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

http://www.producao.usp.br/handle/BDPI/42557

Downloaded from: Biblioteca Digital da Produção Intelectual - BDPI, Universidade de São Paulo
The genus *Nanopterodectes* Mironov, 2009 (Acari, Proctophyllodidae), with descriptions of three new species from antbirds (Passeriformes: Thamnophilidae) in Brazil

Fabio A. Hernandes · Michel P. Valim

Received: 11 June 2012 / Accepted: 3 August 2012 © Springer Science+Business Media B.V. 2012

Abstract Three new species of the recently discovered, and hitherto monotypic, feather mite genus *Nanopterodectes* Mironov, 2009 are described: \( N. \) \( acu \)trirostris \( n. \) sp. from *Stymphalornis acu \)trostris* Bornschein, Reinert & Teixeira, \( N. \) mentalis \( n. \) sp. from *Dysithamnus mentalis* (Temminck), and \( N. \) \( leuc \)opterus \( n. \) sp. from *Pyrglena 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 *Nanopterodectes* is presented for both sexes.

Introduction

The monotypic genus *Nanopterodectes* Mironov, 2009 (Proctophyllodidae: Pterodectinae) was recently erected for *N. formicivorae* (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 *Nanopterodectes* 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.


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; Hernandes & Valim, 2005, 2006; Valim & Hernandes, 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...
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 *Symphalornis 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 *Nanopterodectes*, 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 & Hernandes, 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 (DZSJR), 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**

**Nanopterodectes Mironov, 2009**


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’ (*Nanopterodectes formicivorae* and *N. acutirostris* 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 *Nanopterodectes* 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 *σ1* and *ω3* 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)


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).
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 $\sigma l$ 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 $\sigma l$ of genu III 12 (12–13) long. Genual seta $cG I$ and II, and $mG I$ and II, setiform (Fig. 5A–D). Solenidia $\omega l$ of tarsi I and II subequal in length, 11 (10–13) long. Legs III and IV similar in form and size. Solenidion $\sigma l$ 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 × width, 393–408 × 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 μm
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:
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 spermaduct slightly enlarged near head of spermatheca, most of primary spermaduct indistinct; secondary spermaducts 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 r1 of genu I thin, stick-like, length 27–31, noticeably longer than solenidion o1 of

Fig. 4 Nanopterodectes acutirostris n. sp. female: dorsal (A) and ventral (B) views; spermatheca (C)
corresponding tarsus. Solenidion \( \sigma l \) of genu IV 10-11 long. Genual seta \( cG I \) and II, and \( mG I \) and II, setiform. Solenidia \( oI \) 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 formicivora 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 \( \mu \)m 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 \( \mu \)m) and triangular (Fig. 1E); and in females, setae \( h1 \) and \( ps1 \) are set in a trapezoidal arrangement.

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

S setae f2 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 posterolateral 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 c2 situated on anterior ends of humeral shields. Subhumeral setae c3 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 h3 on lobar apices. Terminal cleft roughly V-shaped, 18 in length. Lamellae short and acute, length from base of h3 to lamellae tip 5. Supranal concavity present, tear-shaped. Setae h1 situated at mid-level of supranal concavity. Setae h3 setiform, 73 long; setae ps2 22 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, c2:e1 103, e1:h3 47, h1:h3 21, h2:h2 31, h3:h3 20, ps2:ps2 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:ps3 15, ps3:ps3 11, ps3:h3 32.

Femora I and II with narrow ventral crests, other segments without processes. Solenidion σ1 of genu I resembling stick, 10 long (Fig. 6C), c.1/3 length of solenidion ω3 of corresponding tarsus, situated at mid-level of segment. Solenidion σ1 of genu IV 5 long. Genual seta cGI and II, and mGI and II, setiform. Solenidia ω1 of tarsi I, II subequal in length, 8–9 long. Legs III and IV similar in form and size. Solenidion σ1 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 c2 situated at anterior end of humeral shields. Setae c3 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 e1 distinctly darker (Fig. 7A). Single pair of ovate pale patches posterior to setae e1. 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 h1 on lobar shield, close to its anterior margin. Setae h2 blade-like with apical filament, total length 67–75, width of...

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

Three distal segments of legs I and II as in male; femur I without ventral crest, femur II with distinct ventral crest. Solenidion σ1 of genu I thin stick-like, length 13–17, about same length as solenidion ω1 of corresponding tarsus. Solenidion σ1 of genu IV 10–11 long. Genual seta cGI and II, and mGI and II, setiform. Solenidia ω1 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.*’ 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 × width, 257 (251–267) × 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 numerousy 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) × 5 (5). Hysterontosal 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:cp 24 (16–26), e1:h1 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)

Femora I and II with narrow ventral crests, other segments without processes. Solenidion $\sigma l$ of genu I resembling short stick, 6 (6–7) long (Fig. 8C), about 1/2 the length of $\omega l$ of corresponding tarsus, situated at mid-level of segment. Solenidion $\sigma l$ of genu IV 8–9 long. Genual seta cGI and II, and mGI and II, setiform. Solenia $\omega l$ of tarsi I and II subequal in length (12–13). Legs III and IV similar in form and size. Solenidion $\sigma l$ of genu III in proximal part of segment. Tarsus IV 29 (28–30) long, with small ventral spine bearing seta $e_1$; 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 $e_1$ separated by 67–73. Scapular shields present, humeral shields large, situated dorso-laterally. Setae $c_p$ situated ventrally, on soft tegument. Setae $c_2$ situated at anterior margin of humeral shields. Setae $c_3$ 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 $e_1$. Length of lobar shield 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 $h_l$ on lobar shield, close to its anterior margin. Setae $h_2$ blade-like with apical filament, total length 90–98, width of enlarged part 6–7. Setae $ps_1$ closer to setae $h_2$ than to $h_3$, bases of setae $ps_1$ and $h_1$ arranged in square. Setae $h_3$ setiform, 67–75 long, c.2/3 of terminal appendages. Distance between dorsal setae: $se_c 2$ 64–82, $c_2:e_1 157–175$, $e_1:h_2 71–89$, $h_2:h_3 43–49$, $h_1:h_2 31–34$, $h_1:h_1 47–49$, $h_2:h_2 83–87$, $h_3:h_3 49–59$.

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. Epignum 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 $f_2$. Pseudanal setae $ps_2$ and $ps_3$ setiform, seta $ps_2$ situated at level of posterior end of anal opening; distance setae: $ps_2:ps_2$ 41–43, $ps_3:ps_3$ 15–17, $ps_2:ps_3$ 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 $\sigma l$ of genu I thin stick-like, length 11, c.1/2 length of solenidion $\omega l$ of corresponding tarsus. Solenidion $\sigma l$ of genu IV 10–11 long. Genual seta cGI and II, and mGI and II, setiform. Solenidia $\omega l$ 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 $\mu$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 $\mu$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 $f_2$ absent. In males: prodorsal shield split into anterior and posterior pieces; setae $e_1$ 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)………………………………(formic-ivorae group)……………………………… 2

   In both sexes: setae $f_2$ present (Figs. 6–7A, 8–9A); setae $e_1$ 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
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 hyster-onotal shield with postero-lateral margins distinctly angular (Fig. 2A); setae h1 and ps1 in trapezoidal

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

Acknowledgements We appreciate the efforts of Mieko F. Kanegae in collecting mites from the plain antvireo, Arthur Macarrão Montanini for collecting mites from the white-shouldered fire-eye, and Bianca L. Reinert, Marcos R. Bornschein, Carlos O.A. Gussoni, Daiane D. Sobotka, Leandro Corrêa and Leandro F. Corrêa for assistance with collecting mites from the Parana antwren. We also thank the two anonymous reviewers for their valuable suggestions regarding the manuscript. This study was supported by the FAPESP – São Paulo Research Foundation (FAH: 2011/50145-0; 2011/20805-8; MPV: 2011/11420-5; 2012/06951-4).

References