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The genus *Nanopteroedectes* Mironov, 2009 (Acari, Proctophyllodidae), with descriptions of three new species from antbirds (Passeriformes: Thamnophilidae) in Brazil

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Abstract Three new species of the recently discovered, and hitherto monotypic, feather mite genus *Nanopteroedectes* Mironov, 2009 are described: *N. acutirostris* n. sp. from *Stymphalornis acutirostris* Bornschein, Reinert & Teixeira, *N. mentalis* n. sp. from *Dysithamnus mentalis* (Temminck), and *N. leucopterus* n. sp. from *Pyriglena leucoptera* (Vieillot). This feather mite genus is currently restricted to passerine birds of the Neotropical family Thamnophilidae in Brazil. A key to the known species of *Nanopteroedectes* is presented for both sexes.

Introduction

The monotypic genus *Nanopteroedectes* Mironov, 2009 (Proctophyllodidae: Pterodectinae) was recently erected for *N. formicivora* (Mironov in Mironov, Literak & Čapek, 2008) from the rusty-backed antwren *Formicivora rufa* (Wied-Neuwied) (Passeriformes: Thamnophilidae). This genus was originally called *Nanodectes* Mironov in Mironov, Literak & Čapek, 2008, but this name is pre-occupied by *Nanodectes* Rentz, 1985

(Insecta: Orthoptera) and has subsequently been renamed *Nanopteroedectes* by Mironov (2009). It contains the smallest members of the tribe Pterodectini Park & Atyeo, 1971, with males ranging from 240–270 and females from 375–440 μm. As for most of the pterodectine feather mites, they live in the narrow corridors between barbs on the ventral side of the vanes of the flight feathers.

According to the classification proposed by Mironov (2009), the Pterodectinae Park & Atyeo, 1971 is divided into two tribes, the Pterodectini Park & Atyeo, 1971 and the Ramphocaulini Park & Atyeo, 1971; the first is associated primarily with passerines and the latter is restricted to hummingbirds. Two distinct branches comprise the Pterodectini, the *Pterodectes* and *Proterothrix* groups (Mironov, 2009). *Nanopteroedectes* belongs to the latter group together with *Megalodectes* Park & Atyeo, 1971, *Afroproterothrix* Mironov & Wauthy, 2010, *Neodectes* Park & Atyeo, 1971, *Proterothrix* Gaud, 1968, *Picipteroedectes* Mironov, Literak, Hung & Čapek, 2012 and *Vireodectes* Mironov, Literak, Hung & Čapek, 2012.

Although Park & Atyeo (1971) mentioned that the Pterodectinae contained nearly a hundred undescribed species, considerable progress has been made in the study of pterodectines from the Neotropical region (OConnor et al., 2005; Hernandez & Valim, 2005, 2006; Valim & Hernandez, 2006, 2008, 2009, 2010; Mironov et al., 2008; Mironov & González-Acuña, 2011). However, our current knowledge is still minimal when compared to the expected diversity in the region (Valim et al., 2011). The need for surveys and taxonomic studies

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which are necessary for revealing a clearer picture of the biodiversity becomes more evident when considering the acarofauna associated with endangered species (Koh et al., 2004). For instance, the Parana antwren *Stymphalornis acutirostris* Bornschein, Reinert & Teixeira (Passeriformes: Thamnophilidae) is a relatively recently discovered bird species with a very local distribution in southern Brazil. This species is critically endangered, and to date no parasites or symbionts have ever been recorded on this host. Herewith, we describe the first feather mite from this host, a species of *Nanopteroedectes*, together with two further species of this genus, which appears to be exclusively associated with birds of the Neotropical family Thamnophilidae.

Materials and methods

Birds were captured using mist-nets and examined by eye for the presence of mites. Whenever feather mites were detected, a feather was carefully plucked off and stored in a vial containing 70% ethanol. The birds were released after the feather examination. Mite specimens were mounted on glass slides in Hoyer's medium (Krantz & Walter, 2009).

All measurements are in micrometres and follow the descriptive method presented in recent papers on the Pterodectinae (see Valim & Hernandez, 2008, 2009, 2010; Mironov & González-Acuña, 2011). Body features measured were as follows: idiosoma length from the anterior end of the prodorsal shield to the lobar apices (excluding the terminal appendages in females); the greatest idiosoma width was measured at the widest region at the level of the humeral shields; the distance between the setae of the same pair was taken as the direct distance between their bases, and distance between different pairs is the direct distance formed by their bases on the same side of the body; the prodorsal shield length is the greatest length from the anterior margin to the posterior end along the mid-line and the width is the greatest width at the widest part of the posterior margins; the hysteronotal shield length is the greatest length from the anterior margin to the base of setae *h3* (in males) and to the transverse furrow at the level of setae *h1* (in females), and the width is the widest region at the anterior margins; the lobar region length (in females) was taken from the anterior end to the lobar apices excluding the terminal appendages.

The chaetotaxy of the idiosoma and legs follows Griffiths et al. (1990) and Atyeo & Gaud (1966), respectively. Host common and scientific names are according to Dickinson (2003). The specimens studied herein are deposited in: the Museum of Zoology of São Paulo University, São Paulo, São Paulo, Brazil (MZUSP), the Acari Collection of Departamento de Zoologia e Botânica (DZSJRP), Universidade Estadual Paulista (UNESP), campus de São José do Rio Preto, São Paulo, Brazil (holotypes and paratypes); and the Collection of Acari of Department of Zoology of the Universidade Estadual Paulista, Rio Claro, São Paulo, Brazil (DZUnesp-RC) (paratypes).

Proctophyllodidae Trouessart & Mégnin, 1884 Pterodectinae Park & Atyeo, 1971 Pterodectini Park & Atyeo, 1971

Nanopteroedectes Mironov, 2009

Syn. *Nanodectes* Mironov in Mironov, Literak & Čapek, 2008 nec *Nanodectes* Rentz, 1985

Type-species: Nanodectes formicivorae Mironov in Mironov, Literak & Čapek, 2008 (by original designation).

So far the genus is restricted to passerines of the family Thamnophilidae, and currently includes the type-species and three new species described below. These species may be arranged into two distinct species groups: the 'formicivorae group' (*Nanopteroedectes formicivorae* and *N. acutirostris* n. sp.) and the 'mentalis group' (*N. mentalis* n. sp. and *N. leucopterus* n. sp.). These groups are based on the presence or absence of hysterosomal setae *f2* in both sexes, and the structure of the prodorsal shield, which is either entire in both sexes or split into two pieces (in males) and incised laterally (in females). The former character has also been used for the definition of species groups in *Montesauria* Oudemans, 1905 (e.g. Mironov, 2006).

Below we present the general morphological features which readily enable species of *Nanopteroedectes* to be distinguished from other pterodectines. In both sexes: hysterosomal setae *d1*, *d2*, *e2* absent; setae *wa*, *ra*, *la* situated on basal half of tarsi I and II; solenidia $\sigma 1$ and $\omega 3$ on legs I subequal in length. In males: genital arch strongly reduced, represented by sclerotised ring at base of aedeagus; genital papillae separated, situated slightly anterior to base of genital apparatus; adanal shields ovate and situated antero-lateral to anal suckers; opisthoventral shields

narrow, represented by longitudinal bands between bases of setae *ps2* and *h2*, inner margins smooth; setae *ps3* situated antero-mesal to anal suckers on soft tegument; small lamellae present on posterior margin of opisthosomal lobes. In females: lobar shield split into halves by narrow median band of soft tegument; translobar apodemes of opisthosomal lobes present, not fused to each other anterior to terminal cleft; anterior and lobar parts of hysteronotal shield completely separated by narrow transverse band of soft tegument. The absence of the genital arch and presence of lamellae on the opisthosomal lobes of the males makes this genus unique among the Pterodectinae.

The formicivorae species group

Setae *f2* absent in both sexes; prodorsal shield split into anterior and posterior pieces in males; and prodorsal shield with incision on lateral margins in females. Species presently included: *N. formicivorae* (Mironov in Mironov, Literak & Čapek, 2008) and *N. acutirostris* n. sp.

Nanopterodectes formicivorae (Mironov in Mironov, Literak & Čapek, 2008)

Syn. *Nanodectes formicivorae* Mironov in Mironov, Literak & Čapek, 2008

Type-host and locality: *Formicivora rufa* (Wied-Neuwied) (Thamnophilidae), the rusty-backed antwren; Nova Andradina, Mato Grosso do Sul, Brazil (Mironov et al., 2008).

Material studied: Paratypes: 1 male and 2 females paratypes, ex *Formicivora rufa*, Nova Andradina, 22°15'S, 53°21'W, Mato Grosso do Sul, Brazil, 30 July 2006, col. I. Literak and M. Čapek, held at MZUSP.

Remarks (Figs. 1A,E, 2A,E)

Males of this species are distinguishable from the morphologically most similar species, *N. acutirostris* n. sp., by: having the antero-lateral margins of the prodorsal shields rounded (Fig. 1A); setae *c2* are on the humeral shields; terminal lamellae which are short (*c.*5 μm) and triangular in shape (Fig. 1E); and, in females, setae *h1* and *ps1* have a trapezoidal arrangement (Fig. 2A).

Nanopterodectes acutirostris n. sp.

Type-host: *Stymphalornis acutirostris* Bornschein, Reinert & Teixeira (Thamnophilidae), the Parana antwren.

Type-locality: Lagoa do Parado, Guaratuba, Paraná, Brazil.

Type-material. Male holotype (DZSJRP 8925) ex *Stymphalornis acutirostris*, Lagoa do Parado, 25°44'36.8"S, 8°42'53.4"W, Guaratuba, Paraná, Brazil, 13 January 2012, col. B.L. Reinert. Paratypes: 9 males and 12 females, same data as holotype. Holotype male, 2 male and 2 female paratypes at DZSJRP; 7 male and 10 female paratypes at DZUnesp-RC.

Etymology: The specific epithet is taken from that of the type-host, and is treated as an adjective in the nominative singular.

Description (Figs. 1B,F, 2B,F, 3–5)

Male [holotype, measurements for 5 paratypes in parentheses]. Idiosoma, length × width, 248 (244–249) × 102 (94–104); length of hysterosoma 159 (160–164). Prodorsal shield: antero- and postero-lateral margins with slightly acute extensions, total length of shield along mid-line 79 (77–82), width of posterior part 68 (67–71), surface uniformly punctate; scapular setae *se* separated by 38 (37–40) (Fig. 3A). Humeral shields situated dorso-laterally, narrow. Setae *cp* situated ventrally on soft tegument. Setae *c2* situated distinctly off humeral shields. Subhumeral setae *c3* lanceolate, 20 (20–23) × 4 (4). Hysteronotal shield: greatest length 148 (146–151), width in anterior region 55 (53–58), anterior margin concave, surface uniformly punctate. Distance between prodorsal and hysteronotal shields 17 (10–13). Opisthosomal lobes very short, posterior margin rounded; terminal cleft *c.*16 (17–18) long, its anterior end angular (Fig. 1B,F). Posterior ends of lobes with tongue-like lamellae, length from base of *h3* to lamellae tip 15 (13–14) (Fig. 3A,B). Supranal concavity present (Figs. 1B, 3A). Setae *h1* situated at mid-level of supranal concavity. Setae *h3* setiform, 88 (70–90) long; setae *ps2* 20 (17–22) long; setae *ps1* minute, *c.*5 long, situated on internal margins of opisthosomal lobes, close to each other. Distance between dorsal setae: *se:c2* 47 (43–48), *c2:e1* 106 (104–109), *e1:h3* 46 (44–50), *h1:h3* 23 (21–24), *h2:h2* 35 (34–38), *h3:h3* 25 (22–26), *ps2:ps2* 47 (47–54).



Fig. 1 Dorsal (A–D) and ventral (E–H) views of the idiosoma of males of the genus *Nanopterodectes*: *N. formicivorae* (Mironov) (A, E); *N. acutirostris* n. sp. (B, F); *N. mentalis* n. sp. (C, G); *N. leucopterus* n. sp. (D, H). Scale-bars: 50 μ m

Epimerites I fused into V-shape (Fig. 3B). Coxal fields I and II without large sclerotised areas. Rudimentary sclerite rEpIIa absent. Coxal fields II and III open. Coxal fields IV with small angle-shaped sclerotised area at bases of trochanters IV. Epimerites IVa present, poorly sclerotised. Length of aedeagus (anterior margin of genital ring to apex) 55 (52–57), width of ring 8 (7–10). Genital shields absent. Anal suckers 9 (9–10) in diameter, corolla with indentations. Distance between ventral setae: $3b:3a$ 21 (17–22), $3a:4a$ 24 (25–31), $4a:g$ 36 (35–38), $g:ps3$ 12 (11–13), $ps3:ps3$ 9 (9–10), $ps3:h3$ 30 (28–32).

Femora I and II with narrow ventral crests, other segments without processes. Solenidion $\sigma 1$ of genu I

stick-like, 19 (15–17) long (Fig. 3C), slightly shorter than solenidion $\omega 3$ of corresponding tarsus, situated at mid-level of segment. Solenidion $\sigma 1$ of genu III 12 (12–13) long. Genua seta cGI and II, and mGI and II, setiform (Fig. 5A–D). Solenidia $\omega 1$ of tarsi I and II subequal in length, 11 (10–13) long. Legs III and IV similar in form and size. Solenidion $\sigma 1$ of genu III in proximal part of segment. Tarsus IV 27 (24–30) long, with small apico-ventral spine bearing seta w ; setae d and e button-like, seta d situated dorsally in basal half of segment, seta e at apex of segment (Fig. 5D).

Female [5 paratypes]. Idiosoma, length \times width, 393–408 \times 131–141; length of hysterosoma 274–284.

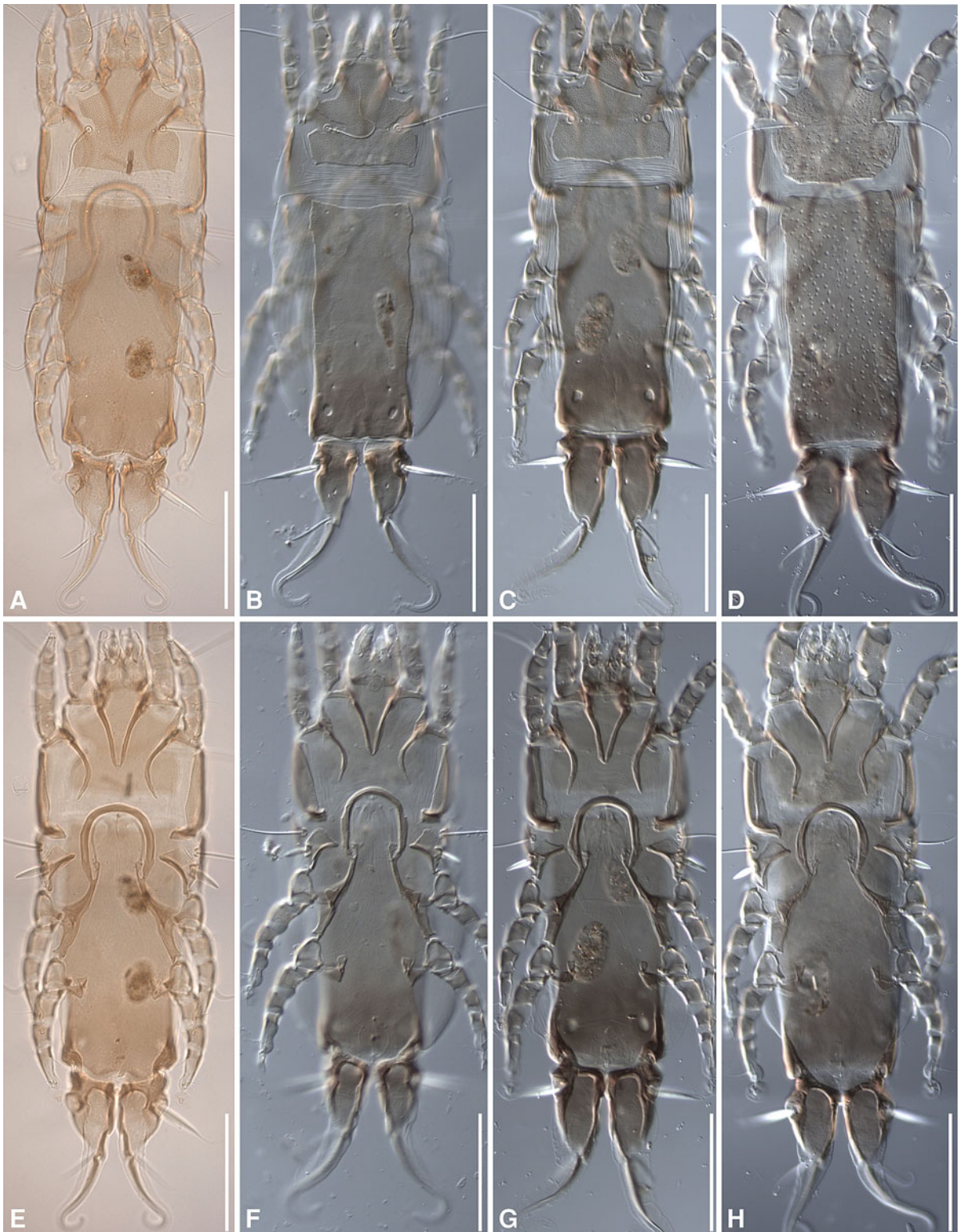


Fig. 2 Dorsal (A–D) and ventral (E–H) views of the idiosoma of females of the genus *Nanopterodectes*: *N. formicivorae* (Mironov) (A, E); *N. acutirostris* n. sp. (B, F); *N. mentalis* n. sp. (C, G); *N. leucopterus* n. sp. (D, H). Scale-bars: 100 μ m

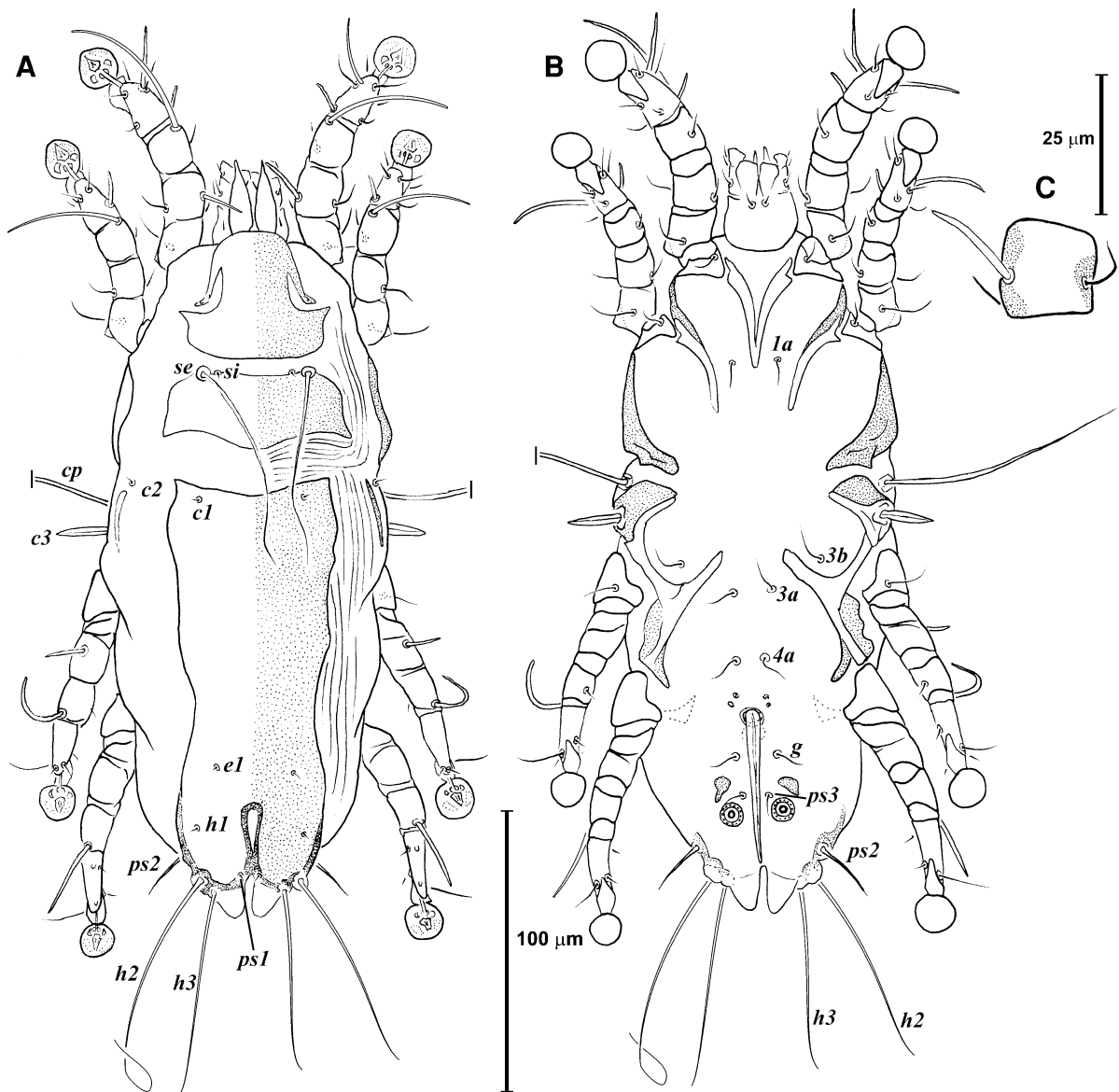


Fig. 3 *Nanopterodectes acutirostris* n. sp. male holotype: dorsal (A) and ventral (B) views; dorsal view of genu I (C)

Prodorsal shield: entire, 93–97 × 88–92, lateral margins with incision extending to bases of setae *se*, antero and postero-lateral extensions well developed and acute, setae *se* separated by 58–61. Humeral shields narrow, situated dorso-laterally. Setae *cp* situated ventrally, on soft tegument. Setae *c2* situated at anterior end of humeral shields. Setae *c3* lanceolate, 20–22 × 4–5. Distance between prodorsal and hysteronotal shields 35–38. Anterior hysteronotal shield roughly rectangular, posterior margin sinuous, greatest length 188–203, width at anterior margin 84–92, surface uniformly

punctate (Fig. 4A). Pair of oval pale patches posterior to setae *e1*. Length of lobar region 72–77, greatest width 84–92. Terminal cleft inverted U- or V-shaped, posterior regions with diverging margins, 51–61 long, distance between lobar apices 22–29. Setae *h1* on lobar shield close to its anterior margin. Setae *h2* blade-like with apical filament, total length 97–102, width of enlarged part 5–6. Setae *ps1* equidistant from inner and outer margins of opisthosomal lobes, bases of setae *ps1* and *h1* arranged in square. Setae *h3* setiform, 56–69 long, *c.2/3* of terminal appendages. Distance between dorsal setae:

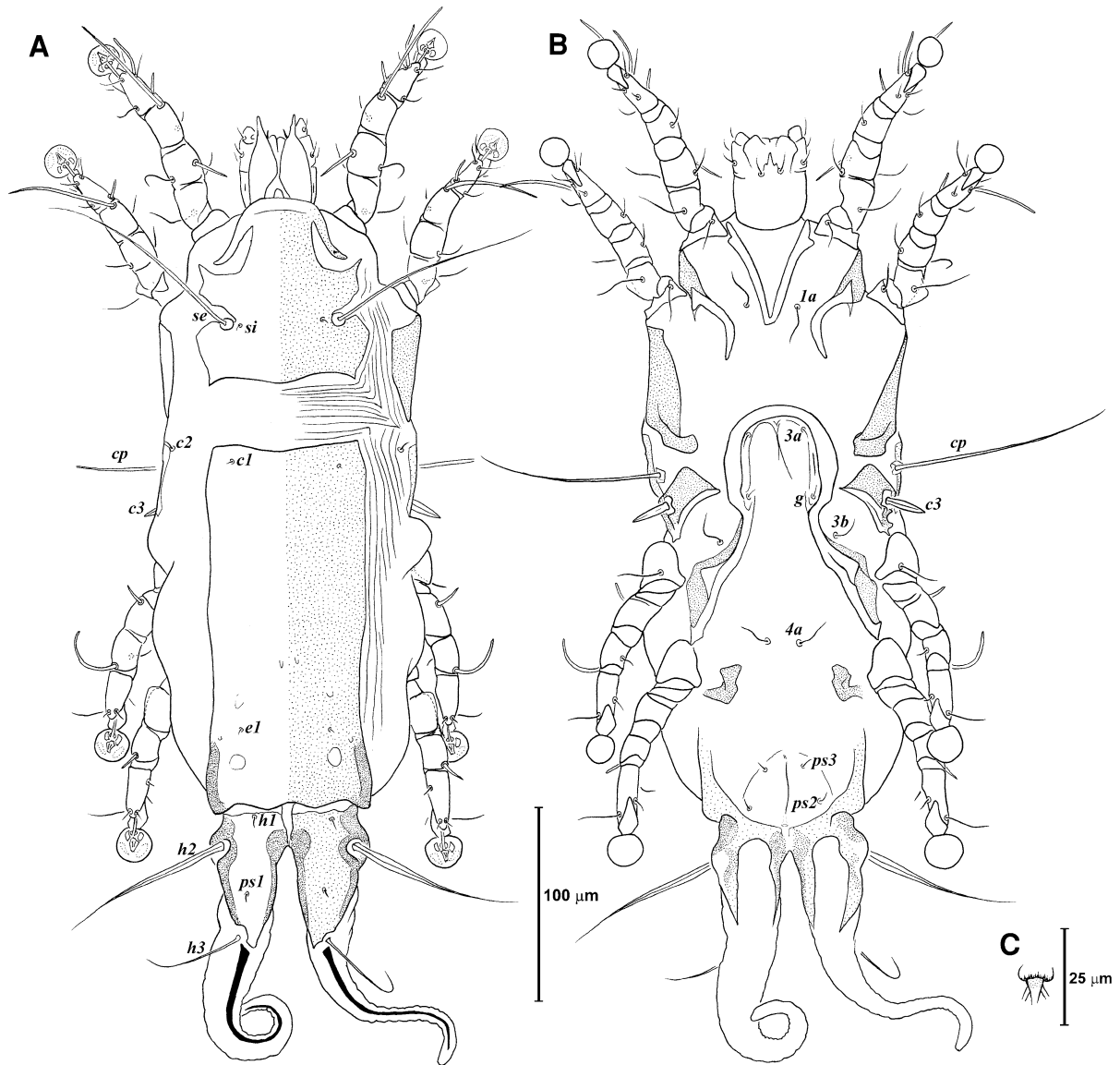


Fig. 4 *Nanopterodectes acutirostris* n. sp. female: dorsal (A) and ventral (B) views; spermatheca (C)

se:c2 74–78, *c2:e1* 148–159, *e1:h2* 66–69, *h2:h3* 44–51, *h1:h2* 19–24, *h1:h1* 48–54, *h2:h2* 70–77, *h3:h3* 40–48.

Epimerites I fused into narrow U or V, internal base of epimerites II with very small acute extensions pointing towards centre of coxal fields II. Coxal fields I and II as in male (Fig. 4B). Epimerites IVa present, in form of irregular plates. Epigynum horseshoe-shaped, without lateral extensions. Primary spermatheca slightly enlarged near head of spermatheca, most of primary spermatheca indistinct; secondary spermatheca short

(Fig. 4C); copulatory opening situated ventrally, posterior to anal opening, between inner ends of translobar apodemes. Pseudanal setae *ps2* and *ps3* setiform, seta *ps2* situated at level of posterior end of anal opening; distances of setae: *ps2:ps2* 35–41, *ps3:ps3* 18–22, *ps2:ps3* 19–21.

Three distal segments of legs I and II as in male; femur I without ventral crest, femur II with ventral crest. Solenidion $\sigma 1$ of genu I thin, stick-like, length 27–31, noticeably longer than solenidion $\omega 1$ of

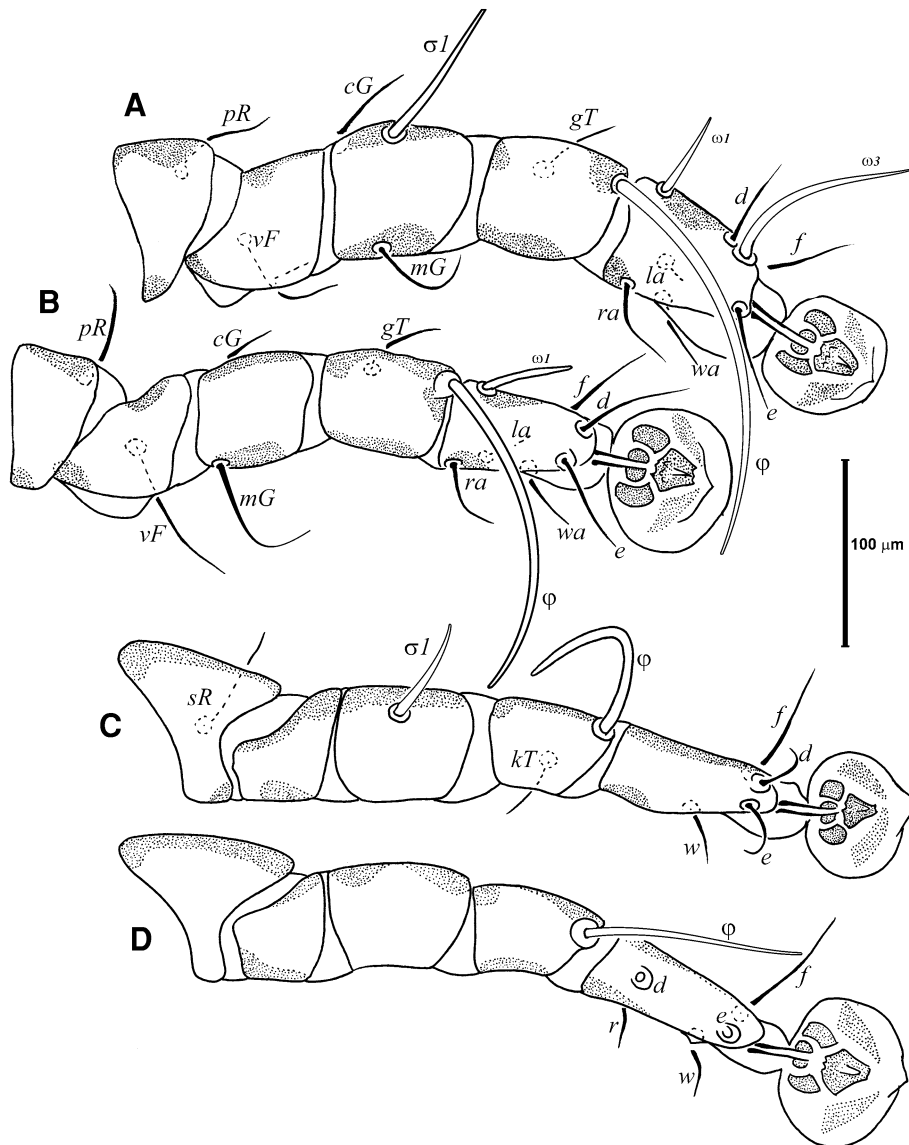


Fig. 5 *Nanopterodectes acutirostris* n. sp. male holotype: dorsal view of legs I–IV (A–D)

corresponding tarsus. Solenidion $\sigma 1$ of genu IV 10–11 long. Genual seta cGI and II, and mGI and II, setiform. Solenidia $\omega 1$ of tarsi I and II subequal in length, 13–15. Genu IV with longitudinal dorsal crest, genu III not modified.

Remarks

Nanopterodectes acutirostris n. sp. differs from *N. formicivorae*, the other species of the formicivorae group, in the following features: in males, the

antero-lateral margins of the prodorsal shields are sharply pointed (Fig. 1B), setae $c2$ are off the humeral shields (Fig. 3A), and the terminal lamellae are 13–15 μm long and tongue shaped (Figs. 1B,F, 3A); and in females, setae $h1$ and $ps1$ are arranged in a square (Figs. 2B, 4A). In the case of *N. formicivorae*: the antero-lateral margins of the prodorsal shields are less pointed (Fig. 1A); and setae $c2$ are set on the humeral shields; in males, the terminal lamellae are short (5 μm) and triangular (Fig. 1E); and in females, setae $h1$ and $ps1$ are set in a trapezoidal arrangement.

The mentalis species group

Setae *f*₂ present in both sexes; prodorsal shield entire in males; prodorsal shield without incision on lateral margins in females. Species presently included: *N. mentalis* n. sp. and *N. leucopterus* n. sp.

Nanopterodectes mentalis n. sp.

Syn. ‘*Proterothrix* s. l. sp.’, ex *Dysithamnus mentalis*, of Kanegae et al. (2008)

Type-host: *Dysithamnus mentalis* (Temminck) (Thamnophilidae), the plain antvireo.

Type-locality: Fazenda Água Limpa, Brasília, Distrito Federal, Brazil.

Type-material: Male holotype (DZSJRP 8930) ex *Dysithamnus mentalis*, Fazenda Água Limpa, 15°57'S, 47°56'W, Brasília, Distrito Federal, Brazil, 13 May 2002, col. M.F. Kanegae. Paratypes: 8 females, same data as holotype. Paratypes: 1 female (DZSJRP 8931); 7 females (DZUnesp-RC 0035-0041).

Etymology: The specific epithet is taken from that of the type-host, and is treated as an adjective in the nominative singular.

Description (Figs. 1C,G, 2C,G, 6–7)

Male [holotype]. Idiosoma, length × width, 232 × 105; length of hysterosoma 156. Prodorsal shield: setae *se* broken off in holotype; antero and postero-lateral extensions acute, lateral margins concave at level of scapular setae, total length of shield along mid-line 72, width of posterior region 77, surface uniformly punctate; scapular setae *se* separated by 39 (Fig. 6A). Scapular shields present, humeral shields narrow and situated dorsally. Setae *cp* situated ventrally, on soft tegument. Setae *c*₂ situated on anterior ends of humeral shields. Subhumeral setae *c*₃ lanceolate, 20 × 5. Hysteronotal shield: greatest length 145, width in anterior part 62, anterior margin concave, surface uniformly punctate. Distance between prodorsal and hysteronotal shields 13. Opisthosomal lobes roughly angular, short with bases of *h*₃ on lobar apices. Terminal cleft roughly V-shaped, 18 in length. Lamellae short and acute, length from base of *h*₃ to lamellae tip 5. Supranal concavity present, tear-shaped. Setae *h*₁ situated at mid-level of supranal concavity. Setae *h*₃ setiform, 73 long; setae *ps*₂ 22 long; setae *ps*₁ minute,

c.6 long, situated on margins of terminal cleft at level of setae *h*₂. Distance between dorsal setae: *se:c*₂ 49, *c*_{2:e₁ 103, *e*_{1:h₃ 47, *h*_{1:h}₃ 21, *h*_{2:h}₂ 31, *h*_{3:h}₃ 20, *ps*_{2:ps}₂ 42.}}

Epimerites I fused into V-shape (Fig. 6B). Coxal fields I and II without large sclerotised areas. Rudimentary sclerite rEpIIa absent. Coxal fields II and III open. Coxal fields IV with small triangular sclerotised area at bases of trochanters IV. Epimerites IVa poorly sclerotised. Length of aedeagus from anterior margin of genital ring to apex 61, width of ring 8. Anal suckers 10 in diameter, corolla with indentations. Distance between ventral setae: *3b:3a* 20, *3a:4a* 30, *4a:g* 35, *g:ps*₃ 15, *ps*_{3:ps}₃ 11, *ps*_{3:h}₃ 32.

Femora I and II with narrow ventral crests, other segments without processes. Solenidion σ ₁ of genu I resembling stick, 10 long (Fig. 6C), *c*.1/3 length of solenidion ω ₃ of corresponding tarsus, situated at mid-level of segment. Solenidion σ ₁ of genu IV 5 long. Genua seta *c*GI and II, and *m*GI and II, setiform. Solenidia ω ₁ of tarsi I, II subequal in length, 8–9 long. Legs III and IV similar in form and size. Solenidion σ ₁ of genu III in proximal part of segment. Tarsus IV 29 long, with small ventral spine bearing seta *w*; setae *d*, *e* button-like, seta *d* situated dorsally, in basal half of segment, seta *e* at apex of segment.

Female [8 paratypes]. Idiosoma, length × width, 396–423 × 126–139; length of hysterosoma 286–305. Prodorsal shield: entire, 94–102 × 95–101, lateral margins slightly concave at level of scapular setae, without any lateral incisions, setae *se* separated by 62–67. Scapular shields present; humeral shields narrow, situated dorso-laterally. Setae *cp* situated ventrally, on soft tegument. Setae *c*₂ situated at anterior end of humeral shields. Setae *c*₃ lanceolate, 21–24 × 5–6. Distance between prodorsal and hysteronotal shields 14–24. Anterior hysteronotal shield roughly rectangular, anterior margin slightly straight, posterior margin rounded, greatest length 203–212, width at anterior margin 91–99, surface uniformly punctate, region posterior to level of setae *e*₁ distinctly darker (Fig. 7A). Single pair of ovate pale patches posterior to setae *e*₁. Length of lobar region 83–91, greatest width 90–96. Terminal cleft narrow, inverted U- or V-shaped, posterior part with divergent margins, 54–60 long, distance between lobar apices 20–31. Setae *h*₁ on lobar shield, close to its anterior margin. Setae *h*₂ blade-like with apical filament, total length 67–75, width of

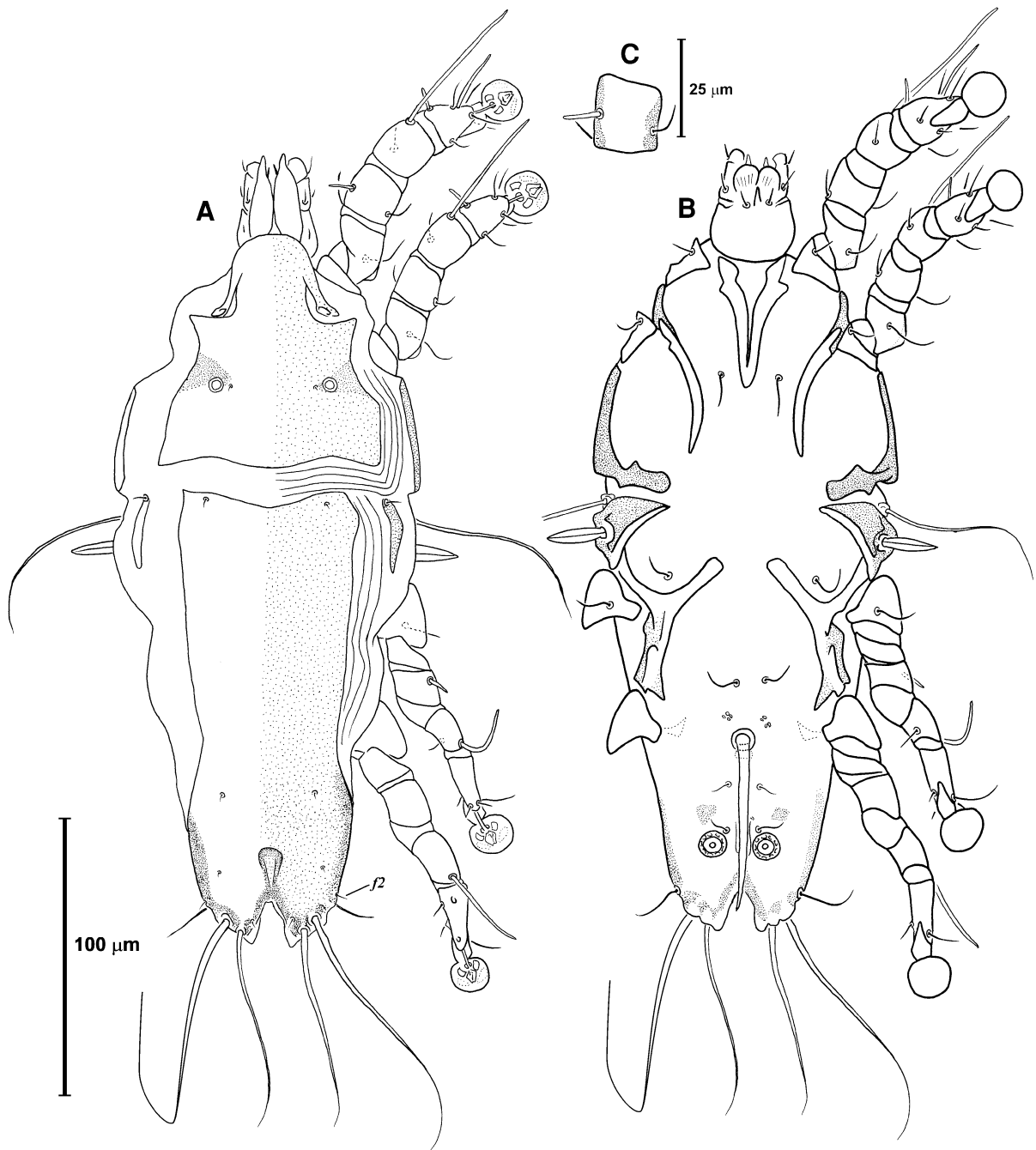


Fig. 6 *Nanopterodectes mentalis* n. sp. male holotype: dorsal (A) and ventral (B) views; dorsal view of genu I (C)

enlarged part 6. Setae *ps1* situated at mid-level between setae *h2* and *h3*. Setae *h3* setiform, 55–81 long, *c.1/2* length of terminal appendages. Distance between dorsal setae: *se:c2* 70–76, *c2:e1* 144–154, *e1:h2* 77–85, *h2:h3* 51–60, *h1:h2* 22–31, *h1:h1* 43–52, *h2:h2* 76–83, *h3:h3* 37–51.

Epimerites I fused forming V-shape, internal base of epimerites II with medium-sized acute extensions pointing towards trochanter II. Lateral part of coxal fields I and II without sclerotised areas (Fig. 7B). Epimerites IVa present, roughly triangular. Epigynum horseshoe-shaped, without lateral extensions. Primary

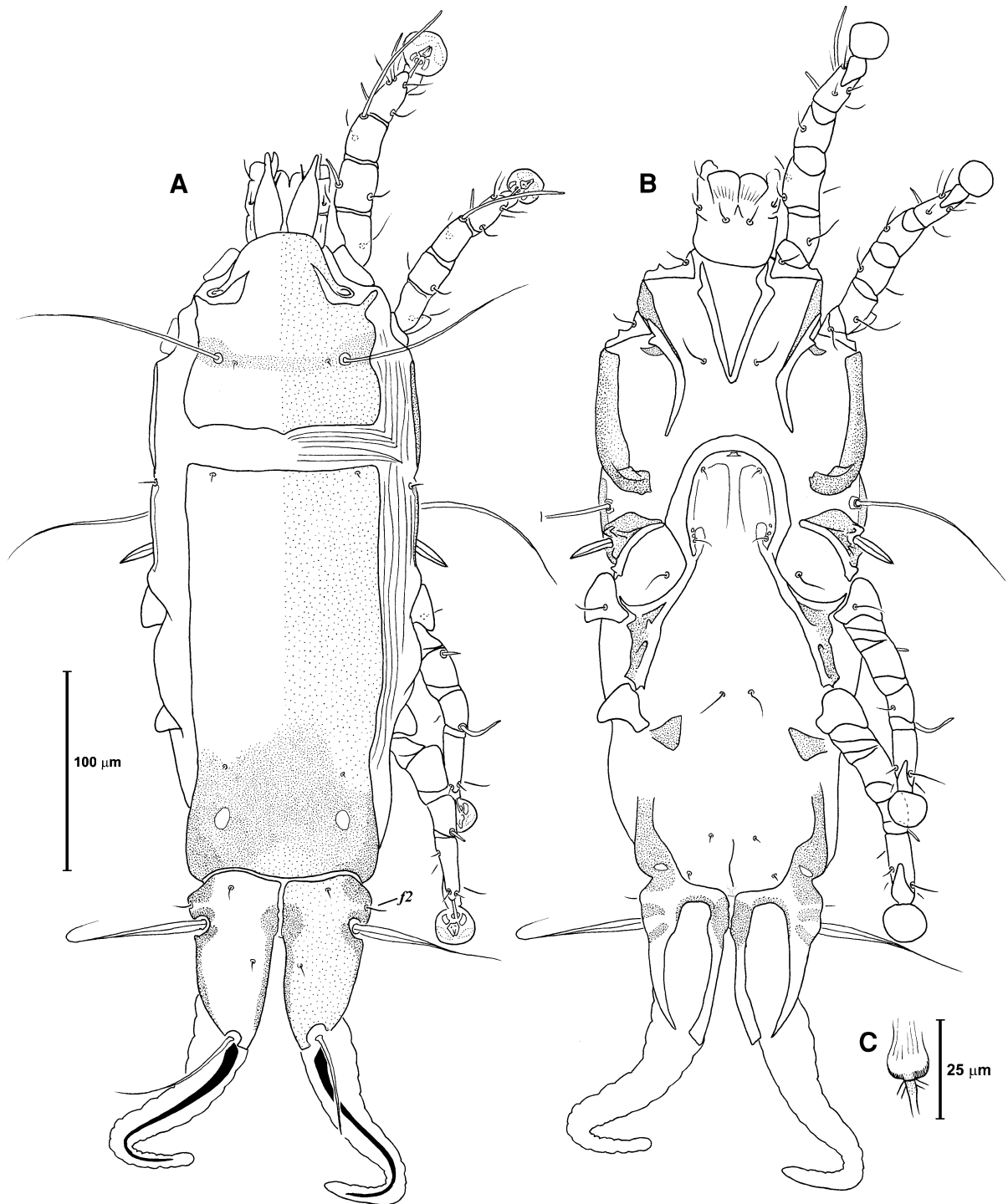


Fig. 7 *Nanopterodectes mentalis* n. sp. female: dorsal (A) and ventral (B) views; spermatheca (C)

spermaduct not enlarged near head of spermatheca, most part of primary spermaduct indistinct; secondary spermaducts short, about same width as primary duct

(Fig. 7C); copulatory opening situated ventrally between inner ends of translobar apodemes. Pseudanal setae *ps2* and *ps3* setiform, seta *ps2* situated at level of

posterior end of anal opening. Lateral margins of hysteronotal shield extend to ventral side of body, with pair of distinct holes; distance between setae: $ps2:ps2$ 41–45, $ps3:ps3$ 18–23, $ps2:ps3$ 21–26.

Three distal segments of legs I and II as in male; femur I without ventral crest, femur II with distinct ventral crest. Solenidion $\sigma 1$ of genu I thin stick-like, length 13–17, about same length as solenidion $\omega 1$ of corresponding tarsus. Solenidion $\sigma 1$ of genu IV 10–11 long. Genua seta cGI and II, and mGI and II, setiform. Solenidia $\omega 1$ of tarsi I and II subequal in length, 15–17. Genu IV with longitudinal dorsal crest, genu III not modified.

Remarks

Both sexes of *N. mentalis* n. sp. differ morphologically from the most similar species *N. leucopterus* n. sp. in having: dorsal shields without lacunae (Figs. 1C, 2C, 6A, 7A); males with short (5 μm), triangular lamellae (Figs. 1C,G, 6A); and female with the postero-lateral margins of the prodorsal shield rounded (Figs. 2C, 7A). In *N. leucopterus*, the dorsal shields have lacunae (Figs. 1D, 2D), the males have long (9–12 μm), triangular lamellae (Fig. 1D), and, in females, the prodorsal shield has widely rounded postero-lateral margins (Fig. 2D).

This species has previously been referred to in the literature as '*Proterothrix* s.l. sp.' by Kanegae et al. (2008) and also by Valim et al. (2011).

Nanopterodectes leucopterus n. sp.

Type-host: *Pyriglena leucoptera* (Vieillot) (Thamnophilidae), the white-shouldered fire-eye.

Type-locality: Arujá, São Paulo, Brazil.

Type-material: Male holotype ex *Pyriglena leucoptera*, Arujá, 23°22'19"S, 46°22'01"W, São Paulo, Brazil, 24 June 2011, col. A.M. Montanhini. Paratypes: 9 males and 7 females, same data as holotype. Holotype, 1 male and 2 female paratypes at DZSJRP; 7 male and 5 female paratypes at DZUnesp-RC.

Additional material examined: 4 males and 13 females from the type-host, Belo Horizonte, Minas Gerais, Brazil; no other data available.

Etymology: The specific epithet is taken from that of the type-host, and is treated as an adjective in the nominative singular.

Description (Figs. 1D,H, 2D,H, 8–9)

Male [holotype, measurements for 5 paratypes in parentheses]. Idiosoma, length \times width, 257 (251–267) \times 100 (97–110); length of hysterosoma 172 (169–186). Prodorsal shield with antero- and postero-lateral extensions acute, lateral margins concave at level of scapular setae, total length of shield along mid-line 82 (81–84), width of posterior part 66 (65–70), surface uniformly punctuate with irregular lacunae distributed posterior to scapular setae and less numerous slightly anterior to those setae (Figs. 1D, 8A); scapular setae se separated by 42 (45–47). Scapular shield present; humeral shields situated dorsally. Setae cp situated ventrally, on soft tegument. Setae $c2$ situated on anterior ends of humeral shields. Subhumeral setae $c3$ lanceolate, 19 (18–20) \times 5 (5). Hysteronotal shield: greatest length 157 (153–163), width in anterior region 59 (59–62), anterior margin concave, surface uniformly punctuate with irregular lacunae distributed between the levels of setae $c1$ and $h1$. Distance between prodorsal and hysteronotal shields 10 (8–15). Opisthosomal lobes short, posterior margin of lobes rounded; terminal cleft with angular anterior end, 18 (18–19) in length (Figs. 1D, 8A). Posterior margin of lobes with relatively long pointed lamellae, length from base of $h3$ to lamella tip 11 (9–12) (Fig. 8A). Setae $h1$ situated at mid-level of supranal concavity (Figs. 1D, 8A). Setae $h3$ setiform, 86 (75–88) long; setae $ps2$ 25 (19–25) long; setae $ps1$ minute, $c.6$ long, situated on margins of terminal cleft at level of setae $h2$. Distance between dorsal setae: $se:c2$ 49 (47–56), $c2:e1$ 105 (103–109), $e1:h3$ 50 (46–52), $h1:h3$ 24 (22–26), $h2:h2$ 34 (31–37), $h3:h3$ 22 (21–25), $ps2:ps2$ 44 (43–46).

Epimerites I fused forming V-shape, fused part with acute median extension (Fig. 8B). Coxal fields I and II without large sclerotised areas. Rudimentary sclerite rEpIIa present, very small. Coxal fields II and III open. Coxal fields IV with small pointed sclerotised area at bases of trochanters IV. Epimerites IVa present, poorly sclerotised. Length of aedeagus from anterior margin of genital ring to apex 72 (69–82), width of ring 11 (9–11). Anal suckers 10 (10–11) in diameter, corolla with indentations. Distance between ventral setae: $3b:3a$ 20

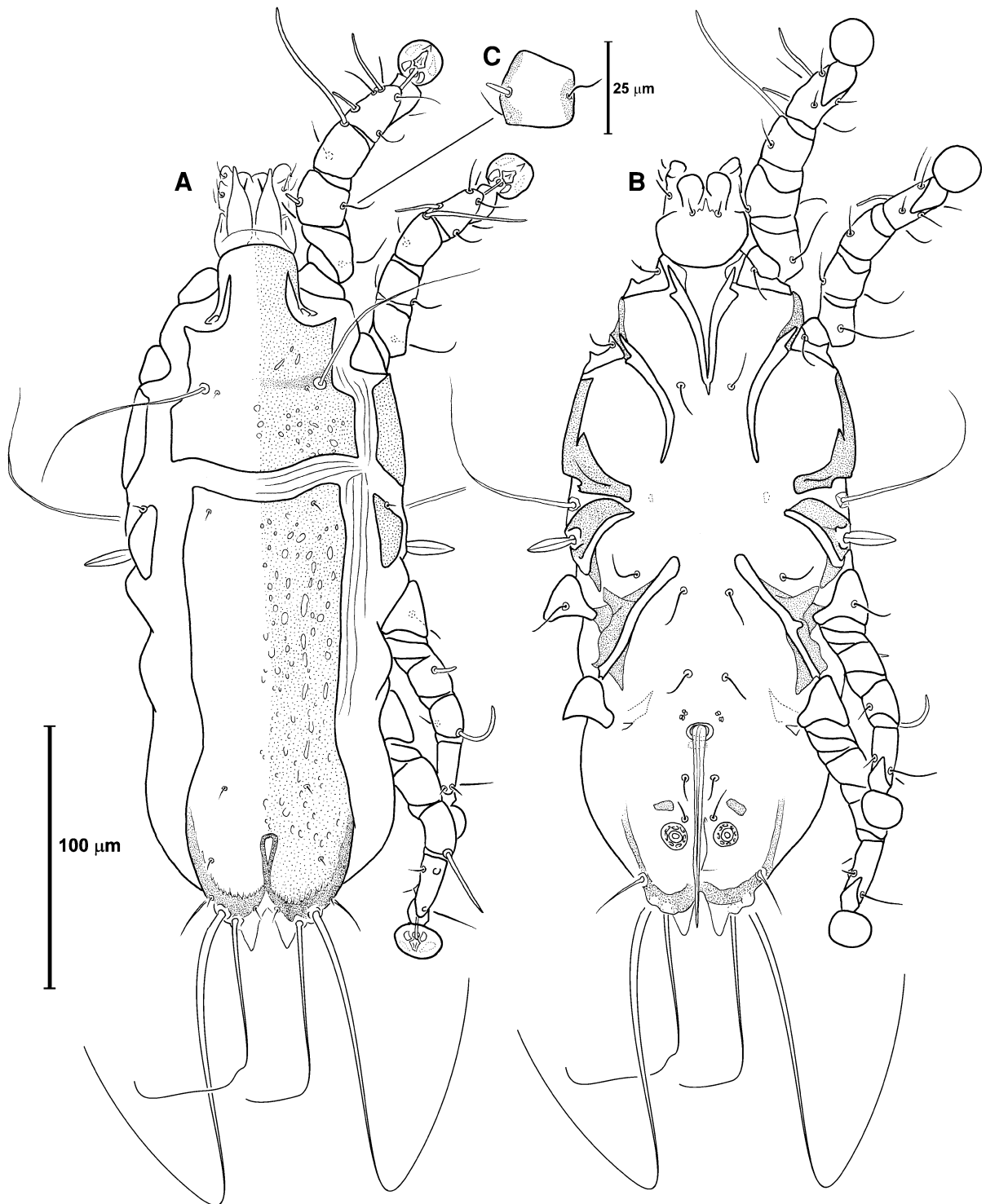


Fig. 8 *Nanopterodectes leucopterus* n. sp. male holotype: dorsal (A) and ventral (B) views; dorsal view of genu I (C)

(19–21), *3a:4a* 31 (28–32), *4a:g* 37 (36–38), *g:ps3* 15 (14–16), *ps3:ps3* 11 (10–12), *ps3:h3* 33 (28–34).

Femora I and II with narrow ventral crests, other segments without processes. Solenidion $\sigma 1$ of genu I resembling short stick, 6 (6–7) long (Fig. 8C), about 1/2 the length of $\omega 1$ of corresponding tarsus, situated at mid-level of segment. Solenidion $\sigma 1$ of genu IV 8–9 long. Genual seta *cGI* and II, and *mGI* and II, setiform. Solenidia $\omega 1$ of tarsi I and II subequal in length (12–13). Legs III and IV similar in form and size. Solenidion $\sigma 1$ of genu III in proximal part of segment. Tarsus IV 29 (28–30) long, with small ventral spine bearing seta *w*; setae *d* and *e* button-like, seta *d* situated dorsally in basal half of segment, seta *e* at apex of segment.

Female [5 paratypes]. Idiosoma, length \times width, 425–444 \times 147–160; length of hysterosoma 292–313. Prodorsal shield: entire, 112–121 \times 111–120, surface as in male, lateral margins concave at level of scapular setae, without any lateral incisions, antero-lateral margins acute, postero-lateral margins widely rounded, setae *se* separated by 67–73. Scapular shields present, humeral shields large, situated dorso-laterally. Setae *cp* situated ventrally, on soft tegument. Setae *c2* situated at anterior margin of humeral shields. Setae *c3* lanceolate, 19–21 \times 4–5. Distance between prodorsal and hysteronotal shields 8–14. Anterior hysteronotal shield roughly rectangular in form, anterior and posterior margins slightly concave, greatest length 216–227, width at anterior margin 95–98, surface uniformly punctuate, with irregular lacunae distributed throughout shield (Figs. 2D, 9A). A pair of faint oval pale patches located posterior to setae *e1*. Length of lobar region 78–87, greatest width 97–101. Terminal cleft with shape of inverted V, posterior part with divergent margins, 54–61 long, distance between lobar apices 27–32. Setae *h1* on lobar shield, close to its anterior margin. Setae *h2* blade-like with apical filament, total length 90–98, width of enlarged part 6–7. Setae *ps1* closer to setae *h2* than to *h3*, bases of setae *ps1* and *h1* arranged in square. Setae *h3* setiform, 67–75 long, *c.2/3* of terminal appendages. Distance between dorsal setae: *se:c2* 64–82, *c2:e1* 157–175, *e1:h2* 71–89, *h2:h3* 43–49, *h1:h2* 31–34, *h1:h1* 47–49, *h2:h2* 83–87, *h3:h3* 49–59.

Epimerites I fused to form V, bases of epimerites I–II with small triangular plates pointing towards centre of coxa I and II, respectively (Fig. 9B). Epimerites IVa present, represented by sclerites of irregular form. Epigynum horseshoe-shaped, without lateral extensions.

Primary spermaduct not enlarged near head of spermatheca, most of primary spermaduct indistinct; secondary spermaducts short, *c.1/2* width of primary duct (Fig. 9C); copulatory opening situated ventrally at level of setae *f2*. Pseudanal setae *ps2* and *ps3* setiform, seta *ps2* situated at level of posterior end of anal opening; distance setae: *ps2:ps2* 41–43, *ps3:ps3* 15–17, *ps2:ps3* 23–26.

Three distal segments of legs I and II as in male; femur I without ventral crest, femur II with small ventral crest. Solenidion $\sigma 1$ of genu I thin stick-like, length 11, *c.1/2* length of solenidion $\omega 1$ of corresponding tarsus. Solenidion $\sigma 1$ of genu IV 10–11 long. Genual seta *cGI* and II, and *mGI* and II, setiform. Solenidia $\omega 1$ of tarsi I and II subequal in length, 14–16. Genu IV with longitudinal dorsal crest, genu III not modified.

Remarks

Both sexes of *N. leucopterus* n. sp. differ from the morphologically closest species, *N. mentalis* n. sp., by having: dorsal shields densely covered by lacunae (Figs. 1D, 2D, 8A, 9A); triangular lamellae (9–12 μ m) in males (Figs. 1D, 8A); and the prodorsal shield with widely rounded postero-lateral margins in females (Figs. 2D, 9A). Whereas, in *N. mentalis*: the dorsal shields lack lacunae (Figs. 1C, 2C); males have short, triangular lamellae (5 μ m) (Fig. 1C); and females have the prodorsal shield with acute postero-lateral margins (Fig. 2C).

Key to species of *Nanopterodectes* Mironov, 2009

1. In both sexes: setae *f2* absent. In males: prodorsal shield split into anterior and posterior pieces; setae *se* set on transverse band of soft tegument (Fig. 1A,B). In females: prodorsal shield with incisions on lateral margins at level of scapular setae *se* and *si* (Fig. 2A,B).....(**formicivora** group) 2
- In both sexes: setae *f2* present (Figs. 6–7A, 8–9A); setae *se* on lightly sclerotised areas of prodorsal shield. In males: prodorsal shield entire (Fig. 1C,D). In females: prodorsal shield without incision on lateral margins (Fig. 2C,D) (**mentalis** group) 3

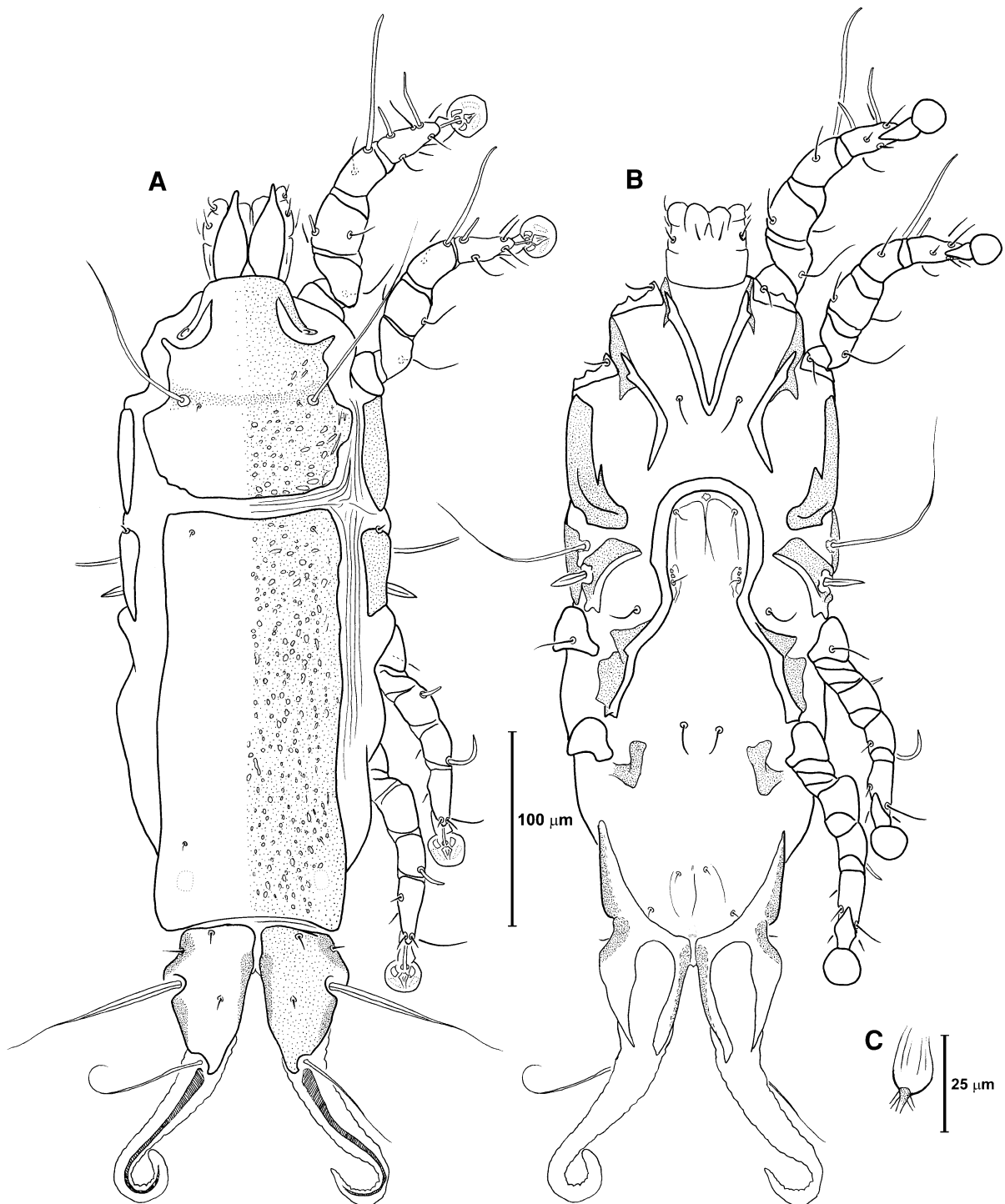


Fig. 9 *Nanopterodectes leucopterus* n. sp. female: dorsal (A) and ventral (B) views; spermatheca (C)

2. In males: antero-lateral margins of prodorsal shields rounded (Fig. 1A); setae *c2* set on humeral shields; terminal lamellae short (*c.*5 μm) and

triangular (Fig. 1A,E). In females: anterior hysteronotal shield with postero-lateral margins distinctly angular (Fig. 2A); setae *h1* and *ps1* in trapezoidal

- arrangement *N. formicivorae* (Mironov in Mironov, Literak & Čapek, 2008)
- In males: antero-lateral margins of prodorsal shields acute (Fig. 1B); setae *c2* set off humeral shields (Fig. 3A); terminal lamellae long (13–15 µm) and tongue-shaped (Fig. 1B). In females: anterior hysteronotal shield lacking angular postero-lateral margins (Fig. 2B); setae *h1* and *ps1* set in square arrangement *N. acutirostris* n. sp.
 - 3. In both sexes: dorsal shields without lacunae (Figs. 1C, 2C). In males: lamellae triangular and short (5 µm) (Fig. 1C,G). In females: prodorsal shield with acute postero-lateral margins (Fig. 2C); internal base of epimerites II with acute extensions pointing towards trochanter II (Figs. 2G, 7B) *N. mentalis* n. sp.
 - In both sexes: dorsal shields densely covered by small circular lacunae (Figs. 1D, 2D). In males: lamellae triangular and long (9–12 µm) (Fig. 1D,H). In females: prodorsal shield with widely rounded postero-lateral margins (Fig. 2D); internal base of epimerites II with acute extensions pointing towards centre of coxa II (Figs. 2H, 9B) *N. leucopterus* n. sp.

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