

Two new species of the feather mite subfamily Pterodectinae (Acari: Astigmata: Proctophyllodidae) from Brazil

FÁBIO A. HERNANDES¹ & MICHEL P. VALIM²

¹Progr. Pós-Graduação em Biologia Animal — Depto. Zoologia e Botânica. Universidade Estadual Paulista - UNESP; Rua Cristóvão Colombo, 2265, Jardim Nazareth, São José do Rio Preto, SP, Brazil, 15054-000. E-mail: fabio_akashi@yahoo.com.br

²Depto. Parasitologia. Universidade Federal de Minas Gerais — UFMG; Av. Presidente Antônio Carlos, 6627, Pampulha, Belo Horizonte, MG, Brazil, 31270-901. E-mail: mpvalim@hotmail.com

Abstract

We describe two new pterodectine feather mites (Analgoidea: Proctophyllodidae) from Brazilian passerines (Passeriformes): *Pterodectes amaurochalinus* sp. n., from *Turdus amaurochalinus* Cabanis (Turdidae), and *Dolichodectes neotropicus* sp. n., collected from *Elaenia chiriquensis* Lawrence (Tyrannidae). A key to species of the genus *Dolichodectes* is presented.

Key words: Astigmata, Analgoidea, feather mite, systematics, *Pterodectes*, *Dolichodectes*, Brazil

Introduction

The feather mite subfamily Pterodectinae is one of the two major subfamilies of Proctophyllodidae, currently comprising about 110 species into 13 genera (Park & Ateyo 1971; Gaud & Ateyo 1996). However, this number of species apparently represents only a small fraction of the real diversity of Pterodectinae (Mironov 2003); feather mites are still poorly explored outside Africa and Europe (Gaud & Mouchet 1957; Mironov & Kopij 1997; Mironov & Fain 2003).

Park & Ateyo (1971) made a revision of Pterodectinae and recognized 9 species in the genus *Pterodectes* Robin; later on, a few scattered surveys on Neotropical region added 9 more species (Berla 1973; Černý 1974; Hernandez & Valim 2005; OConnor *et al.* 2005). Representatives of this genus occur on various avian families of the order Passeriformes, namely on Corvidae, Emberizidae, Fringillidae, Furnariidae, Hirundinidae, Icteridae, Thraupidae, Troglodytidae, Turdidae and Tyrannidae (Park & Ateyo 1971).

Another pterodectine genus, *Dolichodectes* Park & Ateyo, 1971 currently comprises

six species known from passerine birds (Muscicapidae, Sylviidae, Corvidae, Turdidae) of Africa and Europe (Gaud & Mouchet 1957; Park & Atyeo, 1971; Mironov & Fain 2003). The goal of the present paper is to contribute to the knowledge of South American feather mites by describing two new species of the genera *Pterodectes* and *Dolichodectes* collected from Brazilian passerines of the families Turdidae and Tyrannidae. We also propose a key to species of the genus *Dolichodectes*.

Material and methods

The feather mites were collected from the wing feathers of live birds, and then fixed in 70% ethanol. Mites were mounted on slides following standard acarological technique that is clearing in lacto-phenol, mounting in Hoyer's medium and sealing the coverslip with varnish (Flechtmann 1975). The idiosoma and leg chaetotaxy follow Griffiths *et al.* (1990) and Atyeo & Gaud (1966), respectively, as applied by Hernandez & Valim (2005). Measurements are given in micrometers (μm), and distances between setae were measured on one side of the body, except for paired setae measured. The holotype and paratypes are deposited at Collection of Acari of Departamento de Zoologia & Botânica of UNESP-São José do Rio Preto, SP, Brazil (DZSJRP), and at Acarological Collection of Instituto Oswaldo Cruz, Fiocruz, Rio de Janeiro, Brazil (CAIOC).

Proctophyllodidae Trouessart & Megnin

Pterodectinae Park & Atyeo

Pterodectes Robin

Pterodectes amaurochalinus Hernandez & Valim sp. n.

(Figs. 1–7)

Type material: 1 male holotype, 6 male and 8 female paratypes from the Creamy-bellied Thrush, *Turdus amaurochalinus* Cabanis (Passeriformes, Turdidae), Belo Horizonte, Minas Gerais, Brazil, (19°S 55'–43°W 56'); 13.X.2005, coll. M.P. Valim. Holotype male and most paratypes are deposited at DZSJRP; a paratype female and male are deposited at CAIOC.

Male holotype (Figs. 1, 2, 5, 6). (range for 6 paratypes indicated in parentheses). Length of idiosoma 380 (360–380), width 160 (160–170). Prodorsal shield: 120 (120–140) in length along median line, 110 (110–120) in width at posterior margin, posterior two thirds of shield surface with numerous circular lacunae. Setae *ve* absent. Scapular setae *si* and *se* arranged in a transverse line. Scapular setae *se* 110 in length (110–140) and

separated by 60 (60–70); *si* reduced, piliform, separated by 40 (40–50). Setae *c2* on striated tegument, setae *c3* lanceolate, 30 in length and 8 in width (30 x 8–10). Setae *cp* set off humeral shield. Distance between prodorsal and hysteronotal shields in median line 22 (19–30). Hysteronotal shield: greatest length 240 (240–250), width at level of setae *cp* 100 (100–110); surface of the shield with numerous circular lacunae. Dorsal shields with pale, lightly sclerotized areas, one pair on prodorsal shield and four pairs on hysteronotal shields (Fig. 1). Terminal cleft U-shaped, 30 (30–30) from anterior end to lobar apices, supranal concavity indistinct. Setae *h3* spiculiform, relatively short, without terminal filament, separated by 50 (40–50). Length of setae: *ps1* 7 (7–8), *h3* 30 (30), *h2* 198 (190–231), *ps2* 60 (60–90), *f2* 8 (7–8), *ps3* 40 (30–40). Distance between dorsal setae: *si-c1* 80 (80), *c1-c2* 30 (30–40), *c1-d1* 60 (50–60), *d1-d2* 40 (40–60), *d1-e1* 80 (80–110), *d2-e1* 60 (50–60), *e1-e2* 40 (40), *e1-h1* 40 (50–60), *e2-h1* 30 (22–27), *h1-f2* 20 (20–30).

Epimerites I fused as a narrow U, coxal fields I, II and III open. Sclerite (r)EpIIa present. Aedeagus reaches the level of anterior margins of anal discs, 80 in length (80–80); genital arch 40 in width (40–40). Distance between ventral setae: *3a-4a* 100 (100), *4a-g* 40 (40), *g-ps3* 100 (90–100), *ps3-ps3* 70 (70–80). Anal discs edentate, 15 (14–16) in diameter, and distance between centers of discs 30 (30–30). Opisthoventral shields bear seta *ps3* on inner margin (Fig. 2).

Solenidion *σ1* of genu I short and stubby (Fig. 5), seta *cG* of genua I, II setiform. Tarsus IV 43 (41) in length, seta *f* setiform, seta *e* and *d* button-like (Fig. 6).

Female (Figs. 3, 4, 5). (measurements of 8 paratypes). Length of idiosoma excluding terminal appendages 510–550, width 180–210. Prodorsal shield: 140–160 in length along median line, 130–140 in width at posterior margin, posterior 2/3–3/4 of shield with numerous small circular lacunae. Setae *ve* absent. Scapular setae *si* and *se* arranged in transverse line. Setae *se* 120–150 in length and separated by 80; pair *si* reduced, piliform, separated by 50–60. Setae *c2* on striated tegument; setae *c3* lanceolate, 30–40 in length and 9–10 in width. Setae *cp* set off humeral shield. Distance between prodorsal and hysteronotal shields in median line 22–33. Anterior hysteronotal shield: greatest length 260–270, width at level of setae *cp* 120–130; surface with numerous small circular lacunae. Dorsal shields with pale, lightly sclerotised areas, one pair on prodorsal shield and four pairs on hysteronotal shields (Fig. 3). Length of lobar region excluding terminal appendages 90–100, greatest width 80–90. Supranal concavity distinct, circular. Setae *h2* thickened, with very short terminal filament, 80–90 in length, 6–8 in width. Setae *h1* inserted on anterior third of lobar shield. Setae *h1* and *f2* in trapezoidal arrangement. Distance between dorsal setae: *si-c1* 80–100, *c1-c2* 40–60, *c1-d1* 60–80, *d1-d2* 50–60, *d1-e1* 110–130, *d2-e1* 70–90, *e1-e2* 40–50, *e1-h1* 90–100, *e2-h1* 54 (52–54), *h1-f2* 20–40, *f2-h2* 10–20.

Epimerites I fused as a narrow U, coxal fields I, II and III open. Setae *ps2* and *ps3* button-like set in nearly rectangular arrangement. Terminal cleft as an inverted V, its length 54–63 from anterior end to lobar apices. Distance between ventral setae: *1a-3a*

70–80, 3a–g 20–40, 4a–ps3 90–100, g–4a 120–130, ps2–ps3 12–14, ps2–ps2 35–39, ps3–ps3 28–31. Spermatheca and spermatheca as in Fig. 7. Legs I, II as in the male; legs IV extending by ambulacral disc to the level of setae f2.

Etymology

The epithet is derived from specific name of the type host, *Turdus amaurochalinus*.

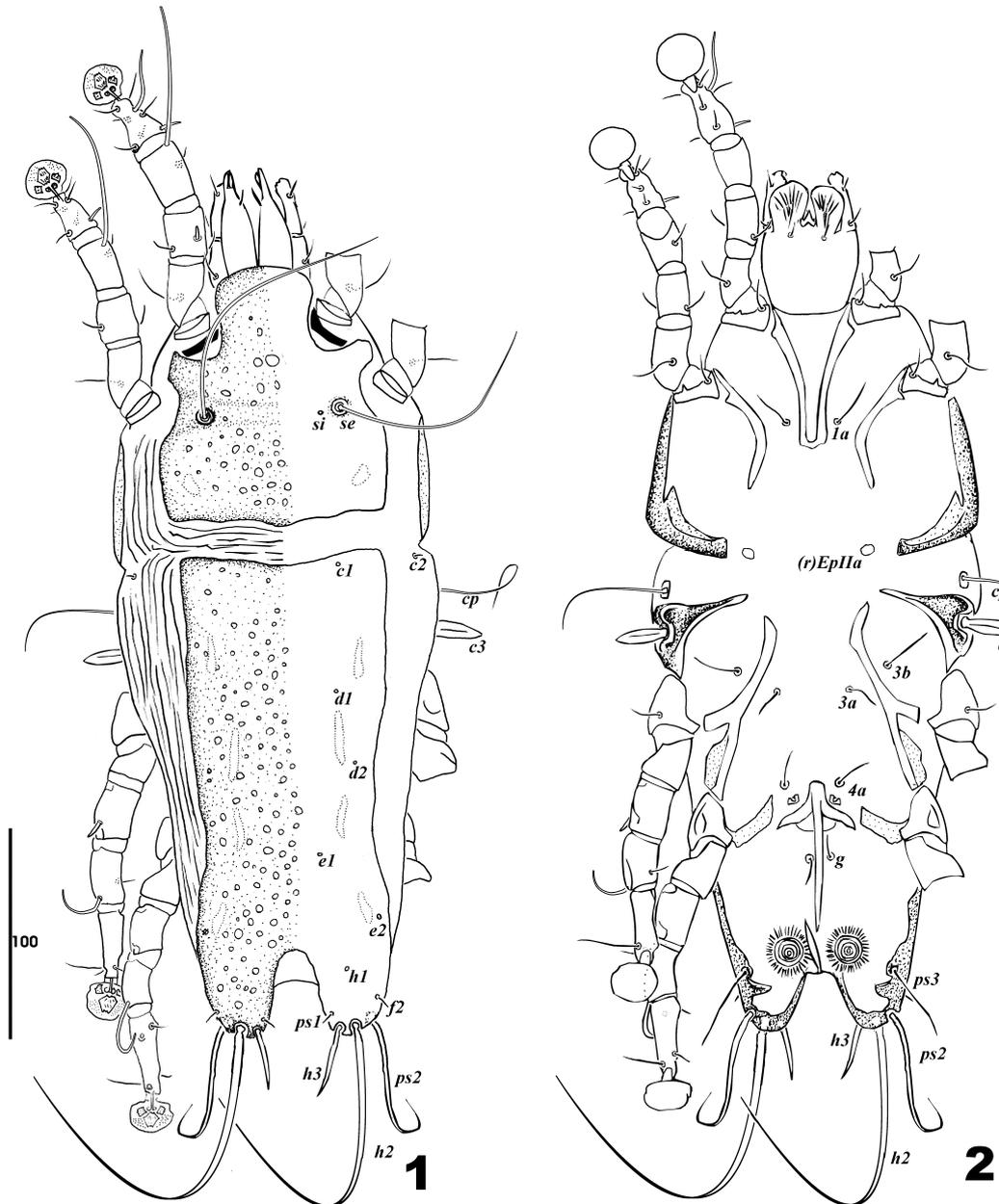


FIGURE 1–2. *Pterodectes amaurochalinus* n.sp. Male: dorsal (1) and ventral (2) views. Scale in μm .

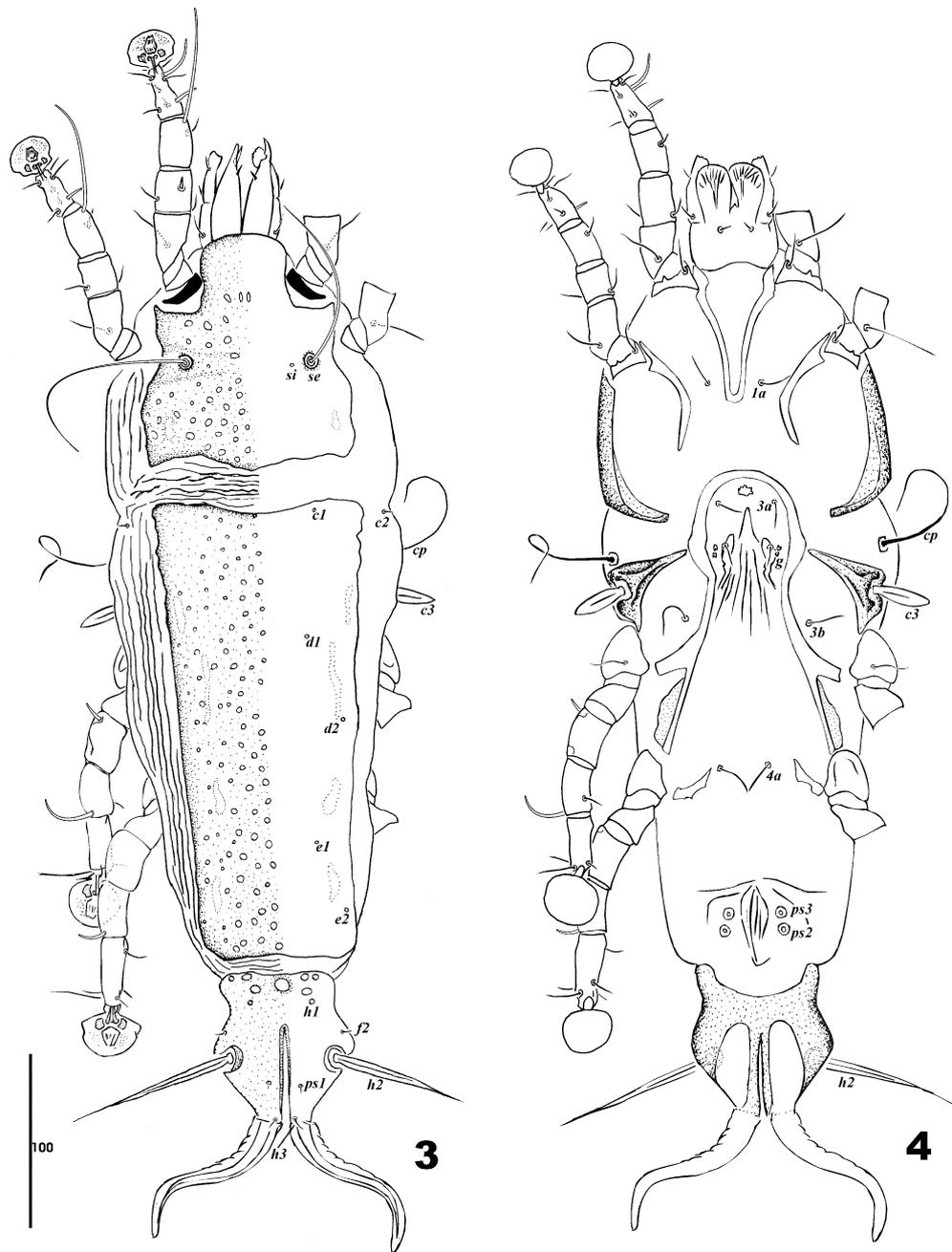


FIGURE 3–4. *Pterodectes amaurochalinus* n.sp. Female: dorsal (3) and ventral (4) views. Scale in μm .

Differential diagnosis

Pterodectes amaurochalinus n. sp. differs from other species of *Pterodectes* described on *Turdus* spp. (*P. turdinus* Berla, 1959 and *P. fissuratus* Hernandez & Valim, 2005) by the following characters: (1) epimerites I and II not connected; (2) dorsal shields without

median longitudinal fissure; (3) pronounced pale, lightly sclerotised areas present on dorsal shields, visible as lighter areas on lateral parts of these shields; and (4) female setae *ps2–ps3* button like. The new species resembles *P. fissuratus* by the structure of epimerites I, which are fused as a narrow U and not connected to epimerites II in both sexes, by relative length of aedeagus, by button-like setae *ps2*, *ps3* and setae *h2* with terminal filament in female. However, in *P. amaurochalinus* there is no suture on dorsal shields, and the lacunae are circular rather than of irregular shape as in *P. fissuratus*. *Pterodectes amaurochalinus* sp. n. can be easily separated from *P. turdinus* by the conformation of epimerites I and II in males, not connected and U shaped. In females of the new species, these epimerites are U shaped as well, whereas in *P. turdinus* there is a weak lateral projection towards epimerites II. In the latter species female setae *ps2–ps3* are setiform. Females of these three species can also be separated by the shape of spermathecae.

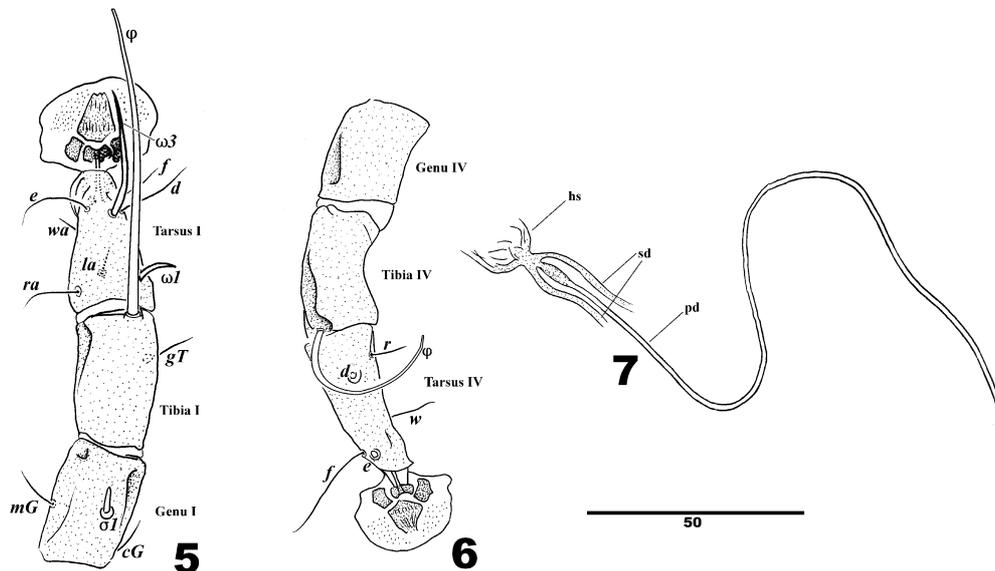


FIGURE 5–7. *Pterodectes amaurochalinus* n.sp. Dorsal view of male legs I (5) and IV (6); female spermatheca (7). Scales in μm .

Remarks

Park & Atyeo (1971) proposed two main species groups (*rutilus* and *gracilis*) in the genus *Pterodectes*. The new species should be referred to the *gracilis* group *sensu* Park & Atyeo (1971), because it has setae *c2* inserted off the hysteronotal shield, and has a narrow genital arch. However, in contrast to the characteristic of the *gracilis* group regarding the structure of setae *h2* in female, *P. amaurochalinus* n. sp. has setae *h2* with a clear terminal filament as in two other species associated with the hosts of genus *Turdus* (*P. fissuratus* and *P. turdinus*). The discovery of several species displaying characteristics of different species groups shows that the current definition of species groups in *Pterodectes* should be revised.

Dolichodectes neotropicus Hernandez & Valim sp. n.

(Figs. 8–17)

Type material: 1 male holotype, 5 male and 13 female paratypes, collected from the Lesser Elaenia, *Elaenia chiriquensis* Lawrence (Passeriformes, Tyrannidae), Fazenda Agua Limpa, Brasília, D.F., Brazil (15°S 57'–47°W 56'); 07.VIII.2002, coll. M.F. Kanegae. Holotype male and most paratypes are deposited at CAIOC; a paratype female and male deposited at DZSJRP.

Male holotype (Figs. 8–9, 12–14, 16–17). (range of 5 paratypes indicated in parenthesis). Length of idiosoma 528 (517–550), width 171 (154–171). Prodorsal shield: 154 (143–165) in length along median line, 132 (127–143) in width at posterior margin, lateral margins entire, surface with few small circular lacunae. Setae *ve* present. Scapular setae *si* and *se* arranged in a transverse line. Scapular setae *se* 150 in length (142–158) and separated by 70 (72–78); *si* reduced, piliform, separated by 48 (46–57). Humeral shields absent. Setae *c2* inserted dorsally on striated tegument, setae *c3* lanceolate, 30 in length and 7 in width (30–33 x 7–8). Distance between prodorsal and hysteronotal shields in median line 11 (11–16). Hysteronotal shield: greatest length 374 (352–396), width at level of setae *cp* 125 (114–131); surface of the shield with numerous small circular lacunae, except for lobar area. Opisthosomal lobes without lateral expansions, about 2 times longer than wide, with round apices. Terminal cleft V-shaped, 71 (63–71) from anterior end to lobar apices, supranal concavity distinct. Setae *h3* relatively short, curved and without terminal filament, separated by 42 (38–46). Setae *ps1* inserted sub-apically, at the level of bases of *h3*. Length of setae: *ps1* 5 (5–8), *h3* 44 (38–44), *h2* 78 (65–78), *ps2* 63 (57–65), *f2* 14 (11–16), *ps3* 27 (22–30). Distance between dorsal setae: *si-c1* 76 (68–84), *c1-c2* 37 (35–41), *c1-d1* 68 (66–75), *d1-d2* 56 (47–56), *d1-e1* 107 (88–100), *d2-e1* 51 (39–51), *e1-e2* 37 (37–44), *e1-h1* 96 (89–105), *e2-h1* 60 (54–63), *h1-f2* 33 (32–39).

Epimerites I fused as a narrow U, their posterior ends connected with central part of epimerites II by thin sclerotised bands; setae *1a* situated on these bands. Epimerites I and II with narrow sclerotised areas. Adanal shield and epimerites IVa fused into a single structure almost completely encircling genital arch. Setae *4a* situated on epimerites IVa, setae *g* on central region of adanal shield (in some paratypes setae *g* off this shield, Fig. 13). Pregenital apodeme as narrow Y, its anterior ends fused with inner margins of coxal fields III, its posterior end almost fused with tips of epimerites IVa. Aedeagus reaches the level of anterior margins of adanal discs, 84 in length (79–87); genital arch 30 in width (29–33). Distance between ventral setae: *3a-4a* 71 (68–73), *4a-g* 54 (52–57), *g-ps3* 65 (54–65), *ps3-ps3* 46 (44–46). Anal discs edentate, 16 (15–16) in diameter, and distance between centers of discs 22 (18–24). Opisthoventral shields bear seta *ps3* on inner margin, postero-lateral to anal discs (Figs. 9, 12–14).

Solenidion *σ1* of genu I short and pointed, seta *cG* of genua I, II setiform (Fig. 16).

Tarsus IV 35 (33–35) in length, seta *f* setiform, setae *e* and *d* button-like (Fig.17).

Female (Figs. 10, 11, 15). (measurements of 13 paratypes). Length of idiosoma excluding terminal appendages 528–572, width 165–187. Prodorsal shield: 143–154 in length along median line, 132–143 in width at posterior margin, lateral margins entire, numerous small circular lacunae uniformly distributed. Setae *ve* present. Scapular setae *si* and *se* arranged in a transverse line. Setae *se* 155–177 in length and separated by 79–82; pair *si* reduced, piliform, separated by 54–58. Humeral shields absent. Setae *c2* inserted dorsally on striated tegument; setae *c3* lanceolate, 30–33 in length and 8–9 in width. Distance between prodorsal and anterior hysteronotal shields along median line 7–19. Anterior hysteronotal shield: greatest length 242–297, width at level of setae *cp* 127–143; surface with numerous small circular lacunae, two pairs of pale, lightly sclerotised areas on posterior half of this shield. Length of lobar region excluding terminal appendages 87–101, greatest width 87–101. Supranal concavity distinct, circular, on anterior margin of lobar shield. Anterior hysteronotal and lobar shields separated by thin band of soft tegument with striae. Setae *h2* blade-like, without terminal filament, 57–68 in length, 8–9 in width. Setae *h3* long, 73–87. Setae *h1* and *f2* approximately at the same transverse level. Distance between dorsal setae: *si-c1* 73–83, *c1-c2* 41–46, *c1-d1* 76–82, *d1-d2* 49–57, *d1-e1* 114–128, *d2-e1* 73–84, *e1-e2* 24–35, *e1-h1* 73–82, *e2-h1* 52–60, *h1-f2* 19–22, *f2-h2* 19–22.

Epimerites I fused as a narrow U, not connected with epimerites II. Epimerites I and II without sclerotised areas. Coxal fields I, II, III and IV open. Setae *ps2* and *ps3* setiform, set in a trapezoidal arrangement. Distance between ventral setae: *1a-3a* 73–82, *3a-g* 22–27, *4a-ps3* 87–101, *g-4a* 132–144, *ps2-ps3* 38–44, *ps2-ps2* 42–46, *ps3-ps3* 24–28. Lobar cleft as an inverted narrow U, 60–68 in length from anterior end to lobar apices. Spermatheca and spermatheca ducts as in Fig. 15.

Legs I, II as in the male, legs IV extending by ambulacral disc to the level of setae *h2*.

Etymology

The epithet points on the first finding of a representative of the genus *Dolichodectes* in the Neotropical Region.

Differential diagnosis

Dolichodectes neotropicus sp. n. is similar to *D. diplocercus* (Gaud & Mouchet, 1957) in having the coxal fields II opened and aedeagus reaching only the level of adanal discs. The new species can be distinguished by the shape of epimerites I, narrow U-shaped rather than Y-shaped. Males of *D. neotropicus* have no lateral expansions on opisthosomal lobes as in *D. myrmecocichlae* Mironov & Fain (2003). Differently from the latter species, the adanal shield in *D. neotropicus* is an entire large plate between genital arch and anal discs. Females of *D. neotropicus* can be separated from other species of *Dolichodectes* by the length of setae *h3*, and by the lack of expansion on primary duct near the head of spermatheca.

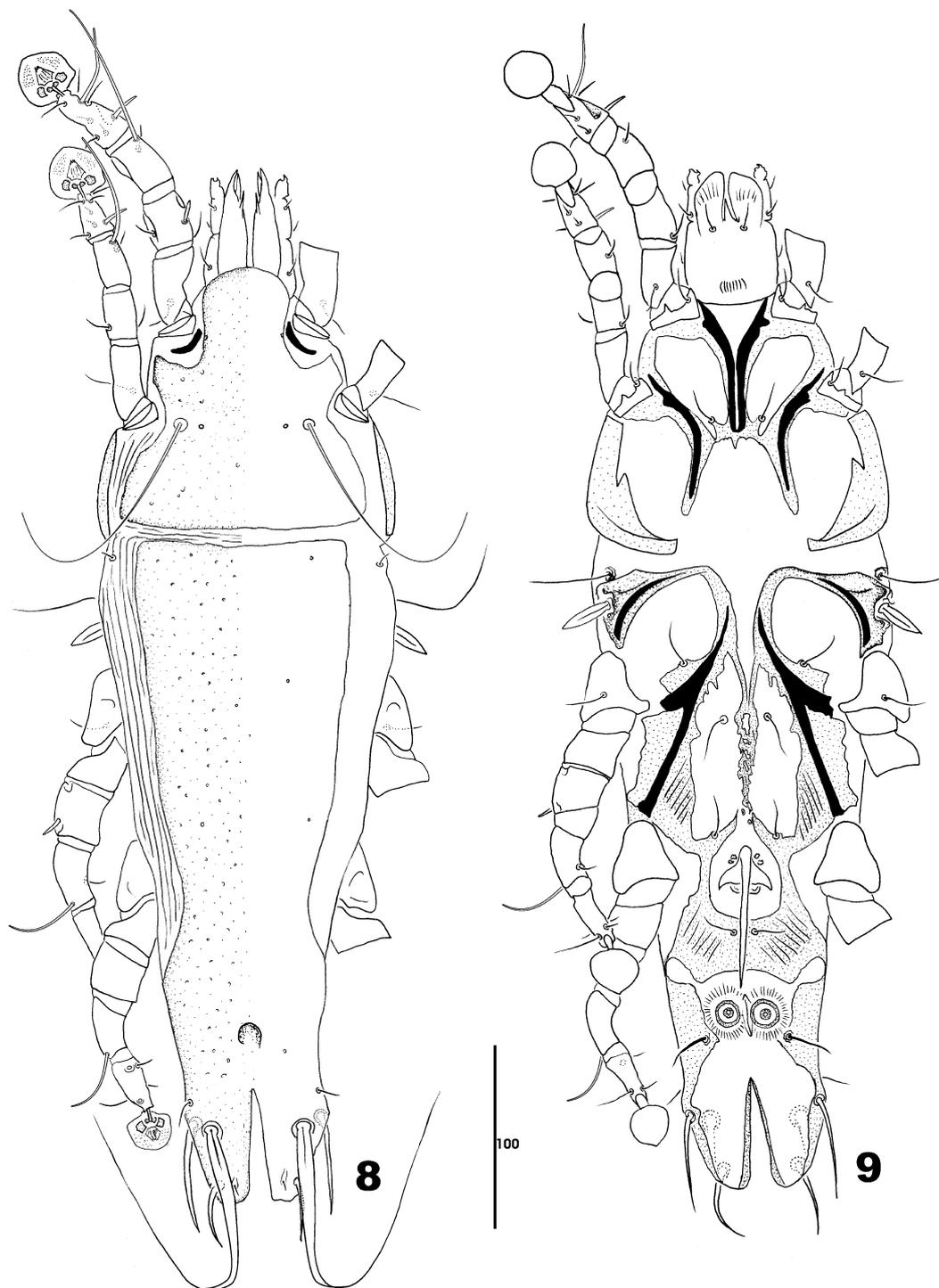


FIGURE 8–9. *Dolichodectes neotropicus* n.sp. Male: dorsal (8) and ventral (9) views. Scale in μm .

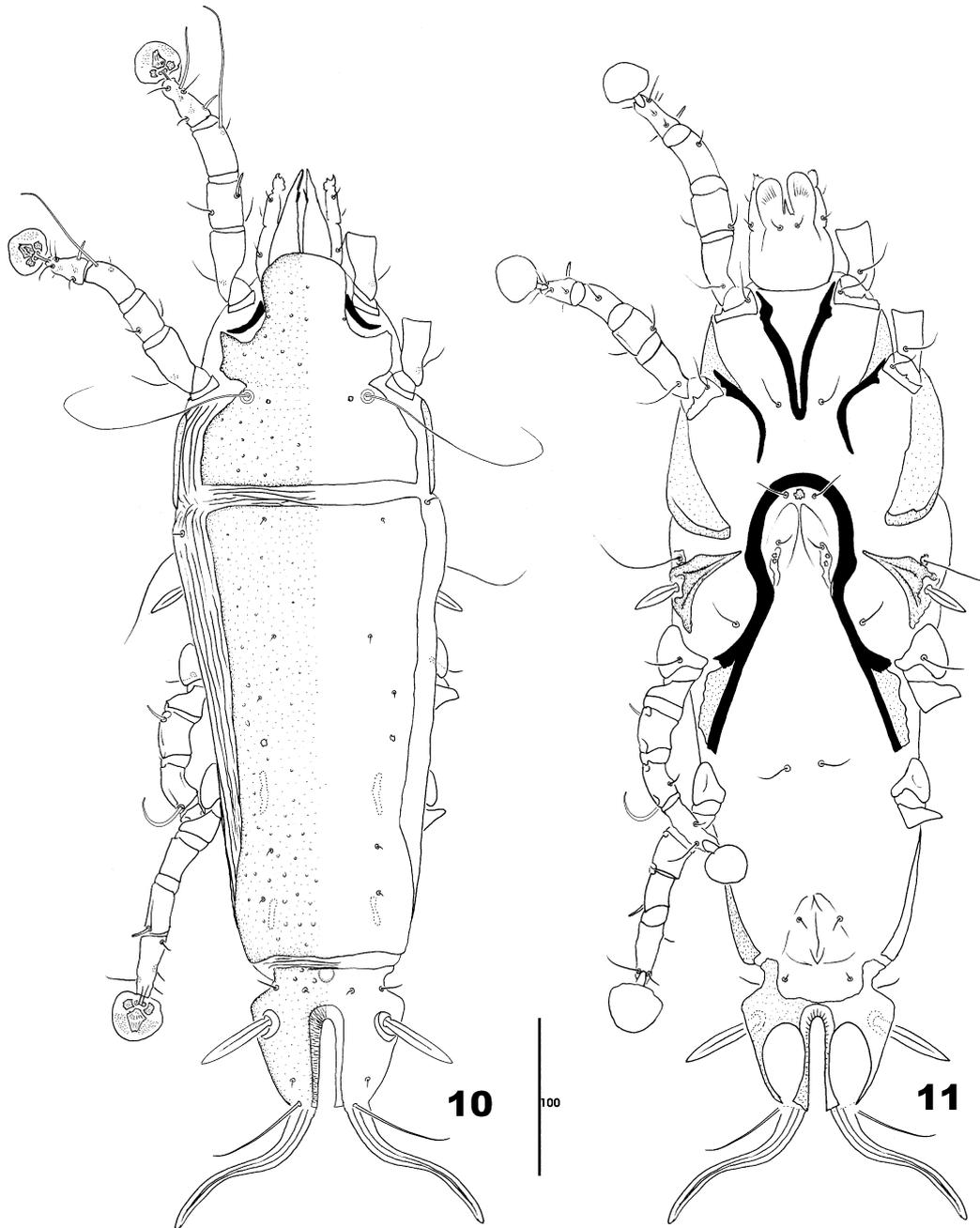


FIGURE 10–11. *Dolichodectes neotropicus* n.sp. Female: dorsal (10) and ventral (11) views. Scale in μm .

Remarks

Dolichodectes neotropicus sp.n. is unique in having male genital discs well evident and set anterior to genital arch, epimerites I of both sexes are as a narrow U, and in female setae *h3* are very long and strong, even longer than *h2*. These features are quite different

from those given by Park & Atyeo (1971) in the definition of the genus *Dolichodectes*. However, until more species are described and the knowledge of such characteristics is fully understood, we do not consider appropriate to erect a new genus to accommodate this new species. The new species was collected from an avian family known to occur mainly in the Neotropics (Tyrannidae), while the previously described species were collected from birds of the Old World (Muscicapidae and Sylviidae) (Gaud & Mouchet 1957) and of both regions (Turdidae and Corvidae) (Gaud & Mouchet 1957; Mironov & Fain 2003). Mironov & Fain (2003) expressed doubts in the monophyly of this genus, because of the wide range of host birds.

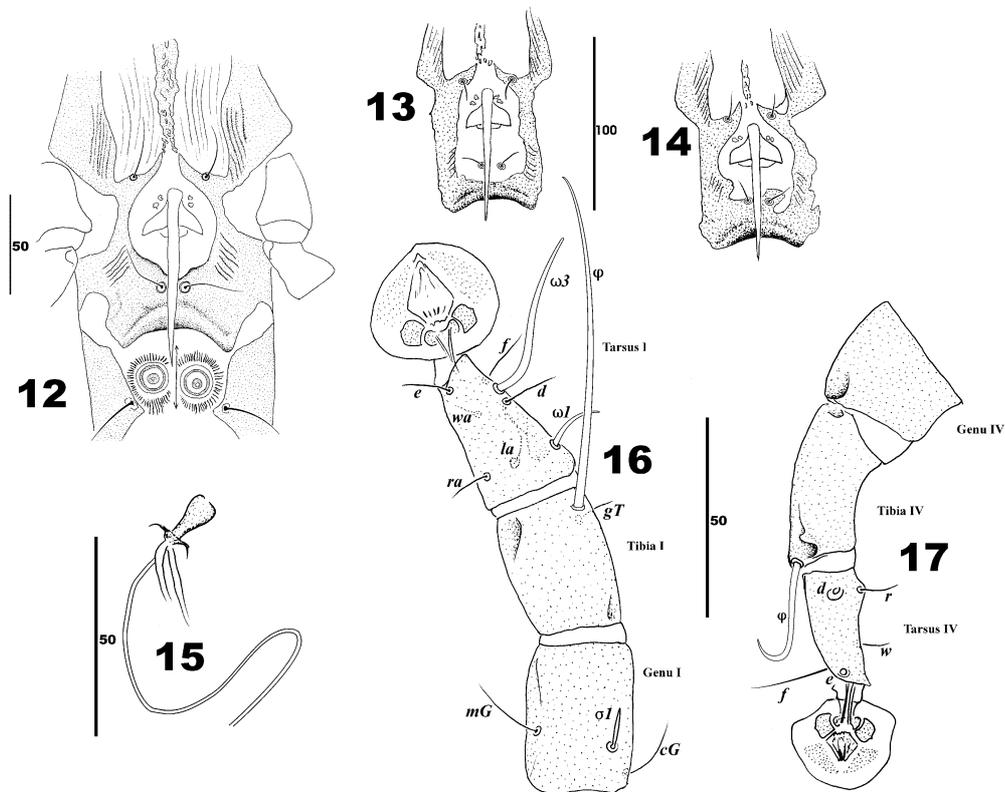


FIGURE 12–17. *Dolichodectes neotropicus* n.sp.. Genital region of male holotype (12), and paratypes (13–14) showing variation on shape of plate anterior to adanal discs; female spermatheca (15); dorsal view of male legs I (16) and IV (17). Scales in µm.

Key to species of the genus *Dolichodectes* Park & Atyeo
(Males and females)

- 1. Aedeagus extending beyond the level of anal discs 2
- Aedeagus shorter, not extending beyond the level of anal discs 3

2. Aedeagus reaches the level of bases of seta *h3*. (Females unknown)
..... *D. allocaulus* (Gaud & Mouchet)
- Aedeagus only reaches the level of anterior end of terminal cleft; females with dilation on primary duct near the head of spermatheca..... *D. glyphonotus* (Gaud & Mouchet)
3. Males with coxal fields II open; in females, setae *h3* long, at least half the length of terminal appendages 4
- Males with coxal fields II closed; in females setae *h3* short, not reaching 1/4 the length of terminal appendages..... 5
4. Epimerites I fused as a narrow U, and setae *ps2* slightly extending beyond lobar apices in males; no dilatation on primary duct of spermatheca in females.....
..... *D. neotropicus* Hernandez & Valim sp.n.
- Epimerites I fused as a Y, and setae *ps2* extending to midlevel of terminal cleft in males; females with dilation on primary duct near the head of spermatheca
..... *D. diplocercus* (Gaud & Mouchet)
5. In males, lobar apices bluntly rounded, setae *ps2* extending beyond lobar apices; in females, anterior hysteronotal shield and lobar shield separated by narrow band of soft tegument..... *D. platynocercus* (Gaud & Mouchet)
- In males, lobar apices acute, setae *ps2* not extending beyond lobar apices; in females, anterior hysteronotal shield and lobar shield not split 6
6. Prodorsal and hysteronotal shields separated by large area of striated tegument (distance between these shields in males about 35 μm , in females about 70 μm). In males, aedeagus reaches the mid level of adanal discs; hysteronotal shield with transverse striae. In females, anterior margin of hysteronotal shield concave, prodorsal shield without lacunae *D. edwardsi* (Trouessart)
- Prodorsal and hysteronotal shields separated by a thin band of soft tegument (distance between these shields about 10 μm in males and females). In males, aedeagus does not reach the level of anal discs, hysteronotal shield with numerous small lacunae. In females anterior margin of hysteronotal shield slightly convex, prodorsal shield with small lacunae in anterior part *D. myrmecocichlae* Mironov & Fain

Acknowledgements

We thank Sergey V. Mironov (Zoological Institute, Russian Academy of Sciences, Saint Petersburg, Russia) for critically reading the manuscript and for valuable suggestions. Augusto Alves (Laboratory of Ornithology, Dept. Zoology, Universidade Federal de Minas Gerais, Brazil) identified the Creamy-bellied Thrush, and Mieko F. Kanegae collected feather mites from the Lesser Elaenia.

References

- Atyeo, W.T. & Gaud, J. (1966) The chaetotaxy of sarcoptiform feather mites (Acarina: Analgoidea). *Journal of the Kansas Entomological Society*, 39, 337–346.
- Berla, H.F. (1959) Analgoidea Neotropica. IV — Sobre algumas espécies novas ou pouco conhecidas de acarinos plumícolas. *Boletim do Museu Nacional (Zoologia)*, 209, 1–17.
- Berla, H.F. (1973) Analgoidea Neotropica. X — Uma nova espécie de *Pterodectes* Robin, 1877. *Revista Brasileira de Biologia*, 33, 21–22.
- Černý, V. (1974) Parasitic mites of Surinam XXXI. New species of Proctophyllodidae (Sarcoptiformes, Analgoidea). *Folia Parasitologica*, 21, 349–361.
- Flechtmann, C.H.W. (1975) *Elementos de Acarologia*. São Paulo. Livraria Nobel S.A., 344 pp.
- Gaud, J. & Atyeo, W.T. (1996) Feather mites of the world (Acarina, Astigmata): the supraspecific taxa. *Annales Musee Royal L'Afrique Centrale, Sciences Zoologiques*, 277, (Part I) 1–187, (Part II) 1–436.
- Gaud, J. & Mouchet, J. (1957) Acariens plumicoles (Analgoidea) des oiseaux du Cameroun I. Proctophyllodidae. *Annales de Parasitologie Humaine et Comparée*, 32, 491–546.
- Griffiths, D.A., Atyeo, W.T., Norton, R.A., & Lynch, C.A. (1990) The idiosomal chaetotaxy of astigmatid mites. *Journal of Zoology*, 220, 1–32.
- Hernandes, F.A. & Valim, M.P. (2005) A new species of *Pterodectes* Robin, 1877 (Proctophyllodidae: Pterodectinae) from the pale-breasted thrush, *Turdus leucomelas* (Passeriformes: Turdidae). *Zootaxa*, 1081, 61–68.
- Mironov, S.V. (2003) On some problems in systematics of feather mites. *Acarina*, 11, 3–29.
- Mironov, S.V. & Fain, A. (2003) New species of the feather mite subfamily Pterodectinae (Astigmata: Proctophyllodidae) from African passerines (Aves: Passeriformes). *Bulletin S.R.B.E.*, 139, 75–91.
- Mironov, S.V. & Kopij, G. (1997) New feather mites species of the subfamily Pterodectinae (Astigmata: Proctophyllodidae) from some passerines (Aves: Passeriformes) of South Africa. *Journal of African Zoology*, 111, 449–463.
- OConnor, B.M., Foufopoulos, J., Lipton, D. & Lindström, K. (2005) Mites associated with the small ground finch, *Geospiza fuliginosa* (Passeriformes: Emberizidae), from the Galápagos islands. *Journal of Parasitology*, 91, 1304–1313.
- Park, C.K. & Atyeo, W.T. (1971) A generic revision of the Pterodectinae, a new subfamily of feather mites (Sarcoptiformes: Analgoidea). *Bulletin of the University of Nebraska State Museum*, 9, 39–88.