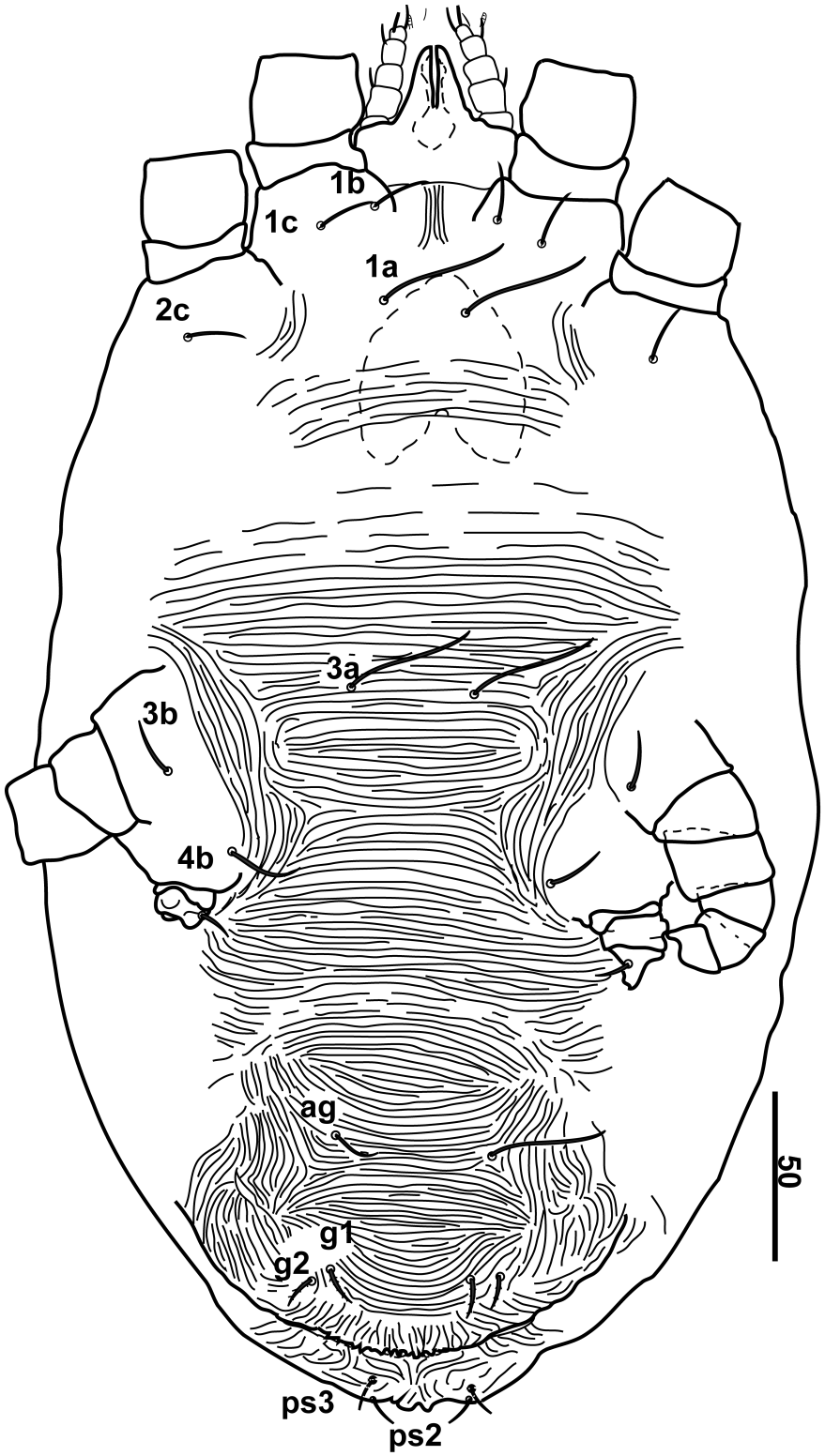


Figure 3 *Phytoptipalpus occultuae* **sp. n.**, female. Ventral view.

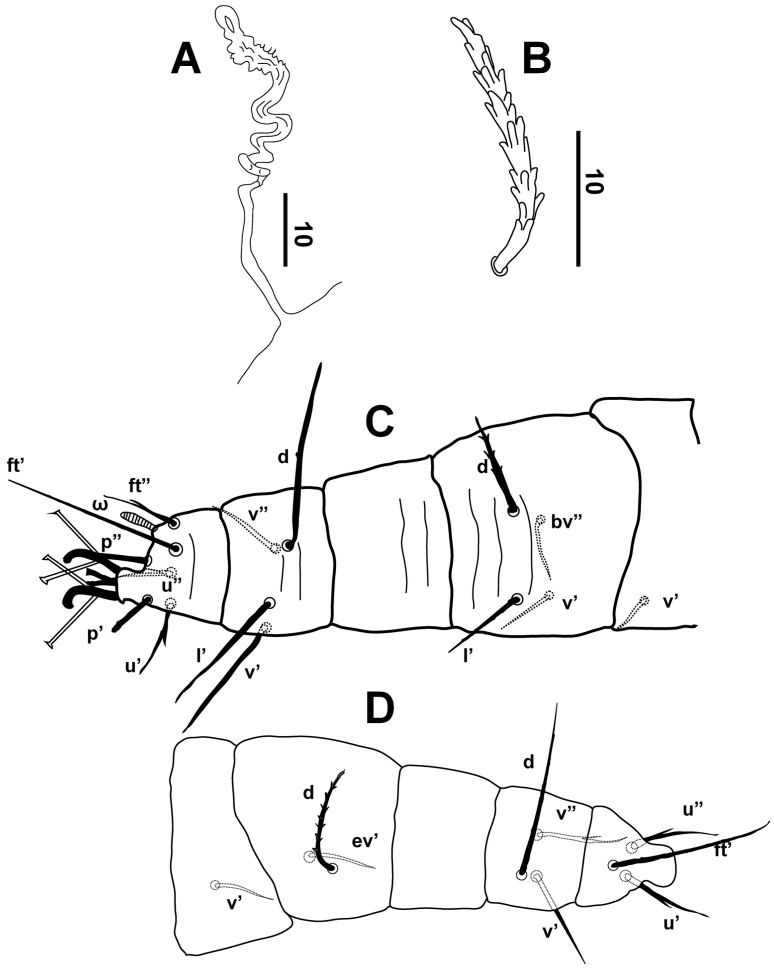


Figure 4 *Phytoptipalpus occultuae* **sp. n.**, female. A – Spermatheca; B – Dorsal seta *Sc1*; C – Leg I and II; D – Leg III.

or four setae (Figs. 5, 7F). Coxal setae are mostly long slender and smooth but one or both members can be forked. Femora I–II with four setae (*d, l', v', bv"*) with seta *d* stout and barbed; femur III with two setae (*ev', d*), seta *d* stout and barbed; genua I–III without setae. Tibiae I-II with four setae (*d, l', v', v"*), tibia III with three setae (*d, v', v"*). Tarsi I and II each with six setae (*ft', ft", p', p", u', u"*) and one abaxial solenidion; tarsi III with three setae (*u', u", ft'*). Each claw with two tenent hairs. Claws uncinate. Empodium with apparently 5 pairs of tenent hairs.

Male (n=8) — **Dorsum**. (Fig. 8) Body measurements: length between setae *v2–h1* 195-230, width between setae *sc2–sc2* 139–167. Propodosomal striae as in female, with two pairs of small eyes and setae *v2, sc1* and *sc2* short and plumose; opisthosoma also striate, mostly transverse medially but irregular laterally, with 13 pairs of short plumose setae gradually becoming longer caudally; asymmetry not so prominent as in female, only one member of setae *e1* absent in one specimen and one member of *v2* in another specimen. Dorsal setae measurements: *v2* 11–13, *sc1* 12–14, *sc2* 13–17, *c1* 9–14, *c2* 12–17, *c3* 16–18, *d1* 11–17, *d2* 13–18, *d3* 14–20, *e1* 13–16, *e2* 14–18, *e3* 15–22, *f2* 14–17, *f3* 15–19, *h1* 12–16, *h2* 14–16.

Venter. (Fig. 9) Cuticle almost completely covered with mostly transverse striae, including coxal fields, also granulate anterior to coxal setae. Setae *ag, g1, g2, ps1* and *ps2* slightly serrate and grouped together on anogenital area terminally. Setae *ps1* forked in one specimen.

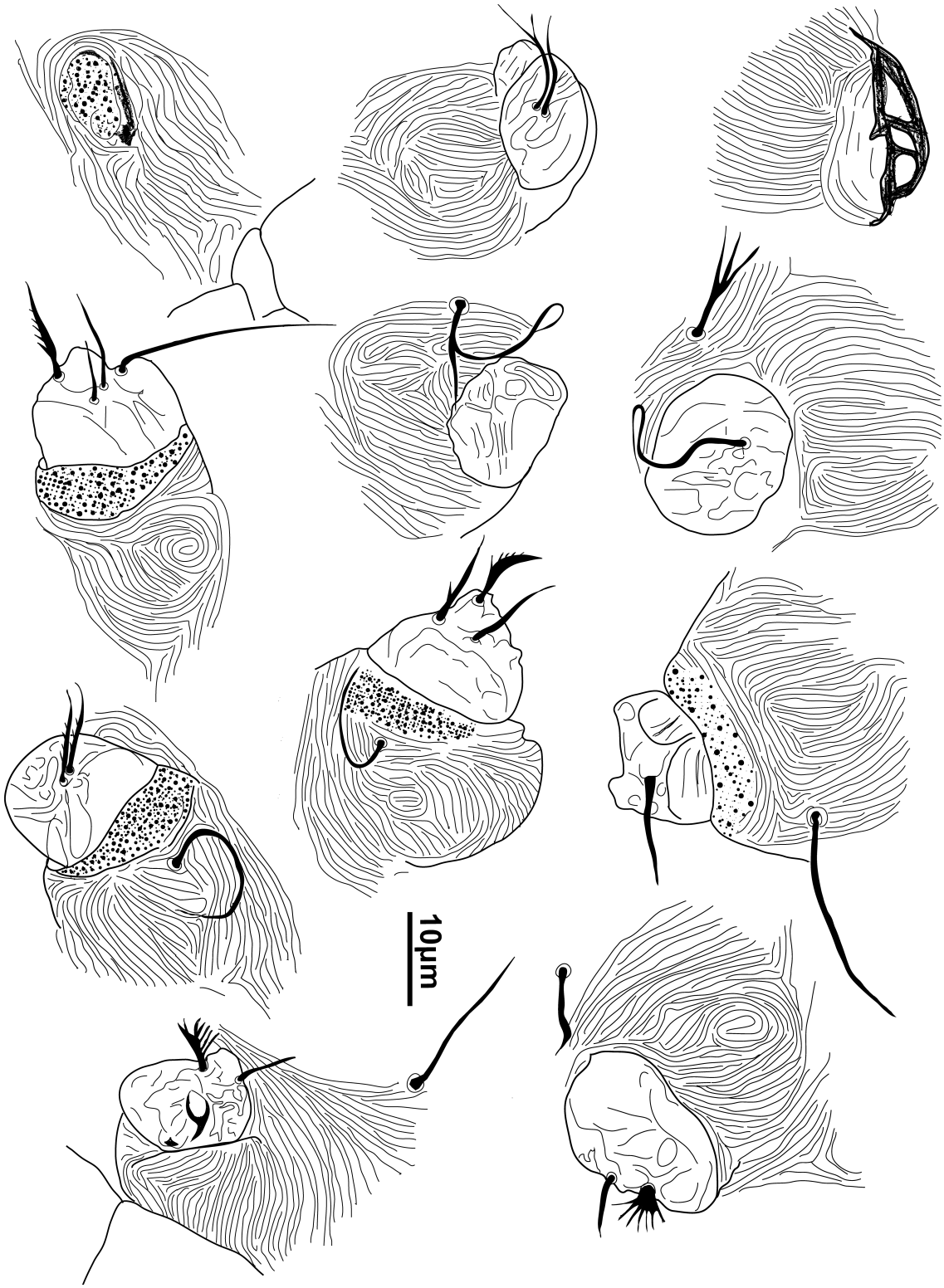


Figure 5 *Phytoptipalpus occultuae* **sp. n.**, female. Variations of leg IV.

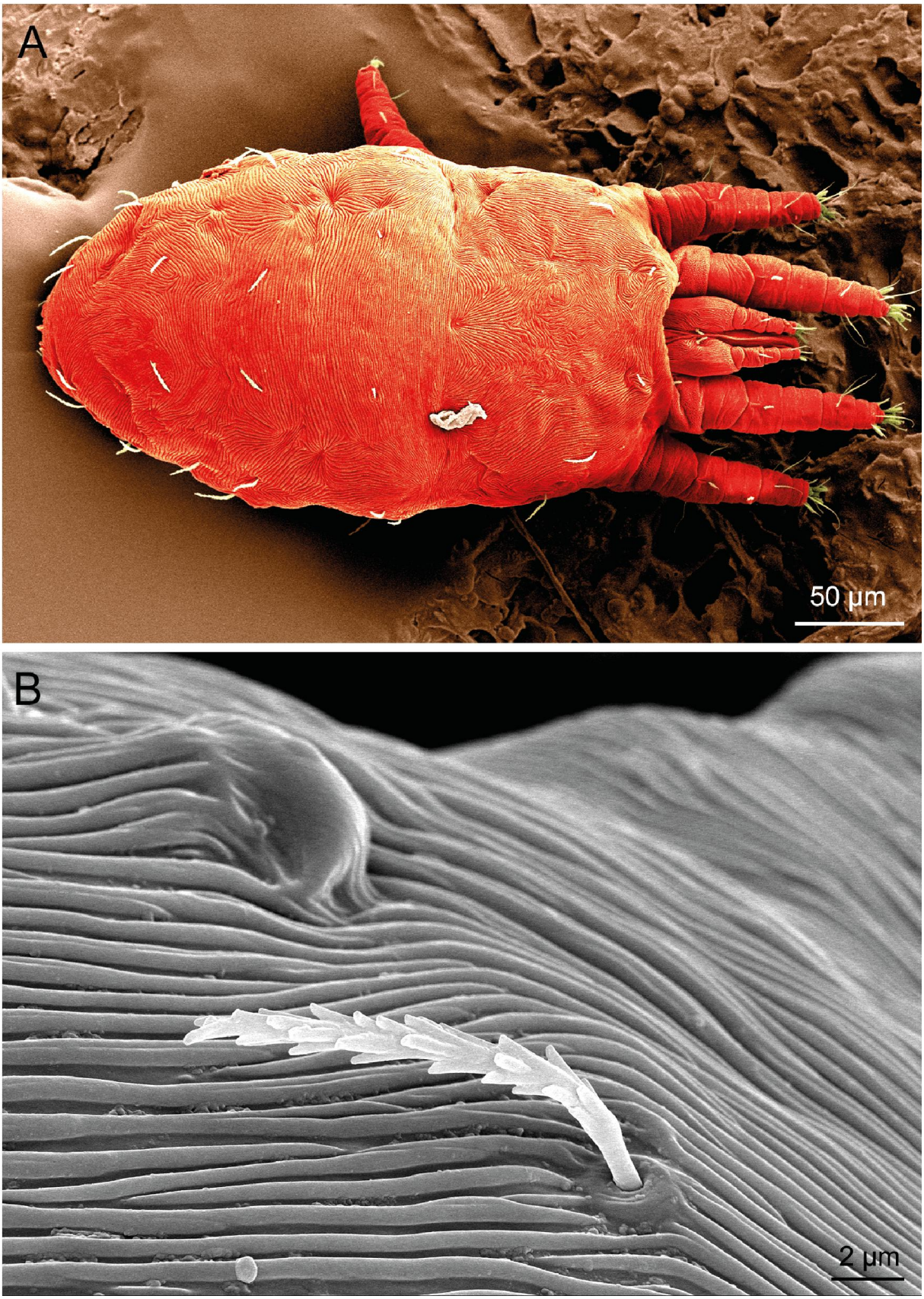


Figure 6 *Phytoptipalpus occultuae* **sp. n.**, female. A – SEM of dorsal view; B – SEM of seta *Sc1*.



Figure 7 *Phytoptipalpus occultuae* **sp. n.**, female. A – SEM of dorsal view of gnathosoma; B – SEM of ventral view of gnathosoma; C – SEM of chelicera; D – SEM of tip of chelicera; E – SEM of empodium I; F – SEM of leg IV; G – SEM of egg.

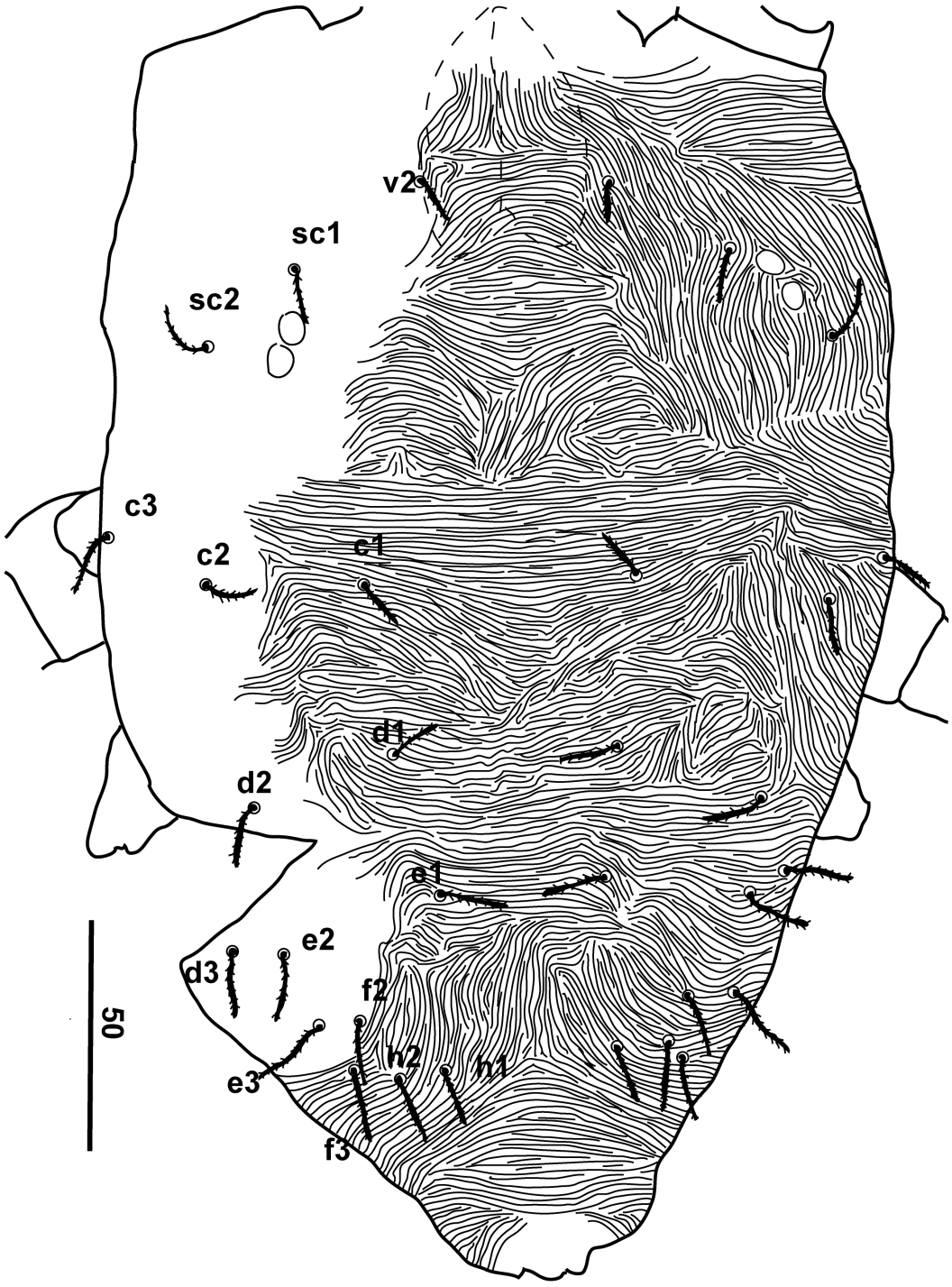


Figure 8 *Phytoptipalpus occultuae* **sp. n.**, male. Dorsal view.

Setae *1a* flagellate with a member absent in one specimen, setae *2c* with one member forked in two specimens, *3a* (flagellate) and *3b* with one member forked in one and two specimens, respectively. Setae *4a*, absent in two specimens, but with one member absent in five specimens and one with both members forked. Setae *4b* absent in four specimens and with only one-member present in the other four. Setal measurements: *1a* 27–36, *1b*, 14–17, *1c* 10–15, *2c* 15–21, *3a* 34–55, *3b* 13–22, *4a* 28–35, *4b* 12–27, *ag* 10–21, *g1* 7–8, *g2* 6–7, *ps1* 6–10, *ps2* 6-8.

Gnathosoma. Length of gnathosoma 55-83. Palps five-segmented. Setal formula: 0-1-0-1-3(ω). Palp tarsus with one solenidion (4) and one eupathidium with tapered tip (6–7) distally, one serrate seta (6–7); palp tibia with one smooth seta (7–10), palp genu and trochanter without setae and palp femur with one serrate seta (5-7). Palp coxa with dorsal spine. Cheliceral stylets distally with lateral serrations. Oesophagus well sclerotised. Seta *m* on venter of gnathosoma absent.

Legs. (Fig. 10B) Lengths of legs (trochanter to tip of empodium): I: 93-101; II: 85-92; III: 79-88; IV: 55-76. Setal formula for legs I–IV (coxae to tarsi): 2-1-4-0-4-6(1); 1-1-4-0-4-6(1); 1-1-2-0-3-3; 0 or1-0-0-0-0 to 3-3, respectively. Leg IV present, with 3 or 4 segments, tarsus and tibia fused or not and genu and femur fused. Tarsus with three setae (*u', u", ft'*), tibia with no setae (on one leg) to one or three setae with *d* and both or one member of *v', v"* absent or present; genu, femur and trochanter without setae, coxa with or without a seta. The remaining chaetotaxy of the males as in the female. Claws and empodia also resemble that of female.

Aedeagus. (Fig. 10A) Elongate funnel, acutely tapered distally, 38-44.

Deutonymph (n=5) — **Dorsum**. (Fig. 11) Body measurements: length between setae v2–h1: 221-257, width between setae sc2–sc2: 139–175. Propodosomal striae as in female, with two pairs of small eyes and setae *v2, sc1* and *sc2* short and plumose; opisthosoma also striate, mostly transverse medially but irregular laterally, with 13 pairs of short plumose setae gradually becoming longer caudally; asymmetry absent. Dorsal setae measurements: *v2* 11–17, *sc1* 15–19, *sc2* 16–20, *c1* 11–13, *c2* 13–21, *c3* 18–24, *d1* 11–16, *d2* 12–19, *d3* 19–23, *e1* 11–15, *e2* 15–21, *e3* 18–22, *f2* 12–18, *f3* 17–22, *h1* 12–17, *h2* 16–18.

Venter. (Fig. 12) Cuticle almost completely covered with transverse striae, including coxal fields, also granulate anterior to coxal setae. Setae *ag, g1*, *ps1* and *ps2* slightly serrate, *g2* absent. Setae *4a* flagellate, present in only one specimen. Setae *4b* also present in only one specimen. Setal measurements: *1a* 26–43, *1b*, 15–21, *1c* 14–20, *2c* 15–21, *3a* 27–43, *3b* 15–24, *4a* 25, *4b* 14, *ag* 15–29, *g1* 8–16, *ps1* 5–7, *ps2* 7-8.

Gnathosoma. Length of gnathosoma 61-74. Palps five-segmented. Setal formula: 0-1-0-1-3(ω). Palp tarsus with one solenidion (4) and one eupathidium with tapered tip (6) distally, one serrate seta (6–8); palp tibia with one smooth seta (8–10), palp genu and trochanter without setae and palp femur with one serrate seta (8-9). Palp coxa, cheliceral stylets, oesophagus and venter of gnathosoma like those of female.

Legs. Lengths of legs (trochanter to tip of empodium): I: 79-88; II: 73-79; III: 72-81. Setal formula for legs I–III (coxae to tarsi): 2-0-3-0-4-6(1), 1-0-3-0-4-6(1), 1-0-2-0-3-3, respectively. Femora I-II with seta *l'* absent. Trochanters I-III also without setae. The chaetotaxy of the remaining segments as that of the female. Leg IV reduced with one serrate, two serrate or two short serrate and two very long smooth setae. Claws and empodia also resemble that of female.

Protonymph (n=2) — **Dorsum**. (Fig. 13) Body measurements: length between setae *v2–h1*: 200-229, width between setae *sc2–sc2*: 149–164. Propodosomal striae as in female, with two pairs of small eyes and setae *v2, sc1* and *sc2* short and plumose; opisthosoma also striate, mostly transverse medially but irregular laterally, with 13 pairs of short plumose setae gradually becoming longer caudally; asymmetry absent. Dorsal setae measurements: *v2* 15–17, *sc1* 15–17, *sc2* 19–20, *c1* 11–14, *c2* 16–17, *c3* 16–21, *d1* 15, *d2* 15–20, *d3* 20–21, *e1* 14–15, *e2* 14–17, *e3* 18–20, *f2* 16–17, *f3* 18–21, *h1* 15–17, *h2* 15–16.

Venter. (Fig. 14) Cuticle almost completely covered with transverse striae, including coxal fields, slightly granulate anterior to coxal setae. Setae *ag*, *ps1* and *ps2* slightly serrate, *g1-2* absent. Setae *4a* and *4b* absent. Setal measurements: *1a* 23–48, *1b*, 14–20, *1c* 11 – 12, *2c* 14, *3a* 28–44, *3b* 13–19, *ag* 15–21, *ps*1 4–5, *ps2* 5-6.

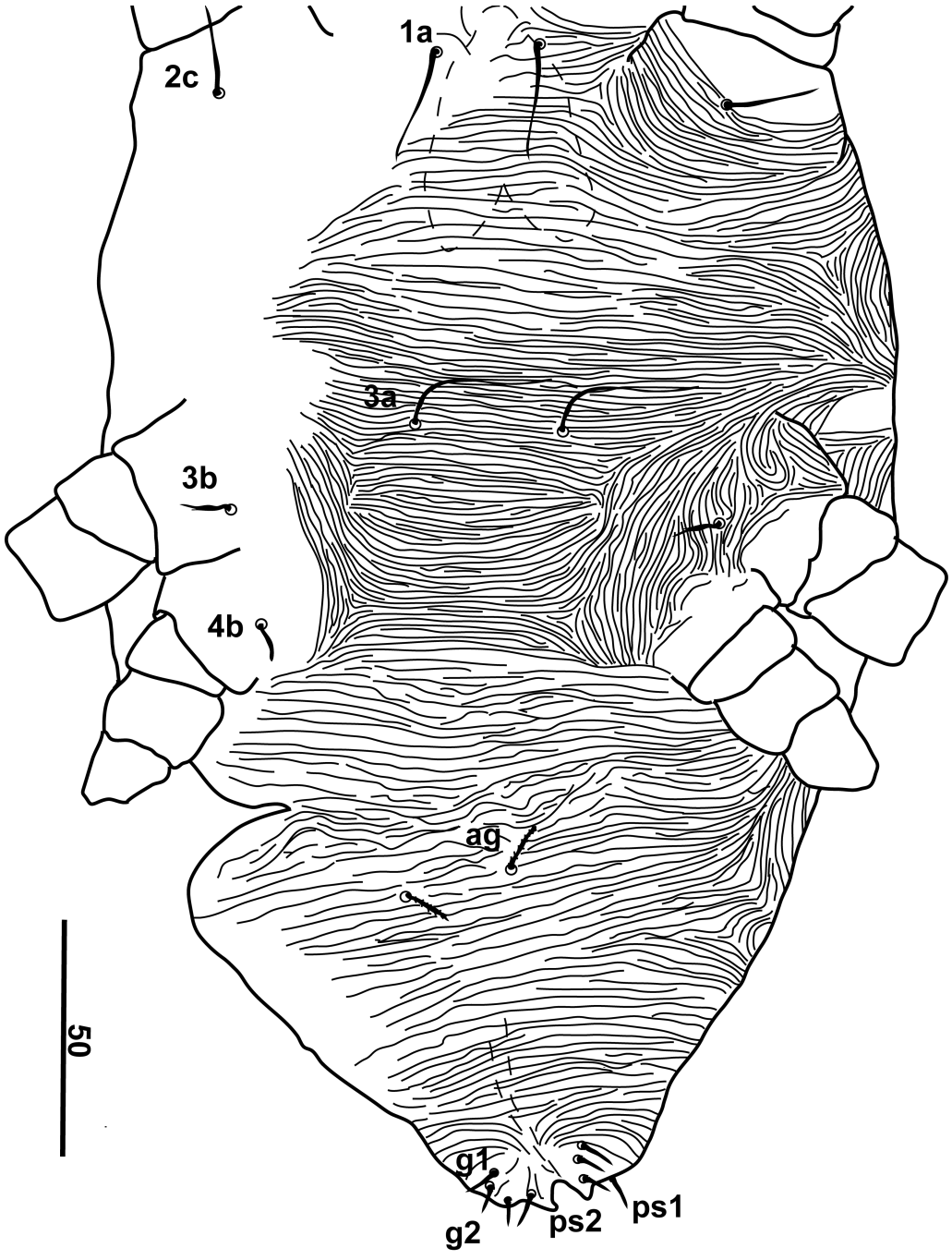


Figure 9 *Phytoptipalpus occultuae* **sp. n.**, male. Ventral view.

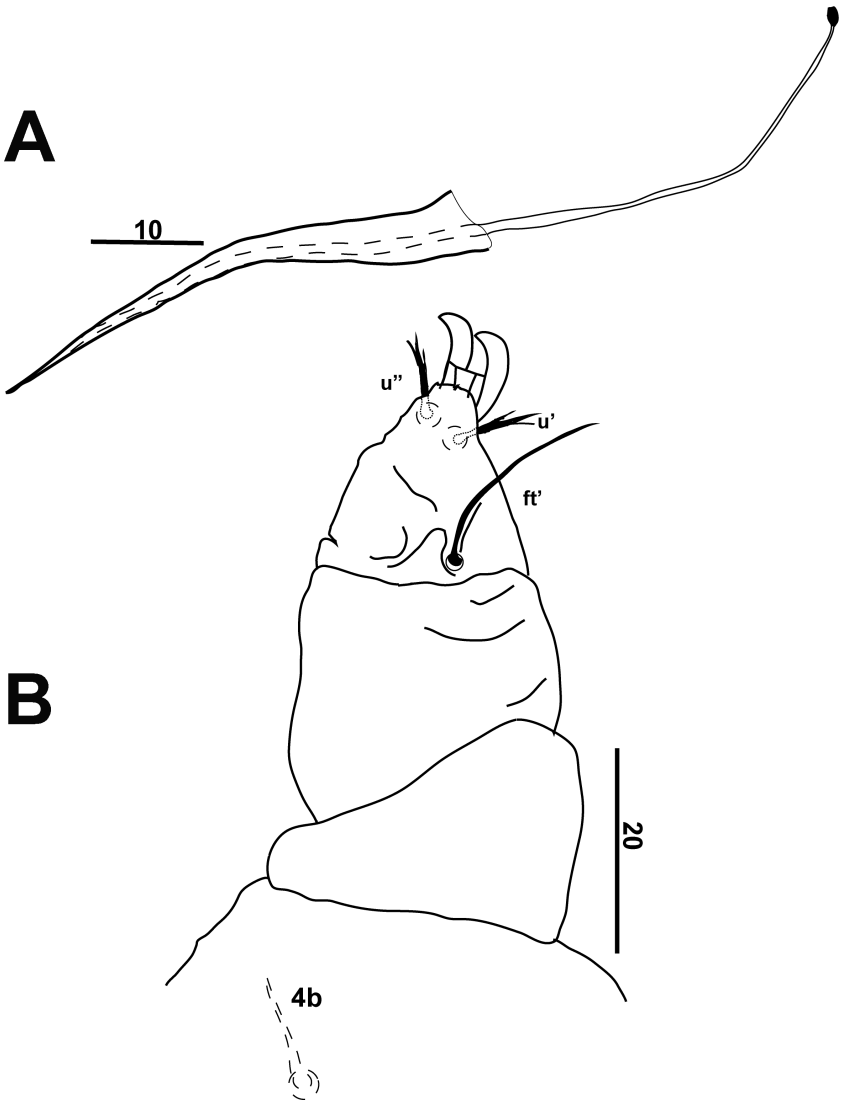


Figure 10 *Phytoptipalpus occultuae* **sp. n.**, male. A – Aedeagus; B – Leg IV.

Gnathosoma. Length of gnathosoma 59-67. Palps five-segmented. Setal formula: 0-1-0-1-3(ω). Palp tarsus with one solenidion (4) and one eupathidium with tapered tip (6) distally, one serrate seta (6–7); palp tibia with one smooth seta (9–10), palp genu and trochanter without setae and palp femur with one serrate seta (9). Palp coxa, cheliceral stylets, oesophagus and venter of gnathosoma like those of female.

Legs. Lengths of legs (trochanter to tip of empodium): I: 75-77; II: 71; III: 68-71. Setal formula for legs I–III (coxae to tarsi): 2-0-3-0-4-6(1), 1-0-3-0-4-6(1), 1-0-2-0-3-3, respectively. Femora I-II with seta *l'* absent. Trochanters I-III also without setae. Leg IV absent or with one seta. The chaetotaxy of the rest of the segments like that of the female. Claws and empodia also resemble that of female.

Larva (n=7) — **Dorsum**. (Fig. 15) Body measurements: length between setae *v2–h1* 153-160, width between setae *sc2–sc2* 108–118. Propodosoma and opisthosoma as in female, but striation rougher on opisthosoma, with two pairs of small eyes and setae *v2, sc1* and *sc2* short and plumose; opisthosoma also striate, mostly transverse medially but irregular laterally, with 13 pairs of short plumose setae gradually becoming longer caudally; asymmetry absent. Dorsal setae measurements: *v2* 14–17, *sc1* 14–19, *sc2* 19–22, *c1* 12–19, *c2* 16–22, *c3* 21–23,

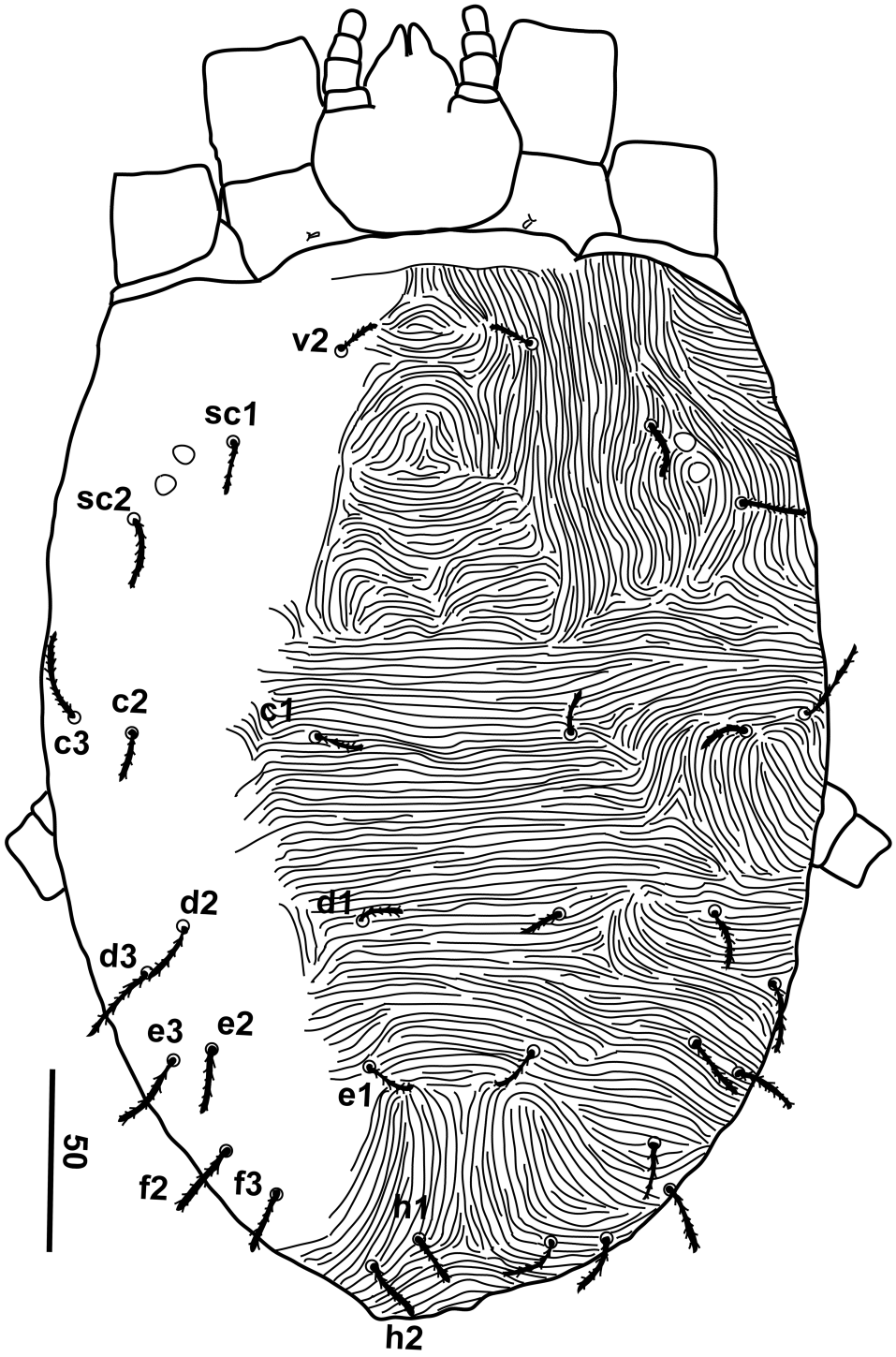


Figure 11 *Phytoptipalpus occultuae* **sp. n.**, deutonymph. Dorsal view.

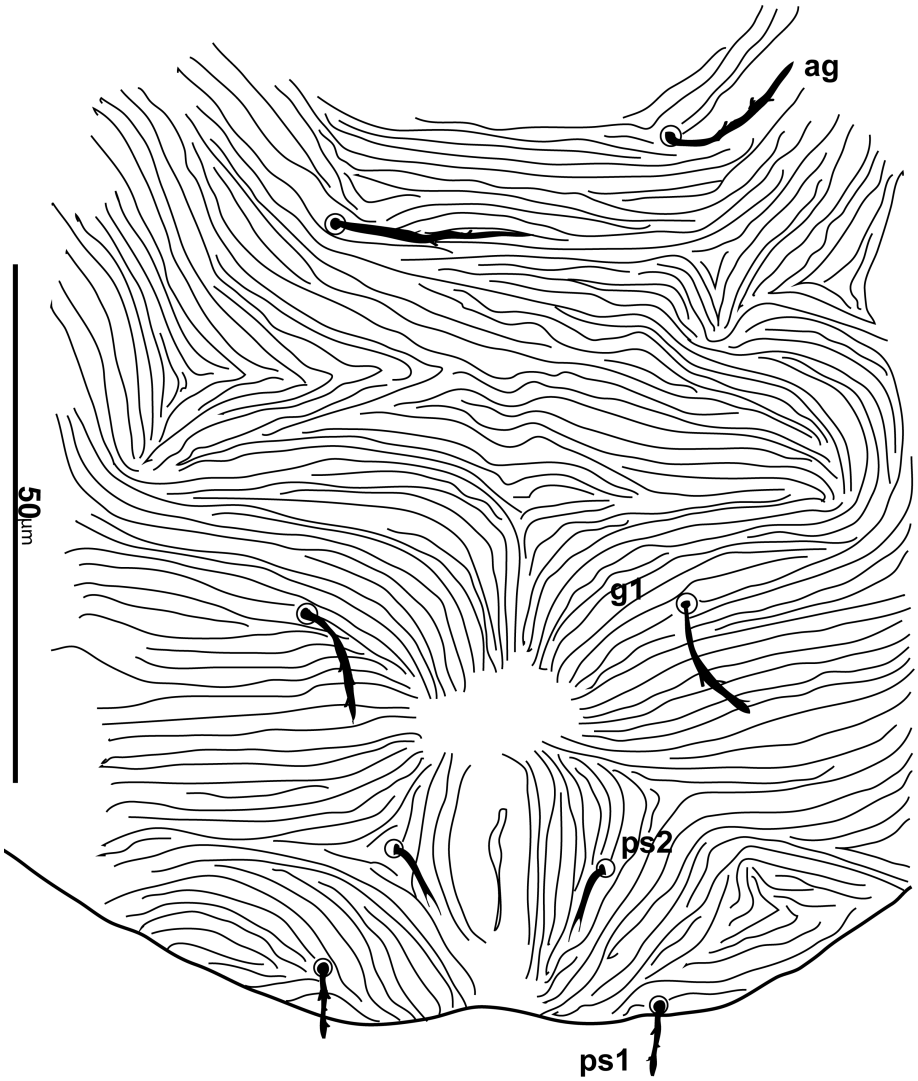


Figure 12 *Phytoptipalpus occultuae* **sp. n.**, deutonymph. Anogenital area.

d1 14-18, *d2* 17–22, *d3* 21–26, *e1* 15–18, *e2* 19–25, *e3* 21–24, *f2* 18–24, *f3* 18–23, *h1* 16–20, *h2* 19–22.

Venter. (Fig. 16) Cuticle almost completely covered with transverse striae, including coxal fields, smooth to very slightly granulate anterior to coxal setae. Setae *ps1* and *ps2* slightly serrate, *ag, g1-2* absent. Setae *4a* and *4b* absent. Setal measurements: *1a* 23–42, *1b* 8–16, *1c* absent, *2c* absent, *3a* 31–48, *3b* absent, *ps1* 3–6, *ps2* 3-6.

Gnathosoma. Length of gnathosoma 44-55. Palps five-segmented. Setal formula: 0-1-0-1-3(ω). Palp tarsus with one solenidion (3-4) and one eupathidium with tapered tip (6-7) distally, one serrate seta (6–8); palp tibia with one smooth seta (9–14), palp genu and trochanter without setae and palp femur with one serrate seta (7-9). Palp coxa, cheliceral stylets, oesophagus and venter of gnathosoma like those of female.

Legs. Lengths of legs (trochanter to tip of empodium): I 63-70; II 60-63; III 50-65. Setal formula for legs I–III (coxae to tarsi): 1-0-3-0-4-6(1), 0-0-3-0-4-6(1), 0-0-2-0-3-3, respectively. Femora I-II with seta *l'* absent. Trochanters I-III also without setae. The chaetotaxy of the rest of the segments like that of the female. Claws and empodia also resemble that of female.

Egg (Fig. 7 G) — Oval with about eight longitudinal strips. Pale red in colour.

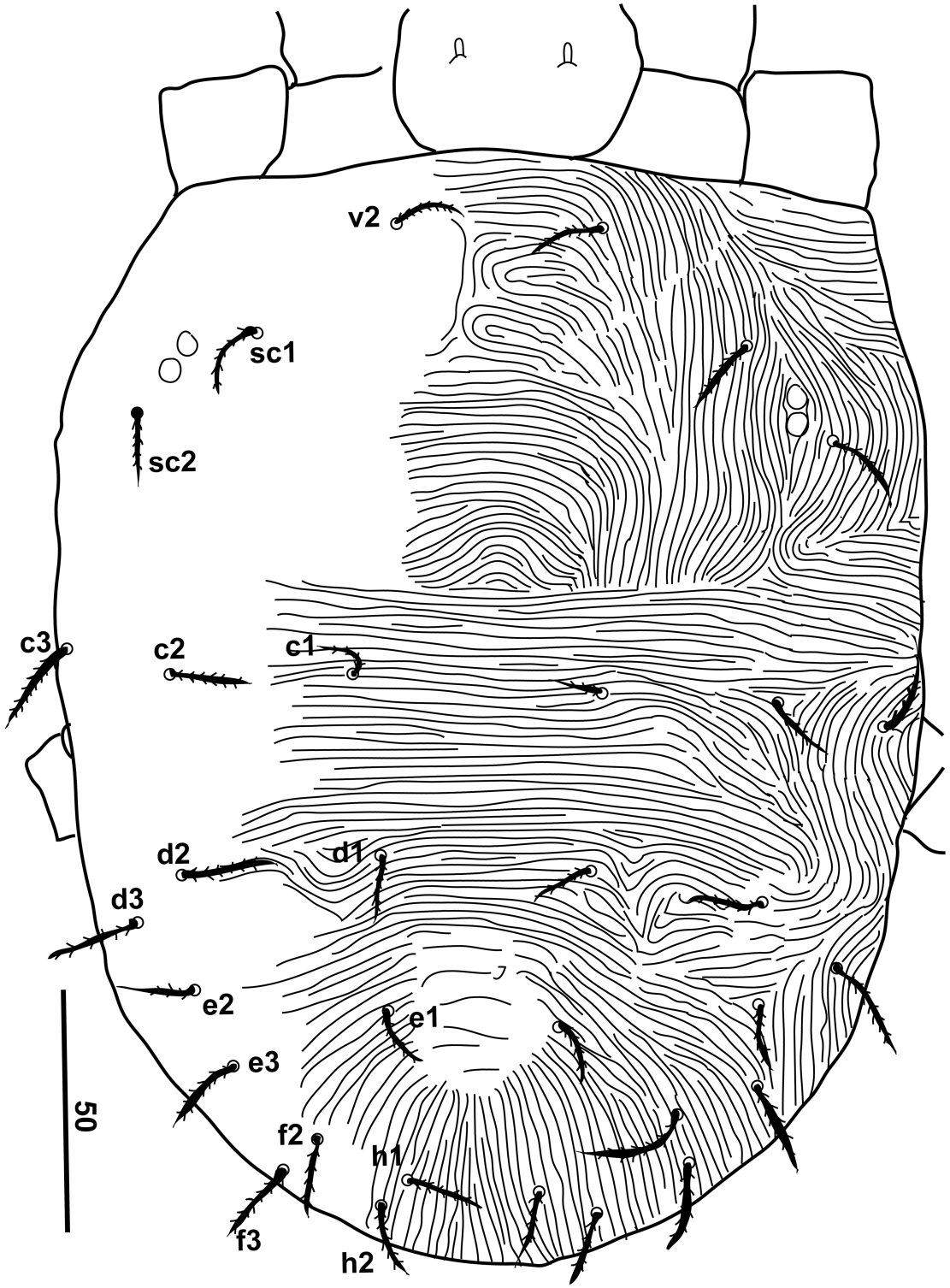


Figure 13 *Phytoptipalpus occultuae* **sp. n.**, protonymph. Dorsal view.

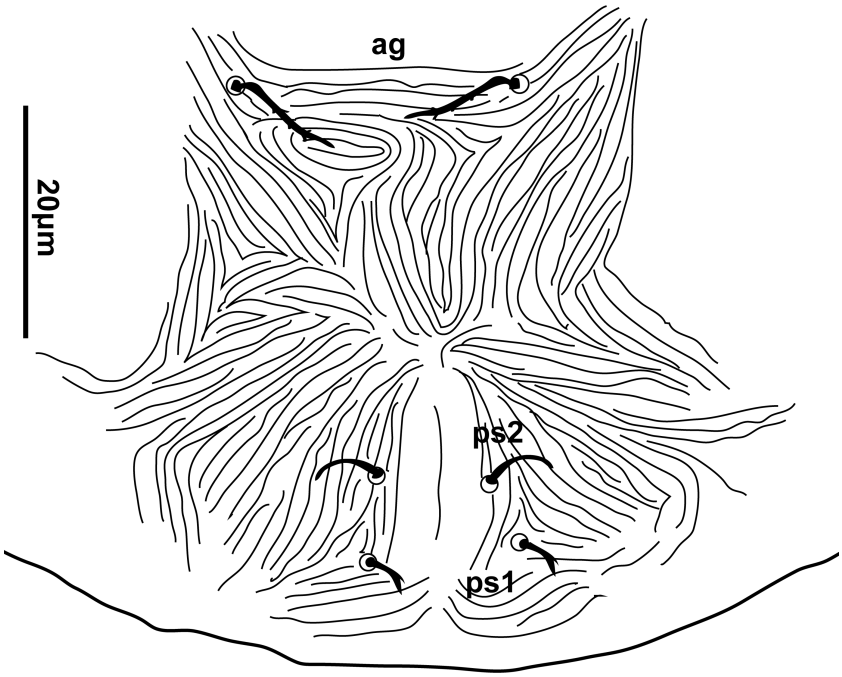


Figure 14 *Phytoptipalpus occultuae* **sp. n.**, protonymph. Anogenital area.

Remarks — This species is characterised by asymmetry which is very prominent on both the dorsum and venter of the female. Leg IV is reduced with or without setae, which distinguishes it from other species in the genus which have three pairs of legs. Seta *l'* is absent on femora I-II in all the immature stages. Setae *g1* are absent in the deutonymph; setae *g1-2* are absent in the protonymph and the larva; and setae *ag* are absent in the larva. Unstable ventral setae *4a* and *4b* were not observed in the protonymph and larva and the latter also lack setae *1c, 2c* and *3b*.

Etymology — The species name (*occultuae*) refers to its behaviour of *hiding* under the bark or in blisters.

Common name — Neser flat mite.

Habits — All stages of the mites occurred in characteristic flat chambers developing under slightly raised bark and small, flat, clam shell-shaped domes in the bark of younger shoots of *Senegalia caffra* (Fig. 1A). The minutely hairy epidermis may be lost giving some domes a waxy appearance and the bark above the mite spaces may die. The closed blisters had soft, green, cellular bases like a slightly raised central roundish disc ringed with by a distinct edge around which a thick layer of healthy green cells from the cambium occurred (Fig. 1B). The mites appeared to be feeding superficially on possibly regenerating cells on the platforms. In older blisters the platforms were irregularly shaped and extended into lateral chambers and tunnels and the cavities contained numerous egg shells and white exuviae (Fig. 1E). Among older galls at the original collection site, small, new cavities containing only a single mite, which can be assumed to be either a larva or protonymph (Fig. 1C). The first eggs were confirmed to be present in August 2019, when first signs of new growth were just appearing on the tree. At this stage, a single short shoot, *c*. 7-8 mm in diameter and 50 mm long from the previous growth cycle was found to have 26 separate mite spaces, mainly blisters, containing a total of 643 mites (1 to 141 per blister, av. *c*.25) and numerous eggs and small immatures among accumulated white exuviae (Fig. 1E).

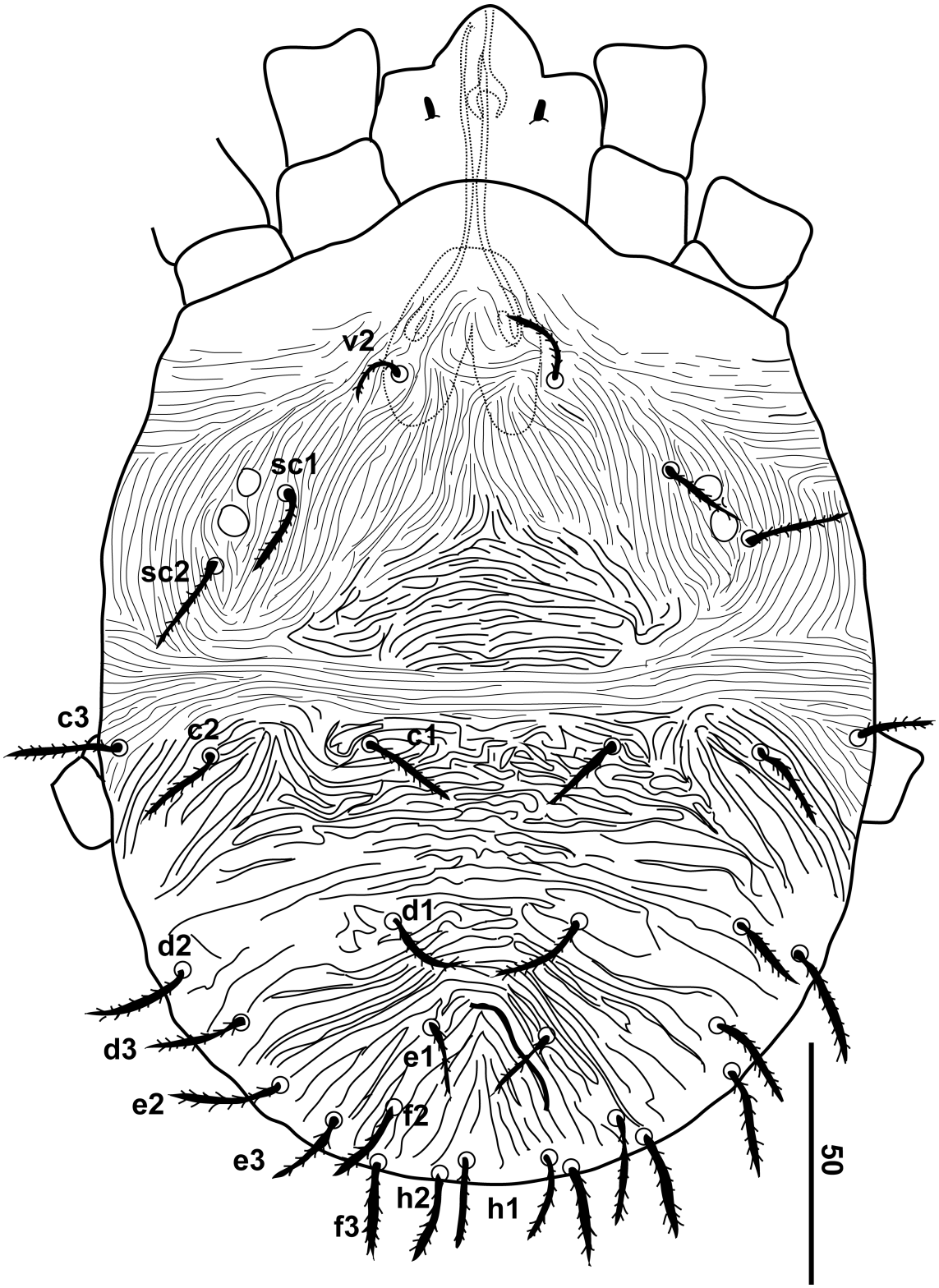


Figure 15 *Phytoptipalpus occultuae* **sp. n.**, larva. Dorsal view.

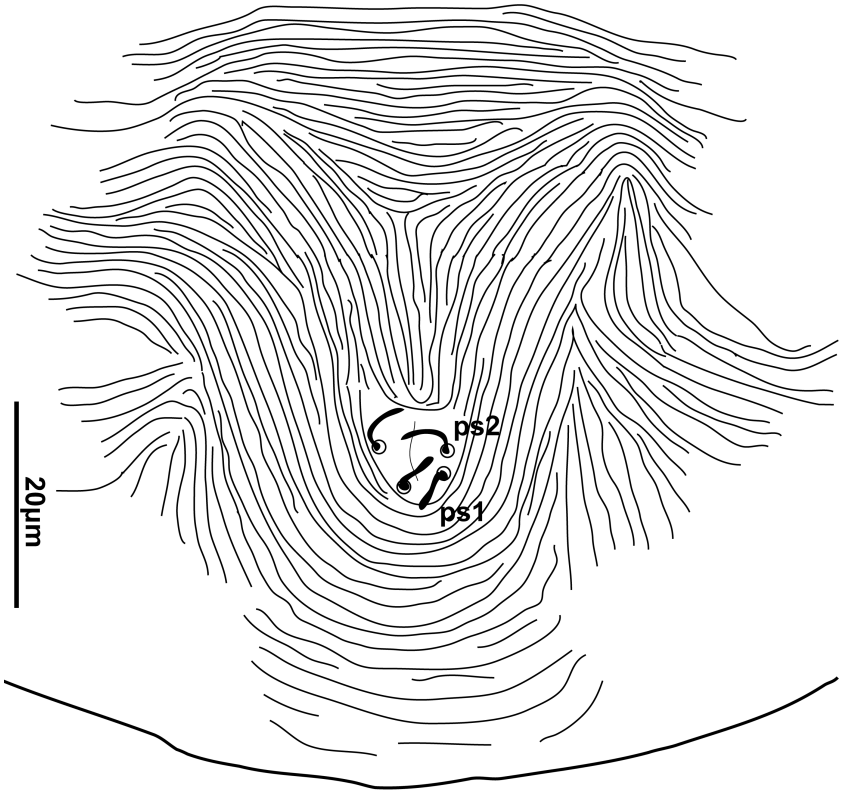


Figure 16 *Phytoptipalpus occultuae* **sp. n.**, larva. Anogenital area.

On the same twig as *P. occultuae* **sp. n.** were also three other mite and insect species living in spaces under the epidermis in soft green tissue, namely, colonies of an as yet unidentified eriophyoid species, however, this occurrence was seldom (Fig. 1D), and two scale insects namely, *Pseudotargionia anareolae* Ben-Dov, Diaspididae and *Abditicoccus acacia* (Brain), Asterolecaniidae (Homoptera), latter probably a gall-former. A second tenuipalpid, *P. multistriatum* (Smith Meyer), was a vagrant on the surface of the twigs (Fig. 1F). Present indications are that *P. occultuae* **sp. n.**, the eriophyoid and *A. acaciae* females penetrate the epidermis independently and that they have no direct interactions. Entry may also be gained through stomata or lenticels. Heavy infestations seemed to lead to twig die-back (unpublished observations of S. Neser).

Crawlers and parasitoids of *A. acaciae* emerge through the ostiole. Cavities under older or cracked domes were entered by *A. acaciae* and mealybug crawlers, scavenging mites and unidentified thrips.

Key to species of *Phytoptipalpus*. Adult females. (Key based on Meyer and Van Dis, 1993)

1. Setae *f2* present 2
— Setae *f2* absent 19

2. Three pairs of legs 3
— Four pairs of legs 4

3. Dorsal setae short (15-20 um), serrate; gnathosoma with setae *m* absent; leg IV reduced . . . . . ***P. occultuae* sp.n.**
— Dorsal setae longer (18-44 um), serrate; gnathosoma with setae *m*; leg IV absent . . . . . *P. muukuorum* Meyer

4. Dorsum with reticulations 5
— Dorsum without reticulations 10

5. Only propodosoma with reticulum medially 6
— Propodosoma and opisthosoma with reticulum 9

6. Tibia IV with 3 setae 7
— Tibia IV with 2 setae . . . . . ***P. lanzhouensis*** Ma and Yuan

7. Femora III-IV, 2-1 setae 8
— Femora III-IV, 3-3 setae . . . . . ***P. xianensis*** Ma and Yuan

8. Dorsal setae broadly lanceolate; palptarsus with only one eupathidium . . . . . ***P. salicicola*** (Al-Gboory)
— Dorsal setae narrowly lanceolate; palptarsus with eupathidium, solenidion and seta . . . . . ***P. cercidium*** (Baker, Tuttle and Abbatiello)

9. Dorsocentral setae narrowly lanceolate and spatulate, serrate, each clearly shorter than half the distance to adjacent setae posterior to it, second reticulate area small, behind setae *c1* . . . . . ***P. nyalai*** (Meyer)
— Dorsocentral setae broadly lanceolate and serrate, each more than half the distance to adjacent setae posterior to it, second reticulum present between setae *e1* and *h1* . . . . . ***P. populus*** (Papaioannou-Souliotis)

10. Dorsal setae slender, setiform, serrate 11
— Dorsal setae spatulate, narrowly or broadly lanceolate, serrate 13

11. Striae on propodosoma transverse medially; setae *3a* and *4a* short, *4a* not reaching *3a* . . . . . ***P. aegyptetrapodus*** Zaher and Yousef
— Propodosoma smooth medially surrounded by longitudinal striae or striae irregular medially; setae *3a* and *4a* much longer 12

12. Genua 1-0-0-0 . . . . . ***P. conostegiae*** Baker and Tuttle
— Genua 2-2-1-0 . . . . . ***P. rosae*** (Mitrofanov and Strunkova)

13. Tibiae 4-4-3-3 14
— Tibiae 3-3-3-3 . . . . . ***P. euphratica*** (Al-Gboory)

14. Genua 2-2-0-0 15
— Genua 2-2-1-0 or 1-1-0-0 17

15. Femora 4-4-2-1 16
— Femora 3-3-2-1 . . . . . ***P. ceibae*** (De Leon)

16. Tarsi 10(1)-10(1)-5-5 . . . . . ***P. lithos*** Hassan, Ashfaq and Li
— Tarsi 8(1)-8(1)-5-5 . . . . . ***P. harveyi*** Meyer and Van Dis

17. Genua 2-2-1-0 18
— Genua 1-1-0-0 . . . . . ***P. multistriatum*** (Meyer)

18. Tarsi 9(1)-9(1)-6-5 . . . . . ***P. lepsis*** Hassan, Ashfaq and Li
— Tarsi 8(1)-8(1)-5-5 . . . . . ***P. phoenicis*** Alatawi, Kamran and Negm

19. With four pairs of legs 21
— With three pairs of legs 20

20. Dorsal setae strongly serrate; coxa III with a seta . . . . . ***P. paradoxus*** Trägårdh
— Dorsal setae slightly serrate; coxa III without setae . . . . . ***P. albizziae*** Pritchard and Baker

21. Propodosoma virtually smooth; dorsal setae broadly spatulate . . . ***P. kalahariensis*** (Meyer)
— Propodosoma broadly striate laterally; dorsal setae narrowly to broadly lanceolate to subspatulate . . . . . ***P. alexandriae*** Meyer and Van Dis

Table 1 Ontogenetic development of leg setae in *Phytoptipalpus occultuae* **sp. n.** Setae are indicated in the stage in which they first appear.

LEG I	**Coxa**	**Trochanter**	**Femur**	**Genu**	**Tibia**	**Tarsus**
Larva	*1a, 1b*		*d, v', bv"*	0	*d, l', v', v"*	*ft', ft", p', p", u', u", ω*
Protonymph	*1c*			0		
Deutonymph				0		
Female.		*v'*	*l'*	0		
Male		*v'*	*l'*	0		
LEG II						
Larva			*d, v', bv"*	0	*d, l', v', v"*	*ft', ft", p', p", u', u", ω*
Protonymph	*2c*			0		
Deutonymph				0		
Female.		*v'*	*l'*	0		
Male		*v'*	*l'*	0		
LEG III						
Larva	*3a*		*u', u", ft'*	0	*d, v', v"*	
Protonymph	*3b*			0		
Deutonymph				0		
Female.		*v'*		0		
Male		*v'*		0		
LEG IV						
Larva				0		
Protonymph				0		
Deutonymph	*4a, 4b* *			0		
Female.				0		
Male				0		*u', u", ft'*

* Setae *4a* and *4b* can be absent or present in Deutonymph and other stages.

Discussion

This new mite species was discovered by the fourth author. The first and second authors encountered the mite outside the agriculture research station in Pretoria. The tree did not show any mayor symptoms that would make an observer suspicious of a pest problem much less the presence of thousands of mites under the bark of the tree. This gobsmacking encounter made us profoundly aware of how little understanding we have of the habits of the family Tenuipalpidae. The family shows a growing range of economic importance in agriculture and forestry. There are already over 1200 flat mites described in this family (Beard *et al*. 2013) but after such an encounter, it is our feeling that a new level of partnership between entomologists and botanists is merited. The level of knowledge needed for such careful observations and meticulous evaluation can only be accomplished by interdisciplinary collaboration.

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