

New observations on the genus *Prolistrophorus* Fain, 1970 (Acari: Astigmata: Listrophoridae)

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Summary

The genus *Prolistrophorus* Fain, 1970 (Acari, Listrophoridae) now comprises, including the new taxa described herein, 26 species grouped in three subgenera. These species live attached permanently to the hairs of their hosts. The whole group is confined to North and South American rodents or South American marsupials. The genus *Prolistrophorus* is redefined and new characters are provided for the definition of the three subgenera: *Prolistrophorus* s.st., *Aprolistrophorus* Fain, 1980 and *Beprolistrophorus* Fain, 1980. Complete descriptions with figures are given for the first time for eight insufficiently known species: *P. grassii* (Radford, 1954), *P. pernamboucensis* Fain, 1973, *P. scotinomys* Fain & Lukoschus, 1982, *P. postscutatus* Fain & Lukoschus, 1982, *P. reithrodontomys* Fain & Lukoschus, 1982, *P. lestoros* Fain & Lukoschus, 1982, *P. cuzcoensis* Fain & Lukoschus, 1982 and *P. akodon*, Fain & Lukoschus, 1982. Four new species are described and depicted: *P. primitivus*, *P. curvistriatus*, *P. monilistriatus* and *P. bidentatus*. Keys to females and males are provided for all the known species of the genus. The origin and the evolution of this genus are discussed.

Introduction

The genus *Prolistrophorus* Fain, 1970 is completely confined to North and South American rodents or marsupials. It includes at present, with the new taxa described herein, 26 species grouped in three subgenera. All these species are fur-mites and permanent parasites, living attached to the hairs of their hosts. A revision of this group of mites has been published by Fain (1973) for the neotropical species and by Fain & Hyland (1974) for the nearctic species.

Fain & Lukoschus (1982) gave short diagnoses of six new species discovered by F.S.L. on South American rodents or marsupials conserved in the Field Museum of Chicago and in US National Mu-

seum of Washington, DC, USA. We here complete these descriptions and redefine the genus *Prolistrophorus*. We also redescribe two insufficiently known species (*P. grassii* (Radford, 1954) and *P. pernamboucensis* Fain, 1973) and describe four new species from neotropical marsupials or rodents: *P. primitivus*, *P. curvistriatus*, *P. monilistriatus* and *P. bidentatus*. In our descriptions the nomenclature of the idiosomal setae proposed by Fain for the Astigmata (Fain, 1963) is used. The length of the dorsal plates is taken in the midline, the width of the body is the maximum width.

Abbreviations of the Institutions where the types (holotypes) have been deposited are: FMNH = Field Museum of Natural History, Chicago; IRSNB = Institut royal des Sciences naturelles de

Belgique, Bruxelles; RMNH = Rijksmuseum van Natuurlijke Historie, Leiden, Nederland; USNM = US National Museum, Washington DC, USA.

Genus *Prolistrophorus* Fain, 1970

Definition

In both sexes. With the general characters of the family Listrophoridae. There is a single postscapular shield which has, towards its centre, a more or less developed oval zone, generally striated, where the punctations are lacking. In some species this soft area is open either anteriorly or posteriorly.

Female. Hysteronotum either with a median shield in front of setae *d2* (subgenus *Prolistrophorus*) or without this shield (subgenera *Aprolistrophorus* and *Beprolistrophorus*). Cuticle behind these setae either punctate or soft, with or without triangular scales. Posterior region of hysteronotum either with one median or two paramedian shields or without shields. Opisthogaster striated longitudinally either with or without scales. Copulatory orifice dorso-terminal.

Male. Dorsum either with one large median hysteronotal or with two paramedian hysteronotal shields. Posterior extremity either bilobed or truncate and straight. In some species (group 'lestoros') the legs III are modified with the basal segments enlarged and more sclerotized than in legs IV. Copulatory adanal suckers present. Tarsi IV with 3 simple and 2 modified sensory setae.

Chaetotaxy of idiosoma. Female with the following setae: *sci*, *sce*, *d1* to *d5*, *l1* to *l5*, *h*, *sh*, *ai*, *ae*, *a3*, *cx I*, *cx III*, *gm*, *gp*, *sx*. Setae *ae* may be lacking. Male as female but the setae *d5* are either thin or foliate and the setae *ga* and *gp* are present but not the *gm*.

Type species. *Listrophorus argentinus* Hirst, 1921.

Subgeneric division of genus *Prolistrophorus*

The genus *Prolistrophorus* has been divided in three subgenera, on the base of the characters of the males (Fain, 1980). We are able now to add also characters of the females.

1. *Prolistrophorus s.str.*

Male with a large median hysteronotal shield, posterior margin of the body incised forming two well developed lobes. Female with a well developed, median hysteronotal shield in front of setae *d2*. Cuticle behind setae *d2* either soft or slightly punctate but always less than the anterior shield. Preterminal area of opisthonotum with a small median shield.

Type species. *Listrophorus argentinus* Hirst, 1921. This subgenus contains at present 12 species, of which 11 neotropical and one nearctic.

2. *Aprolistrophorus* Fain, 1980

Male with two long paramedian and separated hysteronotal shields. Posterior border of body with two well developed lobes except in one species (*P. ctenomys*) where these lobes are small. Female without a median hysteronotal shield in front of setae *d2*. In some species (*P. akodon*, *P. bidentatus*, *P. lestoros* and *P. cuzcoensis*) the cuticle is slightly punctate in a short median area in front of setae *d2* but in these species the median area behind the setae *d2* is also punctate. In other species the area behind setae *d2* is either soft without scales or soft with scales. Preterminal area of opisthonotum either soft or with shields (two paramedian or one median).

Type species. *Listrophorus sparsilineatus* Fain, 1970. This subgenus contains at present 12 species (11 neotropical and one nearctic).

3. *Beprolistrophorus* Fain, 1980

Male with two long paramedian and separate hysteronotal shields; posterior border of body truncate and straight without lobes. Female without a median hysteronotal shield in front of setae *d2*. Median area of hysteronotum behind setae *d2*

either soft or slightly punctate or with a small shield in its posterior part. Posterior part of opisthonotum with two small paramedian shields.

Type species. *Listrophorus bakeri* Radford, 1949. This subgenus contains two species, one from Argentina, the other from north America. Among the species that we describe herein, two (*P. cuzcoensis* and *P. curvistriatus*) are only known from female specimens. They lack an antero-median shield on hysterosoma and they belong therefore to either *Aprolistrophorus* or *Beprolistrophorus*. We place them in *Aprolistrophorus* owing to the fact that they present the same general characters as the species of the 'lestoros' group. The status of a third species (*P. primitivus*) also known only from females, is more conjectural. We have included it provisionally in *Aprolistrophorus*.

Geographical distribution, origin and evolution of genus *Prolistrophorus*

The genus *Prolistrophorus* is confined to the New World and it is more frequent in the Neotropical than in the Nearctic region. Most of the species (18) are found on rodents of the family Cricetidae, subfamily Hesperomyinae, a primitive group represented by many genera and species in South America and by a few taxa in the southern parts of the Nearctic region. The Echimyidae, Ctenomyidae and Muridae each harbour one species. This genus is also found on the marsupial *Lestoros inca* (Caneolestidae) which is infested by six species.

We have shown that there is a good correlation between the importance of the regression in the external structures of a parasite and the degree of evolution of the host (Fain, 1979).

Judging by the degree of reduction of the postscapular shield, the genus *Prolistrophorus* is intermediate in evolution, between *Afrolistrophorus* Fain, 1970 and *Listrophorus* Pagenstecher, 1861. In *Afrolistrophorus*, the most primitive genus, this shield is entire and covers completely the area situated behind the scapular setae. In *Listrophorus*, the most evolved genus, the median area of the postscapular shield has completely disappeared

and there are only two lateral shields completely separated in the midline. In *Prolistrophorus* the postscapular shield is incomplete bearing in its median part a soft non-punctate oval area. It represents therefore a more evolved stage than *Afrolistrophorus* and we can surmise that it derives from the latter. The genus *Afrolistrophorus* is poorly represented in South America but is widespread in Afrotropical rodents. It is possible that this genus has been introduced in to South America with the hystricomorph rodents in the Eocene, by the Continental drift (Fain, 1982). The genus *Listrophorus* is completely absent in tropical Africa and in the Neotropical region. It is endemic for more recent North American and European rodents, especially the Microtidae. These observations on the Listrophoridae confirm the existence of narrow correlations between the evolution of the parasitic mites and of their hosts. Such correlations have already been demonstrated in other groups of mites (e.g., the Myobiidae, see Fain, 1979 and 1982).

Key to the species

Females

(NB (i) The female of *P. cryptophallus* Fain, 1970 is unknown (ii) The females of *P. dolichus* Lizaso 1975 and *P. inornatus* Lizaso, 1977, inadequately described are not mentioned here.)

1. A well-developed median shield, wider than long, is present on hysteronotum in front of setae *d*2. Behind this shield the cuticle is either soft or punctate but these punctations are always distinctly less sclerotized than the shield Subgenus *Prolistrophorus* Fain, 1970 (2)
- Absence of a median shield in front of setae *d*2, however in some species the punctate area covering the opisthonotum extends slightly in front of the setae *d*2.
- Subgenera *Aprolistrophorus* Fain, 1980 and *Beprolistrophorus* Fain, 1980 (10)
2. Median soft non-punctate area of postscapular

- shield closed anteriorly and open posteriorly.
 *P. amazonicus* Fain, 1970
 Median soft non-punctate area of postscapular shield closed and completely surrounded by the shield. 3
3. Postscapular and anterior hysteronotal shields bearing laterally only small scaly-like dark spots. Median soft area of postscapular shield about as long as half the length of the shield and followed by a short longitudinal dark line. Bursa very short and sclerotized with a striated structure. Dorsum strongly sclerotized.
 *P. surinamensis* Fain, 1973
 Lateral parts of the dorsal shields bearing either only transverse striations or small dark spots mixed with narrow lines. Median soft area of postscapular shield distinctly longer than half the length of the shield. Bursa with another structure. Dorsum less sclerotized. 4
4. Prescapular, postscapular and anterior hysteronotal shields coarsely punctate. Opisthogastric scales confined to the longitudinally striated cuticle. 5
 Dorsal shields finely punctate. Opisthogastric scales either confined to the median area or extending more laterally. 6
5. Bursa 80–90 μ long, very thick, strongly sclerotized, describing three large loops. Anterior hysteronotal shield with a few short thin striations laterally. Postscapular shield with short and thick dark bands mixed with small dark scaly-like spots.
 *P. pernamboucensis* Fain, 1973
 Bursa thick but very poorly sclerotized. Dorsal shields bearing laterally long and relatively thin transverse dark lines; on the hysteronotal shield these lines become indistinct in the midline.
 *P. striatus* Fain, 1973
6. Bursa 150 μ long, strongly sclerotized, with the proximal part 45 μ long and much thicker than the posterior part. Opisthogastric scales numerous and confined to the median soft longitudinally striated cuticle.
 *P. paraguayensis* Fain, 1970
 Bursa either short or long but poorly sclerotized. Opisthogastric scales variable. 7
7. Opisthogastric scales very numerous, not confined to the median soft area but also covering the lateral, transversely striated area. 8
 Opisthogastric scales triangular, relatively large, almost confined to the median soft and longitudinally striated area; only a few scales are present on transversely striated area. Body 442 μ long.
 *P. argentinus* (Hirst, 1921)
8. Opisthogastric scales narrow and very small. Setae *d2* and *d3* 5–6 μ long. Body 399 μ long
 *P. frontalis* (Hirst, 1921)
 Opisthogastric scales triangular, larger. Setae *d2* and *d3* 12–18 μ 9
9. Body smaller (365 to 375 μ), opisthosoma 120 μ long). Bursa 40–50 μ long. Copulatory papilla cylindrical, 9 μ long, situated at 6 μ from the anus and directed dorsally. Soft median area of postscapular shield situated in the middle of the shield. Anterior hysteronotal shield fused with coxal IV shields.
 *P. nectomys* Fain, 1970
 Body longer (426 μ , with opisthosoma 160 μ long). Bursa 120–140 μ long, opening at 3 μ behind the anus, with a short conical copulatory papilla directed posteriorly. Median soft area of postscapular shield closer to posterior margin than to the anterior margin of the shield. Anterior hysteronotal shield not fused with coxal IV shields.
 *P. grassii* (Radford, 1954)
10. Median soft and non-punctate area of postscapular shield open either anteriorly or posteriorly. 11
 Median soft and non-punctate area of postscapular shield closed and completely surrounded by the shield. 13
11. Median soft non-punctate area of the postscapular shield very large, open anteriorly and closed posteriorly. Posterior region of opisthonotum with three small punctate shields, one anterior median and two posterior and lateral
 *P. bakeri* (Radford, 1949)
 Median soft non-punctate area of postscapular shield closed anteriorly and open posteriorly. 12
12. Opisthonotum soft, without shields, completely covered with triangular scales.

- P. reithrodontomys* Fain & Lukoschus, 1982
 Opisthonotum mostly punctate, either with rounded scales confined to the antero-lateral parts or without scales.
 *P. sparsilineatus* (Fain, 1970)
13. Opisthogaster finely striated, without cuticular scales. Postscapular shield without dark lines or scales, the median soft area abruptly widened in its posterior half in the shape of an inverted key-hole. *P. ctenomys* Fain, 1970
 Opisthogaster with numerous scales. Postscapular shield either with or without dark lines or scales, the median soft area not in an inverted key-hole. 14
14. Posterior half of opisthonotum covered with numerous triangular scalea. Soft median area of postscapular shield very small and completely situated in the posterior third of the shield. *P. primitivus* n.sp.
 Opisthonotum without scales. Soft median area of postscapular shield longer and not completely situated in the posterior third of the shield. 15
15. Postscapular shield with laterally 4 to 5 transverse dark and thin lines not interrupted in their middle by a longitudinal or oblique line or groove. 16
 Postscapular shield bearing laterally dark markings consisting of either thick spindle-shaped lines or rounded spots or narrow transverse lines interrupted in their middle by an oblique or longitudinal dark line or groove, Posterior region of opisthosoma with either one median or two lateral shields. 17
16. Median soft area of postscapular shield long (57 μ) and very narrow (10–12 μ wide). Absence of shields in the posterior region of opisthosoma.
 *P. scotinomys* Fain & Lukoschus, 1982
 Median soft area or postscapular shield much wider (58 μ long and 42 μ wide). Posterior region of dorsum with two small paramedian shields. The area situated between setae *d*2–*d*2 and *d*3–*d*3 with short transverse striations thicker than in the other areas.
 *P. hirstianus* Fain, 1973
17. Opisthonotum with a median area where the striations are strongly oblique or longitudinal. This area is followed by about 10–12 normal transverse striations. Postero-lateral parts of opisthosoma with a trilobed shield.
 *P. curvistriatus* n.sp.
 Opisthonotum without such structure. When oblique striations are present they are confined to the posterior part of the opisthonotum. . . 18
18. Postscapular shield bearing laterally at both sides, thin dark lines interrupted in their middle 19
 Postscapular shield bearing laterally, at both sides, dark spindle-shaped or oval spots. . . 20
19. Postero-lateral shields of opisthosoma separated in the midline and almost completely divided in two unequal parts by a deep anterodorsal incision; their posterior extremity ending in a conical projection.
 *P. postscutatus* Fain & Lukoschus, 1982
 Postero-lateral shields of opisthosoma larger, with only a short and narrow dorsal incision; without conical projection.
 *P. cuzcoensis* Fain & Lukoschus, 1982
20. Postscapular shield bearing laterally numerous small oval or crescentic dark spots. Anterolateral region of hysteronotum with a few short scales.
 *P. lestoros* Fain & Lukoschus, 1982
 Postscapular shield with spindle-shaped dark spots. Anterolateral region of hysteronotum without scales. 21
21. Body recurved ventrally in its anterior third. The seven or eight first striations of hysteronotum thick and very prominent. Posterior extremity with two pointed conical projections *P. bidentatus* n.sp.
 Body not distinctly recurved anteriorly. Anterior striations of hysteronotum not prominent. Absence of posterior pointed projections. . 22
22. Lateral dark spots of postscapular shield spindle shaped and separated from each other. Postero-lateral region of body with a pair of small triangular shields.
 *P. akodon* Fain & Lukoschus, 1982
 Lateral dark spots of postscapular shield slightly oval and connected to each other by mean of very thin dark lines giving a moniliform

aspect. Postero-lateral region of body with a pair of much larger shields separated in the midline by a small median shield.
 *P. monilistriatus* n.sp.

Males

(NB (i) The males of following species are unknown: *P. pernamboucensis* Fain, *P. amazonicus amazonicus* Fain, *P. primitivus* n.sp., *P. cuzcoensis* Fain & Lukoschus, *P. curvistriatus* n.sp. (ii) The males of *P. dolichus* Lizaso and *P. inornatus* Lizaso, inadequately described are not mentioned here.

1. Presence of a large median hysteronotal shield. Posterior border of the body incised with two well-developed lobes.
 Subgenus *Prolistrophorus* Fain, 1970
 (3)
 Presence of two long paramedian hysteronotal shields. 2
2. Posterior border of body incised in two well developed lobes.
 Subgenus *Aprolistrophorus* Fain, 1980
 (11)
 Posterior border of body truncate and straight
 Subgenus *Beprolistrophorus* Fain, 1980
 (20)
3. Median non-punctate area of postscapular shield open posteriorly. Opisthogaster with cuticular scales.
 *P. amazonicus amazonicus* Fain, 1973
 Median non-punctate area of postscapular shield closed and completely surrounded by the shield. Opisthogaster without scales. 4
4. Genital organ surrounded anteriorly and laterally by a very strong sclerite shaped in an inverted 'U'.
 *P. cryptophallus* Fain, 1970
 Genital organ without this sclerite. 5
5. Opisthosoma short (65 μ). Legs IV relatively very strong and distinctly longer than opisthosoma. Tarsi IV 32 μ long, with apical third turned inwards. Posterior lobes wider (18 μ) than long (10 μ). Adanal suckers triangular (15 \times 12 μ). Median soft area of postscapular shield about half as long as the shield.

- *P. nectomys* Fain, 1970
 Legs IV shorter than opisthosoma. Tarsi IV not distinctly turned inwards. Median soft area of postscapular shield either longer or shorter than half the length of the shield. 6
6. Setae *d*5 short and broadly foliate. Median soft area of postscapular shield shorter than half the length of the shield. Posterior extremity deeply incised. Presence of two small paramedian shields behind coxae IV. Postscapular shield with laterally poorly distinct dark spots more or less scaly-like.
 *P. surinamensis* Fain, 1973
 Setae *d*5 thin, piliform. Median soft area of postscapular shield distinctly longer than half the length of the shield. Posterior extremity not so deeply incised. Absence of paramedian shields behind coxae IV. 7
7. Epimerites III thick and fused in the midline in front of the genital organ.
 *P. paraguayensis* Fain, 1970
 Epimerites III short, not fused in the midline 8
8. Anterior half of hysteronotal shield bearing 8 to 12 complete transverse striations. Adanal suckers 10 μ long, 8–9 μ wide. Median soft area of postscapular shield 51 μ long and 29 μ wide. Posterior lobes as long as wide (12 μ), widely separated from each other.
 *P. striatus* Fain, 1973
 Anterior half of hysteronotal shield with 3 to 4 poorly distinct transverse dark lines either complete or present only laterally. 9
9. Posterior lobes wider (18–19 μ) than long (11–13 μ). Adanal suckers oval, longer (20 μ) than wide (12 μ). Anterior part of hysteronotal shield with 3–4 pairs of short lateral striations. Median soft area of postscapular shield 42 μ long and 20 μ wide, the shield is 60 μ long. Tarsi IV 25 μ long. Opisthosoma 90 μ long.
 *P. grassii* (Radford, 1954)
 Posterior lobes either large and longer than wide or small and as long as wide. 10
10. Posterior lobes large, longer than wide (17 \times 15 μ). Adanal suckers 20 μ long and 12 μ wide
 *P. argentinus* (Hirst, 1921)
 Posterior lobes small, as long as wide (10–12 μ). Adanal suckers slightly longer (12–13 μ) than

- wide ($10\ \mu$). *P. frontalis* (Hirst, 1921)
11. Median soft area of postscapular shield open posteriorly. 12
 Median soft area of postscapular shield closed and completely surrounded by the shield. . . 15
12. Penis very thick, tapering only near apex and bearing two thick setae close to the apex. Posterior lobes longer than wide ($22 \times 15\ \mu$).
 *P. reithrodontomys* Fain & Lukoschus, 1982
 Penis thinner, with apical half narrow. Posterior lobes as long as wide ($15\ \mu$). 14
14. Penis straight or very slightly curved. Median soft area of postscapular shield $27\ \mu$ maximum wide and $50\ \mu$ long (ratio 1:1,9).
 *P. sparsilineatus* (Fain, 1970)
 Penis distinctly curved. Median soft area of postscapular shield $15\text{--}17\ \mu$ wide and $45\ \mu$ long (ratio 1:2,8).
 *P. scotinomys* Fain & Lukoschus, 1982
15. Postscapular shield without dark markings (linear, oval or rounded). Median soft area of postscapular shield in the shape of an inverted key-hole. Posterior lobes short, poorly developed. Coxae III normally developed as well as the other segments of this leg.
 *P. ctenomys* Fain, 1970
 Postscapular shield with dark markings laterally. Median soft area not in an inverted key-hole. Posterior lobes well developed. Coxae III dilated, the other segments of these legs either normal or modified. 16
16. Coxae III slightly dilated, the other segments of legs III normal. Posterior lobes ending in two small triangular projections.
 *P. akodon* Fain & Lukoschus, 1982
 Coxae III strongly dilated and very voluminous. Basal segments of legs III (trochanter, femur and genu) modified (short and wide) and more sclerotized than in legs IV; the tarsi III being either normal or with an apico-dorsal conical projection. Posterior lobes of body without projections.
 group 'lestoros' 17
17. Opisthosoma short ($80\ \mu$ long). Tarsus III without distinct apico-dorsal projection. Postscapular shield bearing laterally thin and short dark lines. Hysteronotal shields with very thin dark lines in their anterior half.
 *P. postscutatus* n.sp.
 Opisthosoma longer ($100\text{--}120\ \mu$). Tarsus III with a distinct dorso-apical projection. Postscapular shield with thick dark markings. Hysteronotal shields with either thin or thick dark lines. 18
18. Postscapular shield and anterior half of hysteronotal shields with spindle-shaped dark markings, most of them being joined to each other by very thin dark lines giving a moniliform aspect. Hysteronotal shields without lines in their posterior half.
 *P. monilistriatus* n.sp.
 Postscapular shield without moniliform markings. Hysteronotal shields variable. 19
19. Postscapular shield bearing at each side about 15 to 17 small dark oval spots slightly wider than long. Hysteronotal shields with numerous dark oblique lines, the antero-laterals being thick and moniliform, the posterior ones (in the posterior half of the shield) being very thin.
 *P. lestoros* Fain & Lukoschus, 1982
 Postscapular shield bearing at each side a few (6 to 8) spindle-shaped dark markings. Hysteronotal shield with a few thin oblique lines all concentrated in the anterior half of the shield *P. bidentatus* n.sp.
20. Median soft area of postscapular shield open anteriorly. Setae *d5* piliform. Adanal suckers relatively small. Hysteronotal shields slightly extending in front of setae *d2*.
 *P. bakeri* (Radford, 1949)
 Median soft area of postscapular shield closed. Setae *d5* foliate. Adanal suckers very large. Hysteronotal shields extending far in front of setae *d2*.
 *P. hirstianus* Fain, 1973

Study of the species

1. *Prolistrophorus (Prolistrophorus) dolichus* Lizaso, 1975

Prolistrophorus dolichus Lizaso, 1975, p. 73 (Figs. 1–8)

It is not possible to recognize this species because of the lack of adequate description and figures. At first sight it resembles *P. argentinus* (Hirst, 1921). The type host was an un-identified rat captured in the Butantan Institute, São Paulo, Brazil.

2. *Prolistrophorus (Prolistrophorus) inornatus* Lizaso, 1977

Prolistrophorus inornatus Lizaso, 1977, p. 205 (Figs. 1–7)

The type host of this species is *Oryzomys subflavus*, from Bahia, Brazil but, as *P. dolichus*, the status of this species is unknown because of the inadequate description.

3. *Prolistrophorus (Prolistrophorus) grassii* (Radford, 1954)

Listrophorus grassii Radford, 1954, p. 594 (Fig. 1)
Prolistrophorus grassii, Fain & Hyland, 1974, p. 40

The types of this species are probably lost (Fain & Hyland, 1974). New specimens have been collected in the USA from the following hosts:

(i) *Oryzomys palustris palustris* (type host): from Okefinkee Swamp situated in Georgia (as the typical locality) 14.I.1917, rat in USNM no. 223922 (6 females and 3 males; coll. F.S.L.); also from Enfaula, Wildlife Refuge, Barbour Co., Alabama, 18.II.1976 (4 females and 6 males; coll. J. Whitaker).

(ii) *Oryzomys palustris odoratus*: from Oap-Locka, Florida, 15.XII.1934. Rat in USNM no. 259240 (one female, one male; coll. F.S.L.)

(iii) *Synaptomys cooperi*: from Bicknell, Indiana, rat in USNM no. 206439 (one female and one male; from Cranberry riv., W. Virginia, 7.X.1909; rat in USNM no. 204111 (one female; coll. F.S.L.); from Harvey (1.6 km N, 2 km E), Marion County, Iowa,

3.X.1970 (one female and one male; coll. N. Wilson); from Mills Co, near Hillsdale, 24.IX.1972 (one female; coll. N. Wilson).

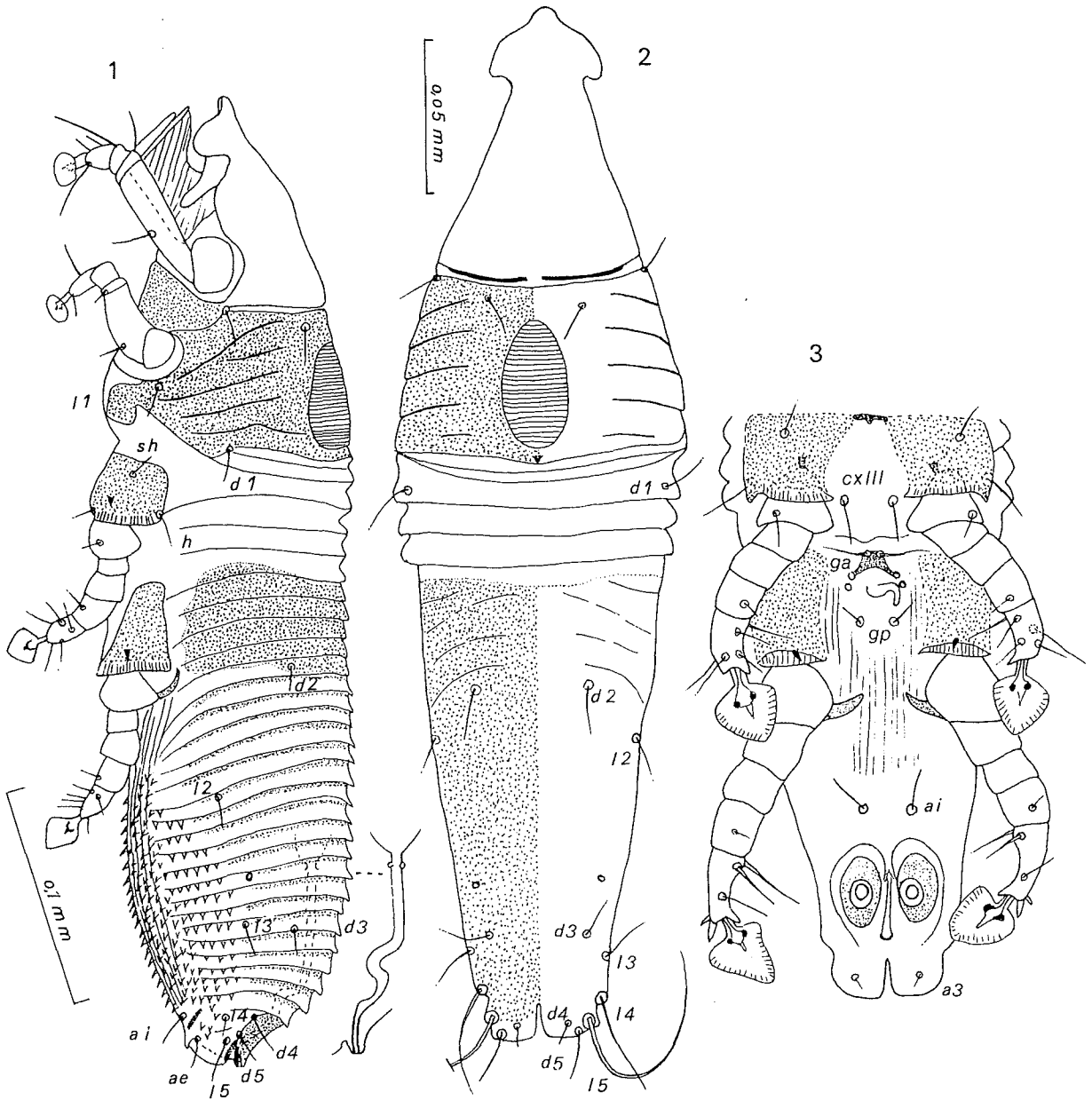
As the original description is incomplete we think it is useful to give here a new description with new, more detailed figures of this species. our description is based on specimens collected from the typical host from Georgia.

Female (Fig. 1). A specimen is 426 μ long; the opisthosoma is 160 μ long. Median soft area of postscapular shield 51 μ long, closer to the posterior margin than to the anterior margin of the shield; this shield is 72 μ long and bears laterally 5 thin incomplete striations. Anterior hysteronotal shield with 4 to 5 transverse striations and not fused laterally with the shield of coxa IV. Opisthogaster with numerous triangular scales not confined to the median longitudinally striated cuticle but also covering a part of the lateral, transversely striated parts of the venter. Bursa poorly sclerotized and wide, its length in straight line is 90 to 130 μ ; it opens at 3 μ from anus on a very short (3 to 5 μ) cylindrico-conical papilla directed backwards.

Male (Figs. 2, 3). A specimen is 345 μ long and 100 μ wide in ventral view. Median soft area of postscapular shield 42 μ long and 20 μ wide; maximum length of the shield 60 μ . Posterior lobes of body wider (18–19 μ) than long (11–13 μ). Adanal suckers elongate longer than wide (20 \times 12 μ). Anterior part of hysteronotal shield with 3 or 4 pairs of short lateral striations. Tarsi IV 25 μ long. Legs iV shorter than opisthosoma, the latter 90 μ long.

Remarks

P. grassii differs from *P. nectomys* Fain, 1970, in the female by the following characters: hysteronotal shield not fused with coxal shield of leg IV (fused in *nectomys*); bursa longer (50 μ in *P. nectomys*); copulatory papilla shorter, closer to anus and directed posteriorly (in *P. nectomys* it is 9 μ long, farther from anus and directed dorsally). The male differs from *P. nectomys* by the greater length of opisthosoma (65 μ in *P. nectomys*) and the shorter legs IV, shorter than opisthosoma (longer than



Figs. 1-3. *Prolistrophorus (Prolistrophorus) grassii* (Radford). Fig. 1. Female, lateral view. Fig. 2. Male, dorsal view. Fig. 3. Male ventral view of hysterosoma.

opisthosoma in *P. nectomys*); the shape of tarsus IV, shorter (25μ instead of 32μ) and almost straight (distinctly curved in *P. nectomys*); adanal suckers more elongate (more or less triangular ($15 \times 12\mu$) in *P. nectomys*); posterior lobes longer ($9-10\mu$ in *P. nectomys*); greater length of the soft

median area of postscapular shield, distinctly longer than half the length of the shield (about as long as half the length of this shield in *P. nectomys*); greater length of the body ($340-370\mu$ in *P. grassii* compared with $285-310\mu$ in *P. nectomys*).

4. *Prolistrophorus* (*Prolistrophorus*) *pernamboucensis* Fain, 1973

Prolistrophorus pernamboucensis Fain, 1973a, p. 332; 1973b, p. 43 (Fig. 34)

This species is known only from the holotype female and a nymph in moulting stage and containing a female. It has been inadequately described and depicted and we give here a more complete description and a detailed figure of the holotype.

Female (Figs. 4–5). Holotype 510 μ long and 108 μ wide in ventral view. Postscapular shield 75 μ long, with a median soft and striated area 45 μ long, and bearing laterally short, narrow and sinuous dark bands unequal in length and forming 4 transverse rows. There is a distinct hysteronotal shield in front of the setae *d*₂; this is 36 μ long and bears a few short striations in its lateral parts. This shield is separated from the coxal shields of legs IV. The cuticle behind this shield is slightly and completely punctate. The punctation on the two dorsal shields is coarser than on the other punctate areas of the body. Opisthogaster striated longitudinally bearing numerous small triangular scales all confined to the median longitudinally striated area. Bursa short, thick, strongly sclerotized and describing 3 loops. There is a small termino-dorsal copulatory papilla.

Host and locality. Holotype female and paratype nymph from *Oryzomys* sp., San Lourenço, Pernambuco, Brazil. Rat in BM no. 3.10.1.100-105. Holotype in BM.

Remarks

This species is closest to *P. surinamensis* Fain, 1973. It differs from it by the structure of the bursa (sinuous, thick and sclerotized), the coarse aspect of the punctation on the dorsal shields, the shape of the dark bands, which are longer and fewer, on the postscapular shield.

5. *Prolistrophorus* (*Aprolistrophorus*) *primitivus* n.sp.

Female (Fig. 6). Holotype 396 μ long and 90 μ wide in lateral view. Postscapular shield 80 μ long, with a soft median area only 19 μ long and entirely situated in the posterior third of the shield. Hysteronotum without shields but bearing numerous triangular scales in its posterior half or third. Opisthogaster covered with numerous triangular scales. Bursa short, poorly sclerotized, opening without a papilla immediately behind the anus.

Male. unknown.

Host and locality. Holotype from *Oryzomys albicularis*, Caracas, Venezuela, 1956. Rat in USNM no. SVP 1049. One paratype female from *Akodon bogotensis*, Cristobal, 3.III. 1968; rat in USNM no. 495648. Holotype in USNM.

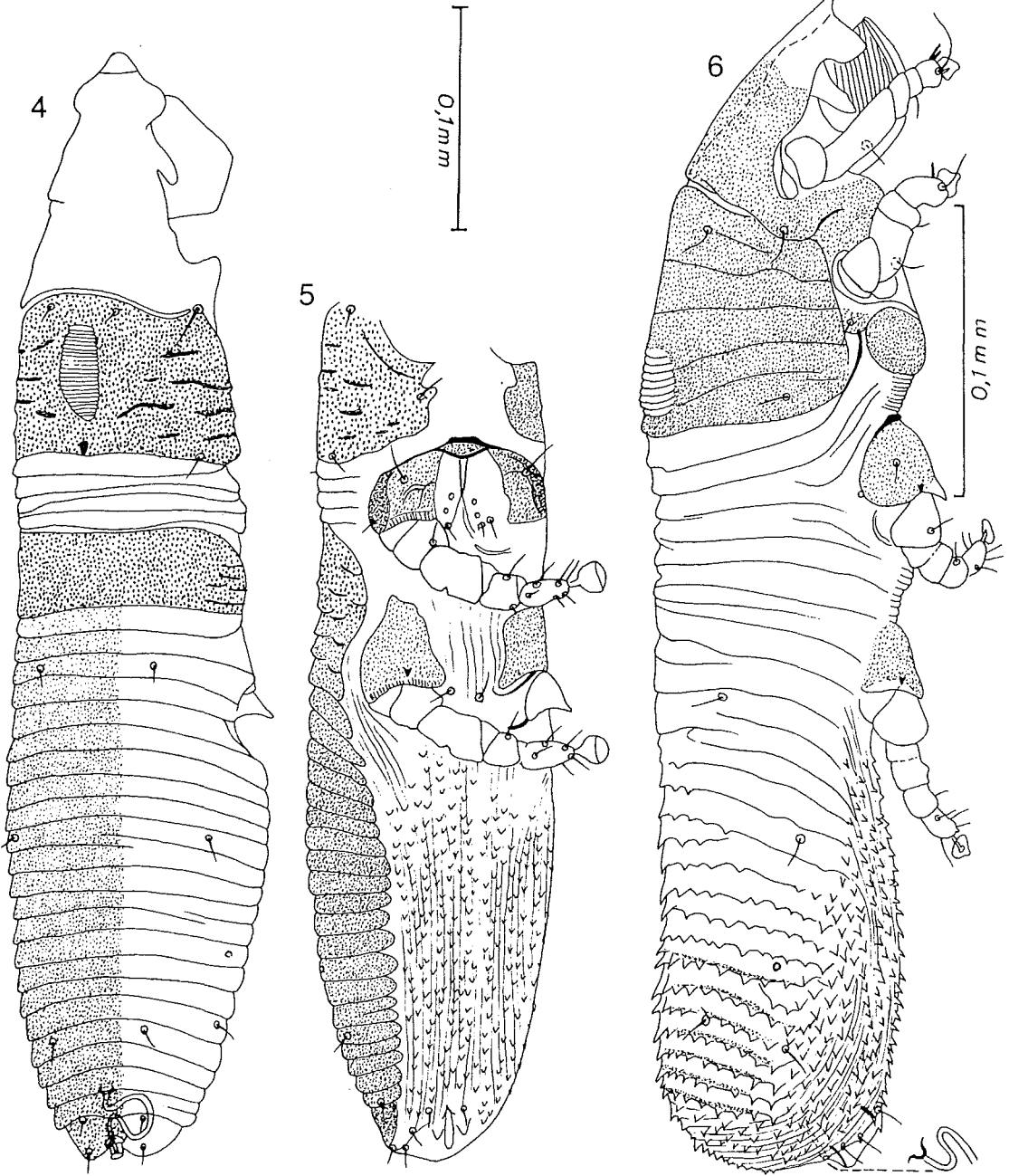
Remarks

This species is well characterized by the very small size of the soft area in the median part of the postscapular shield. It is included provisionally in subgenus *Aprolistrophorus* until the male is discovered.

6. *Prolistrophorus* (*Aprolistrophorus*) *scotinomys* Fain & Lukoschus, 1982

Prolistrophorus (Aprolistrophorus) scotinomys Fain & Lukoschus, 1982, p. 100

Female (Figs. 7–8). Holotype 408 μ long, 99 μ wide in latero-ventral view. In 2 paratypes: 420 \times 100 μ and 422 \times 98 μ (both in lateral view). Postscapular shield 71 μ long with a median soft area 57 μ long and 10–12 μ maximum width. Lateral parts of this shield with four thin, dark transverse lines. Hysteronotum without a distinct anterior transverse shield but with transverse punctate bands. Opisthonotum without postero-lateral shields. Opisthogaster with numerous triangular scales practically confined to the median longitudinally striated region. Bursa very poorly sclerotized, de-

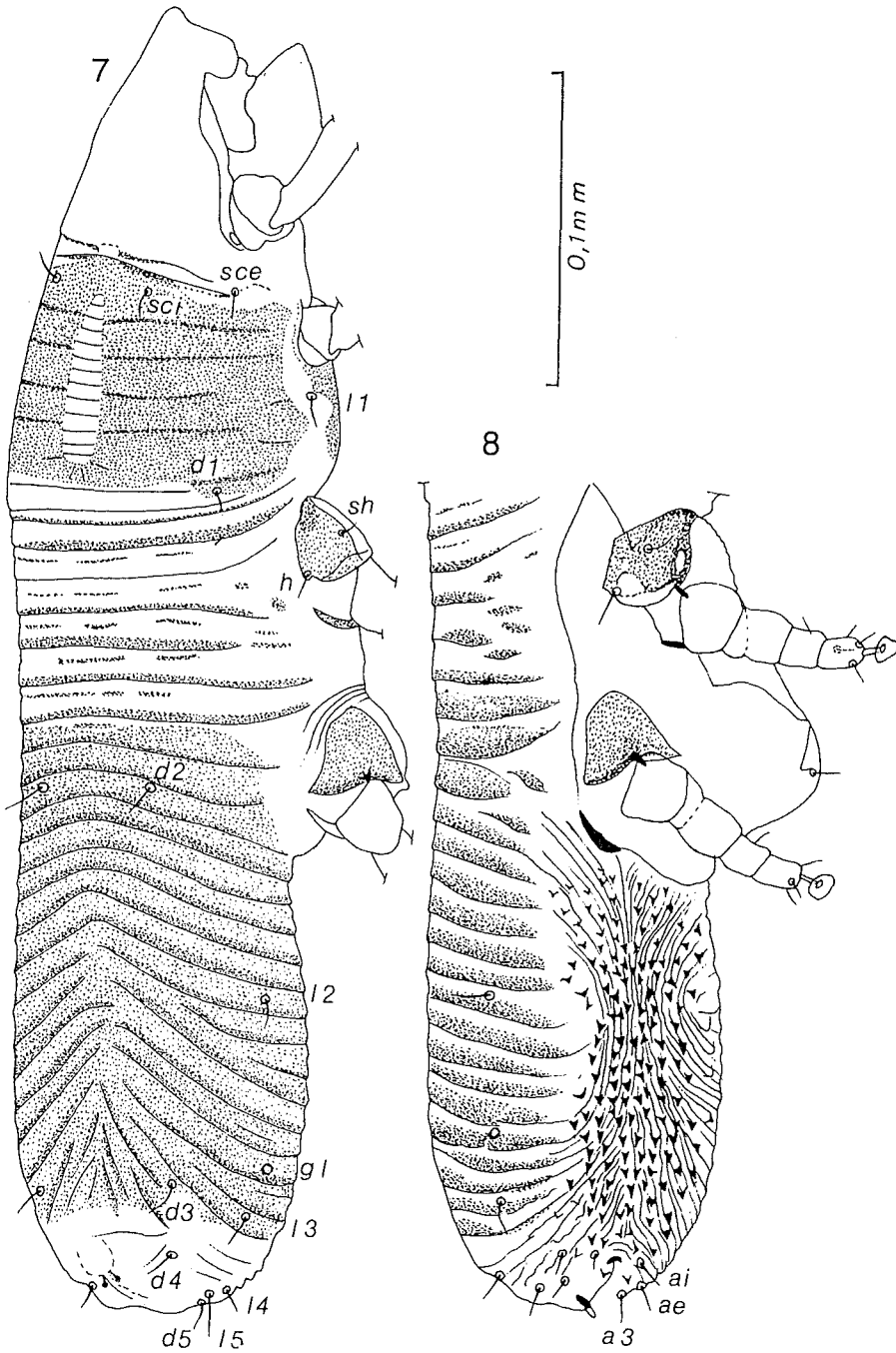


Figs. 4-5. *Prolistrophorus (Prolistrophorus) pernamboucensis* Fain. Fig. 4. Female, dorsal view. Fig. 5. Female, ventral view. Fig. 6. *Prolistrophorus (Aprolistrophorus) primitivus* n.sp. Female, lateral view.

scribing several loops. Spermatheca situated close to posterior extremity. Opening of bursa situated in a depression immediately behind the anus; there is no copulatory papilla.

Male (Fig. 9). A paratype is 366 μ long and 102 μ

wide in lateral view. Postscapular shield with a large median soft and striated area open posteriorly. Lateral parts of the shield with four narrow, dark, transverse lines. Hysteronotum with two long paramedian shields. Posterior extremity with two well developed truncate lobes bearing only



Figs. 7-8. *Prolistrophorus (Aprolistrophorus) scotinomys* Fain & Lukoschus. Fig. 7. Female, dorsal view. Fig. 8. Female, ventral view.

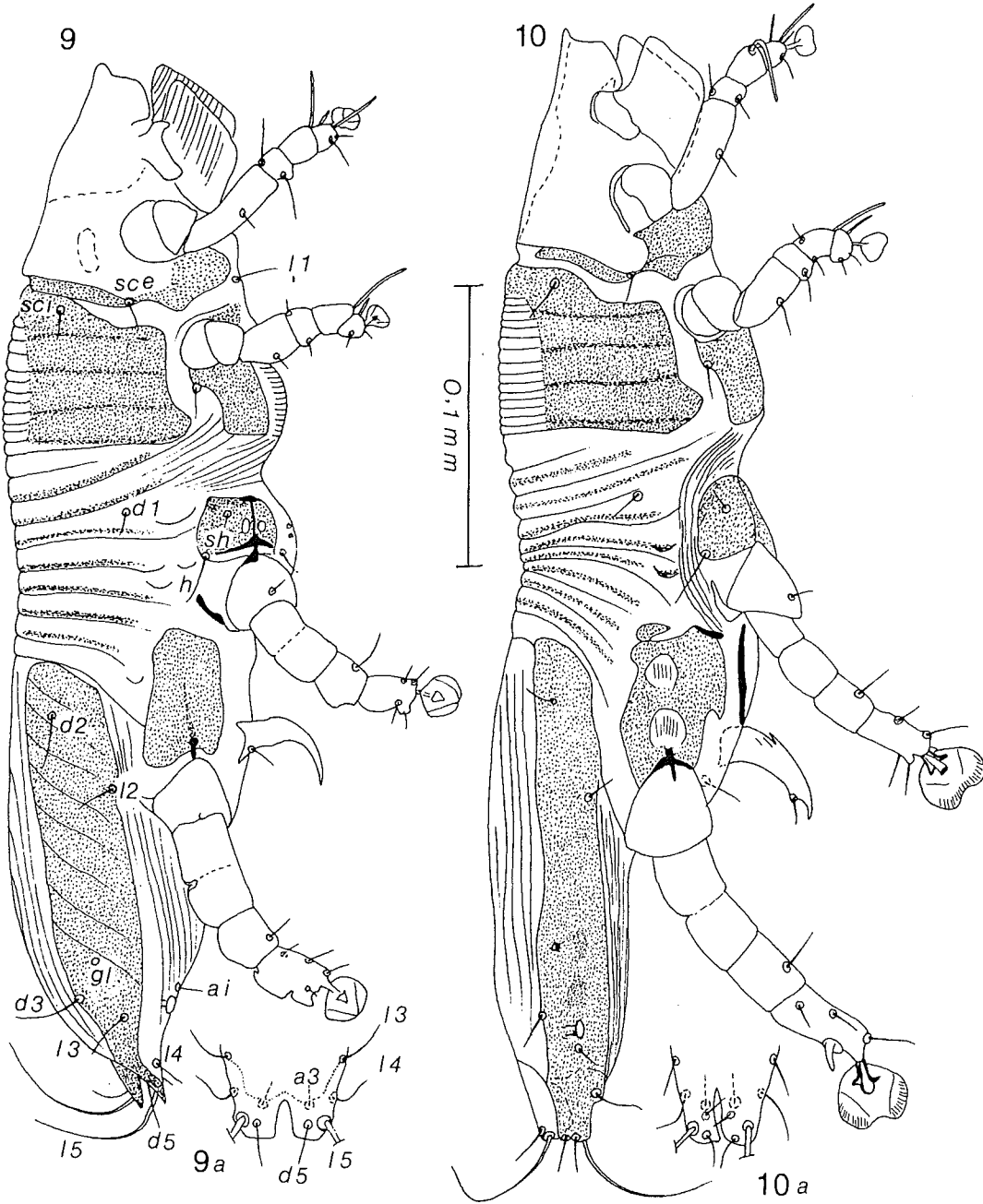


Fig. 9-10. *Prolistophorus (Aprolistophorus) scotinomys* Fain & Lukoschus. Male, lateral view. Fig. 9a. Male, lobes in dorsal view. Fig. 10. *Prolistophorus (Aprolistophorus) reithodontomys* Fain & Lukoschus. Fig. 10. Male, lateral view. Fig. 10a. Male, lobes in dorsal view.

simple setae. Penis with basal half thick; the apical half is curved and much thinner, its total length is 27 μ . Adanal suckers very small (diameter: 4 to 5 μ). Setae *d 4* and *ae* lacking.

Host and locality. Holotype from *Scotinomys xerampelinus*, Panama, Chiriqui Province, 3,5 km E of Escopeta 81° 50' W, 8° 34' N, 1800 m; 5.VIII.1980. Rat in FMNH (coll. R.H. Pine). Paratypes: 23 females and 7 males from the same host and locality (dates: 5-16-19 and 28.VII.1980 (coll. F.S.L.) Hosts in USNM.

Several paratypes (2 females and 2 males), from *Scotinomys* sp. from the same locality and dates.

Remarks

This species is clearly distinguished from all other species of the subgenus by the strong sexual dimorphism (especially in the shape of the soft median area in the postscapular shield).

7. *Prolistrophorus* (*Aprolistrophorus*) *reithrodontomys* Fain & Lukoschus, 1982

Prolistrophorus (*Aprolistrophorus*) *reithrodontomys* Fain & Lukoschus, 1982, p. 100

Female (Figs. 11–12). Holotype 458 μ long and 96 μ wide in ventral view. In three paratypes: 445 \times 95 μ , 450 \times 100 μ and 466 \times 105 μ . Postscapular shield 66 μ long, with a soft median area widely open posteriorly. Lateral parts of postscapular shield bearing 5 dark transverse lines. Opisthonotum completely soft with very oblique striations bearing numerous triangular scales. Bursa very poorly sclerotized and short, opening on a short rounded papilla situated dorsally 30 μ from posterior extremity. Opisthogaster covered with numerous scales, the median scales being smaller than the lateral ones.

Male (Fig. 10). A paratype is 396 μ long and 98 μ wide in lateral view. Postscapular shield as in female but there are only four transverse dark lines. Hysteronotum with two paramedian non-striated shields. Penis very thick and curved ven-

trally, bearing two short setae close to the apex. Posterior lobes 22 μ long. Adanal suckers very small (diameter: 4 to 5 μ). Setae *d 4* are present, the *ae* are lacking.

Host and locality. Holotype from *Reithrodontomys creper*, Cerro Bollo, Cloud Forest, Panama, Chiriqui Province (81° 50' W, 8° 34' N), 16.VI.1980. Paratypes: 4 males and 15 females. From *Reithrodontomys* sp. from the same locality but on 26.VII.1980: 3 males and 7 females (paratypes). All the hosts are in FMNH, they were collected by R.H. Pine. Holotype in FMNH.

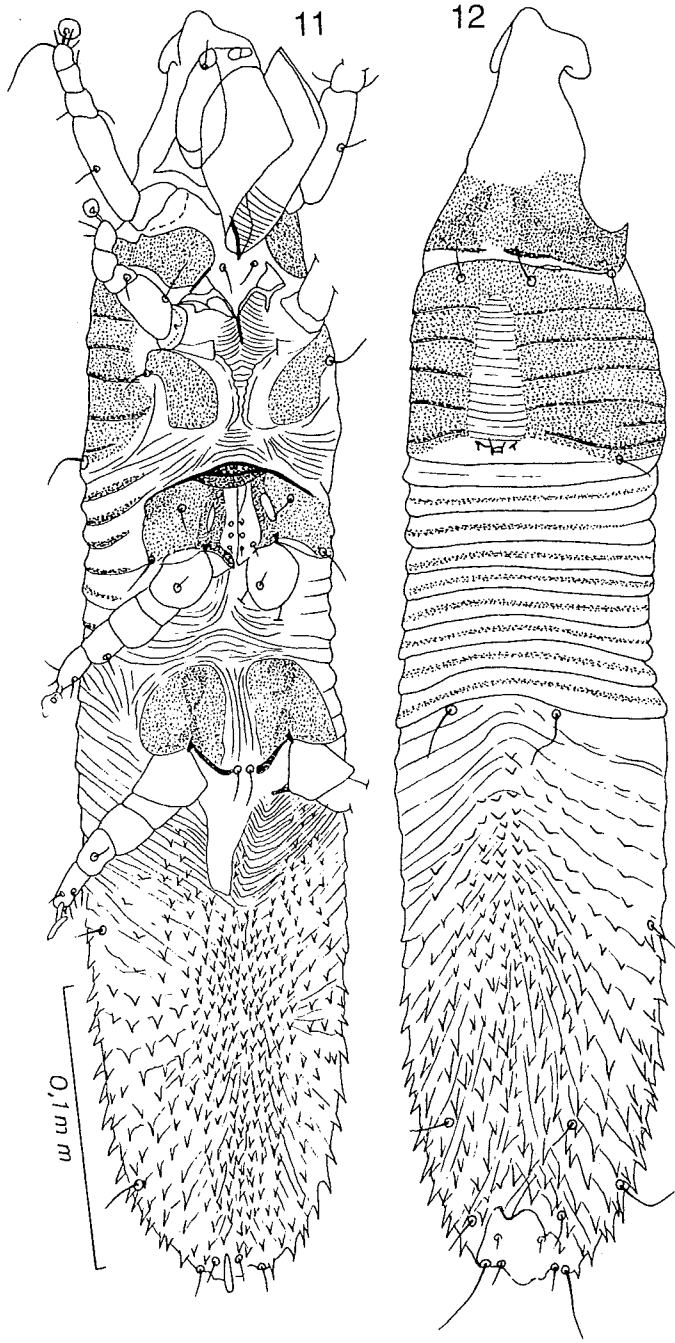
Remarks

In the female of this species the soft area of the postscapular shield is open posteriorly as in *P. sparsilineatus* and *P. amazonicus*. It differs from these species mainly by the presence of very numerous scales in the median and lateral parts of opisthonotum. In the male the soft median area of the postscapular shield is open posteriorly, as in the males of *P. sparsilineatus* and *P. scotinomys*. It differs from these species by the shape of the penis (which is uniformly thick) and the absence of striations on the hysteronotal shields.

8. *Prolistrophorus* (*Aprolistrophorus*) *lestoros* Fain & Lukoschus, 1982

Prolistrophorus (*Aprolistrophorus*) *lestoros* Fain & Lukoschus, 1982, p. 100

Female (Fig. 13). Holotype 442 μ long and 118 μ wide in lateral view. Postscapular shield 87 μ long, with a median soft area 59 μ long and bearing laterally on both sides five transverse rows of dark oval spots. An indistinct dark and very narrow oblique line divides these rows in their middle. Hysteronotum punctate in its posterior two thirds and bearing in its posterior quarter a well developed shield covering the lateral and the median parts of the body. Lateral surfaces of metapodopoda with a few scales. Opisthogaster scaly. Bursa very poorly sclerotized. Copulatory orifice situated at 35 μ behind the anus.



Figs. 11-12. *Prolistrophorus (Aprolistrophorus) reithodontomys* Fain & Lukoschus. Fig. 11. Female, ventral view. Fig. 12. Female, dorsal view.

Male (Fig. 14). A paratype is 415 μ long and 135 μ wide in lateral view. Postscapular shield 75 μ long, the median soft area is 51 μ long and is closer to the posterior than to the anterior margin of the shield. This shield bears numerous dark oval spots disposed along 4 or 5 transverse rows. Hysteronotal shield bearing in its anterior half 4 to 5 thick dark lines with irregular thickenings. Adanal suckers 12 μ wide. Legs III modified: coxae very broad, trochanter, femur and genu distinctly wider than in legs IV and more sclerotized. Legs IV longer than legs III and not modified.

Host and locality. Holotype, 4 paratype females and 4 paratype males from *Lestoros inca*, Cuzco, Peru, 17.VII.1953. Animal in FMNH, no 75587. Holotype in this Museum.

Remarks

This species is characterized by the strong development of the coxae III and the modification of the legs III in the male. The female differs from the other species of the subgenus *Aprolistrophorus* in the appearance of the postscapular shield which bears only small, oval dark spots divided by an indistinct oblique dark line.

9. *Prolistrophorus (Aprolistrophorus) monilistriatus* n.sp.

Female (Fig. 15). Holotype 458 μ long and 135 μ wide in lateral view. In two paratypes: 440 \times 120 μ and 460 \times 134 μ . Postscapular shield 96 μ long, with a median soft area 58 μ long and bearing on both sides 5 transverse dark lines resembling a string of beads (moniliform). These lines are interrupted in the middle by an oblique narrow groove, rather poorly visible. Opisthonotum with a median area slightly punctate and two postero-lateral, well developed shields. A small median punctate area is present between the two lateral shields. Bursa very poorly sclerotized, only a short portion is visible close to the spermatheca. Copulatory papilla absent. Opisthosoma scaly.

Male (Fig. 16). A paratype is 380 μ long and 108 μ wide in lateral view. Opisthosoma 115 μ long. Postscapular shield 75 μ , with a median soft area 48 μ long and with dark markings as in the female. Hysteronotal shields bearing a few dark moniliform-like lines only in their anterior half, the posterior half without dark lines. Adanal suckers round, 12 μ wide. Posterior extremity deeply incised. Setae *d5* slightly dilated. Coxae III and legs III as in the male of *P. lestoros*.

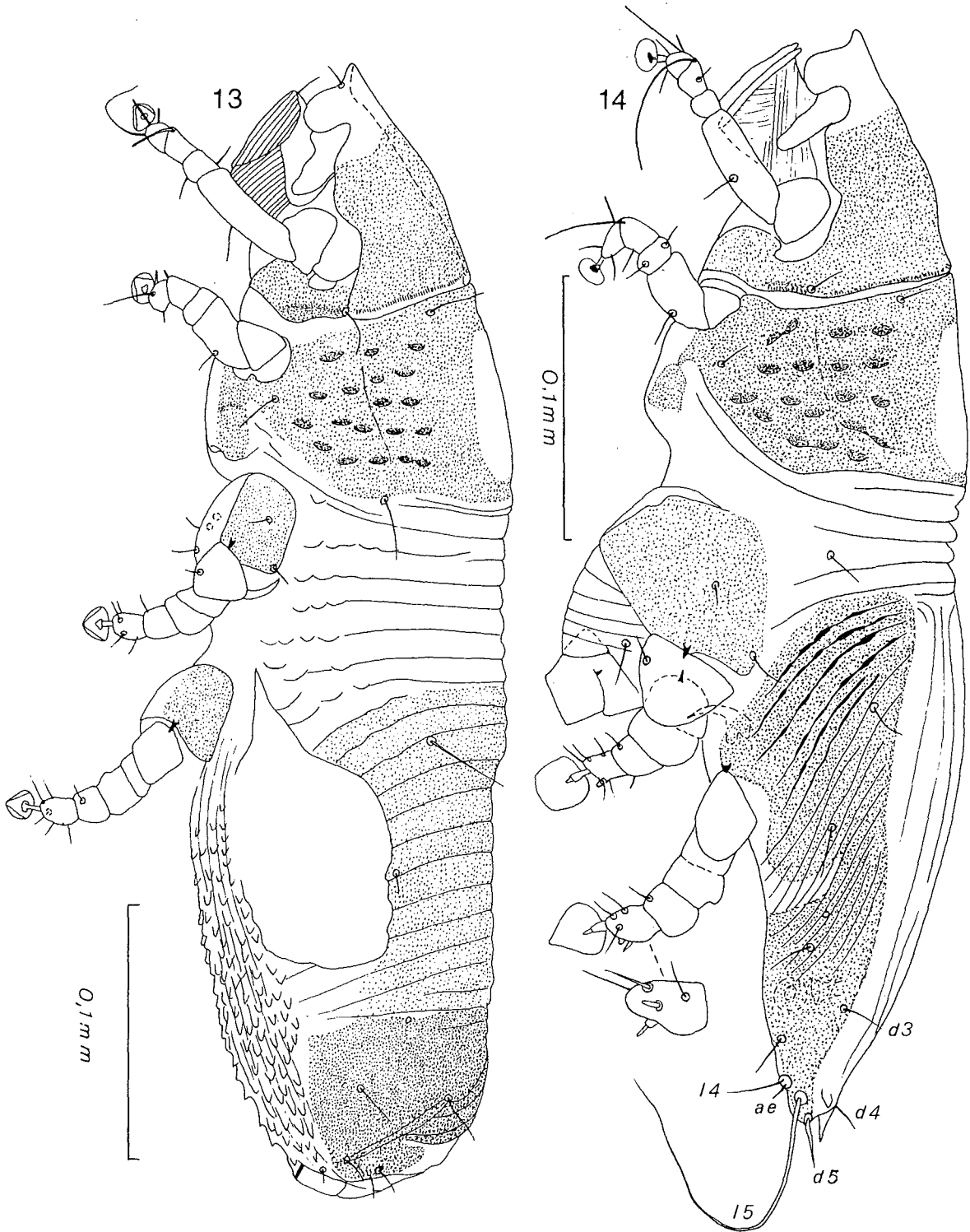
Host and locality. Holotype and paratypes (16 females and 8 males) from *Lestoros inca*, Cuzco, Peru, 17.VII.1953. Animal collected by Kalinowski and deposited in FMNH, no. 75587. Holotype in FMNH. This animal was also parasitized by 5 other species of the same subgenus (*P. lestoros*, *P. bidentatus*, *P. postscutatus*, *P. cuzcoensis* and *P. curvistriatus*).

Remark

This species belongs to the group 'lestoros'. It is distinguished from the other species of this group by the shape of the dark markings on the dorsal shields and the shape and the development of the posterior shields of opisthonotum in the female (see keys).

10. *Prolistrophorus (Aprolistrophorus) bidentatus* n.sp.

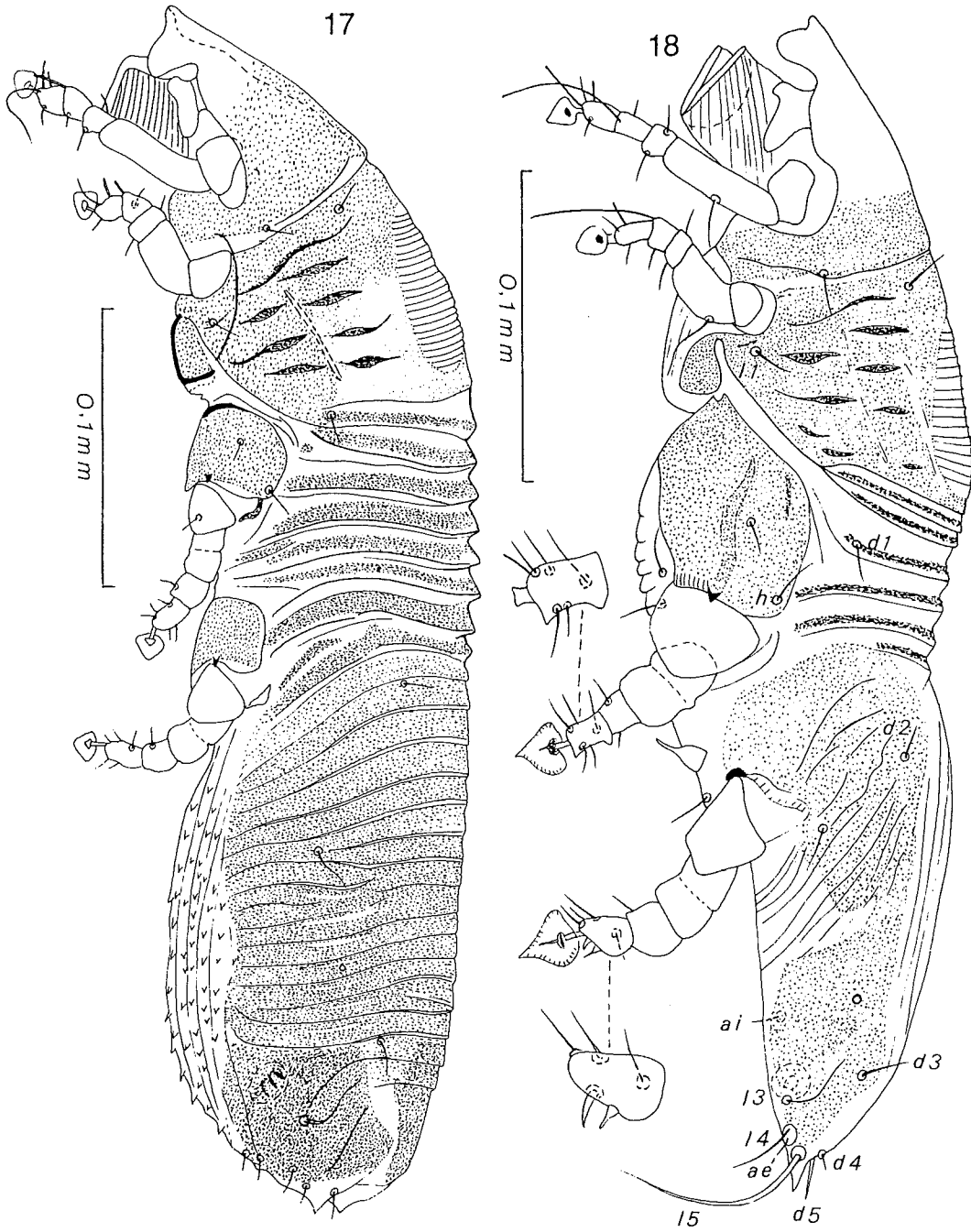
Female (Fig. 17). Holotype 480 μ long and 105 μ wide in lateral view. In 3 paratypes: 420 \times 89 μ , 432 \times 93 μ and 435 \times 93 μ . Body distinctly curved ventrally in its anterior third. Postscapular shield 84 μ long, its median soft oval area 56 μ long. The lateral parts of that shield bear at both sides five dark spindle-shaped bands of which the four posteriors are interrupted by an oblique groove. The first seven or eight striations behind this shield are very thick and prominent. Hysteronotum strongly punctate in its posterior two thirds. Opisthonotum with two postero-lateral shields relatively short and not bearing the oil gland orifices; they are separated in the midline by a smaller median shield.



Figs. 13-14. *Prolistrophorus (Aprolistrophorus) lestoros* Fain & Lukoschus. Fig. 13. Female, lateral view. Fig. 14. Male, lateral view.



Figs. 15–16. *Prolistrophorus (Aprolistrophorus) monilistriatus* n.sp. Fig. 15. Female, lateral view. Fig. 16. Male, lateral view.



Figs. 17-18. *Prolistrophorus (Aprolistrophorus) bidentatus* n.sp. Fig. 17. Female, lateral view. Fig. 18. Male, lateral view.

Opisthogaster scaly. Bursa poorly sclerotized, only its proximal part is distinct. Spermatheca at 25–35 μ from posterior extremity, the latter being prolonged by two small conical projections.

Male (Fig. 18). A paratype from *Lestoros inca* is 375 μ long and 108 μ wide in lateral view. Postscapular shield 78 μ long, with median soft oval area 57 μ long and reaching close to the posterior margin of the shield. The lateral parts of this shield bear spindle-shaped dark bands as in the female. Hysteronotal shields bearing in its anterior half very oblique and thin dark lines. Coxae III very thick. Legs III modified as in *P. lestoros*.

Host and locality. Holotype and paratypes (13 females and 3 males) from *Lestoros inca*, Cuzco, Peru. Animal in FMNH, no. 75587, coll. Kalinowski. Other paratypes (7 females) from *Reithrodontomys megalotis longicauda*, from Pitalama, California, USA, 1973 (animal in Museum of Leiden, Nederland).

Remarks

This species belongs to the group 'lestoros'. It differs from the other species of this group, in the female by the recurved aspect of the body and the presence of two triangular projections behind the postero-laterals shields. In both sexes it is distinguished by the aspect of the dark markings of postscapular shield and the thick and proeminent aspect of the first hysterosomal striations (behind the postscapular shield).

11. *Prolistrophorus* (*Aprolistrophorus*) *postscutatus* Fain & Lukoschus, 1982

Prolistrophorus (*Aprolistrophorus*) *postscutatus* Fain & Lukoschus; 1982, p. 100

Female (Fig. 19). Holotype 390 μ long and 135 μ wide in lateral view. In two paratypes: 392 \times 128 μ and 375 \times 125 μ . Postscapular shield 80 μ long, with a median soft area 60 μ long and bearing laterally, at both sides, five thin dark transverse lines interrupted in the middle by an oblique

groove. Hysteronotum poorly punctate in its posterior two thirds. Posterior region of opisthosoma with two lateral bilobed shields bearing the oil gland pores and the setae *l3*, *l4* and *d4*. These shields are prolonged posteriorly by a short triangular process much less developed than in *P. bidentatus*. Opisthogaster scaly. Bursa very poorly sclerotized, only partly visible.

Male (Fig. 20). The paratype is 350 μ long and 115 μ wide in lateral view. Postscapular shield 60 μ long, its median soft area 40 μ long and closer to posterior margin of the shield than to its anterior margin. Dark markings on the shield as in female. Opisthosoma short (80 μ long). Hysteronotal shields bearing in their anterior half several strongly oblique narrow dark lines. Coxae and legs III as in *P. lestoros* except that tarsi III have no dorso-apical projections. Adanal suckers 13–14 μ wide.

Host and locality. Holotype and paratypes (5 females and one male) from *Lestoros inca* Cuzco, Peru, 17.VII.1953. Animal in FMNH, No. 75587 (coll. Kalinowski). Holotype in FMNH.

Remarks

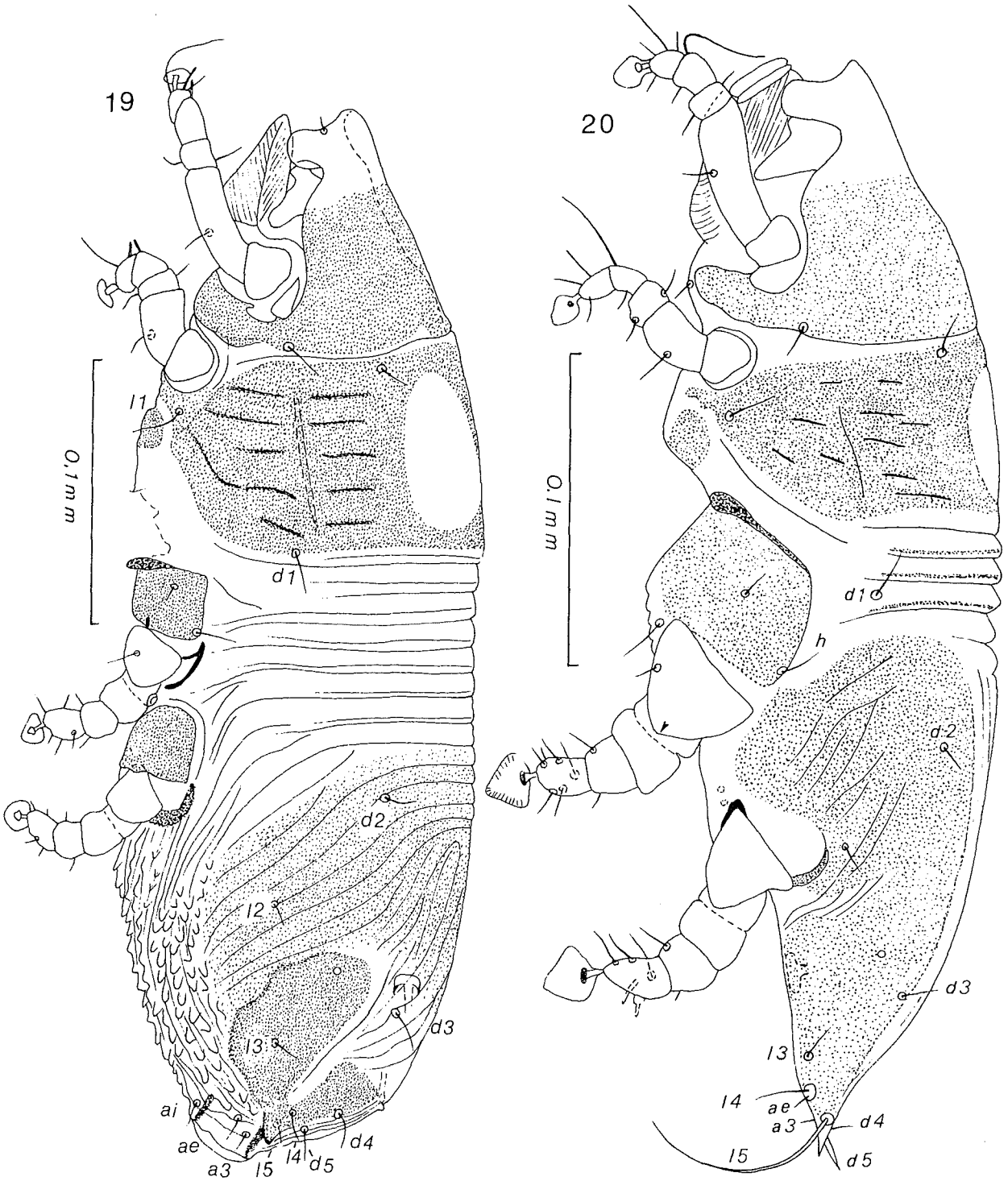
This species belongs to the group 'lestoros'. It is characterized by the narrow aspect of the transverse lines on postscapular shield and on hysteronotal shields.

12. *Prolistrophorus* (*Aprolistrophorus*) *cuzcoensis* Fain & Lukoschus, 1982 nom. emend.

Prolistrophorus (*Aprolistrophorus*) *cuzcoensis* Fain & Lukoschus, 1982, p. 101

The name of this species was misspelled 'cuzcoensis' in the original description. We emend here this name in 'cuzcoensis'.

Female (Fig. 21). Holotype 369 μ long and 135 μ wide in lateral view. In a paratype: 375 \times 120 μ . Postscapular shield 84 μ long, with a soft median area 57 μ long and bearing laterally on both sides



Figs. 19–20. *Prolistrophorus (Aprolistrophorus) postscutatus* Fain & Lukoschus. Fig. 19. Female, lateral view. Fig. 20. Male, lateral view.

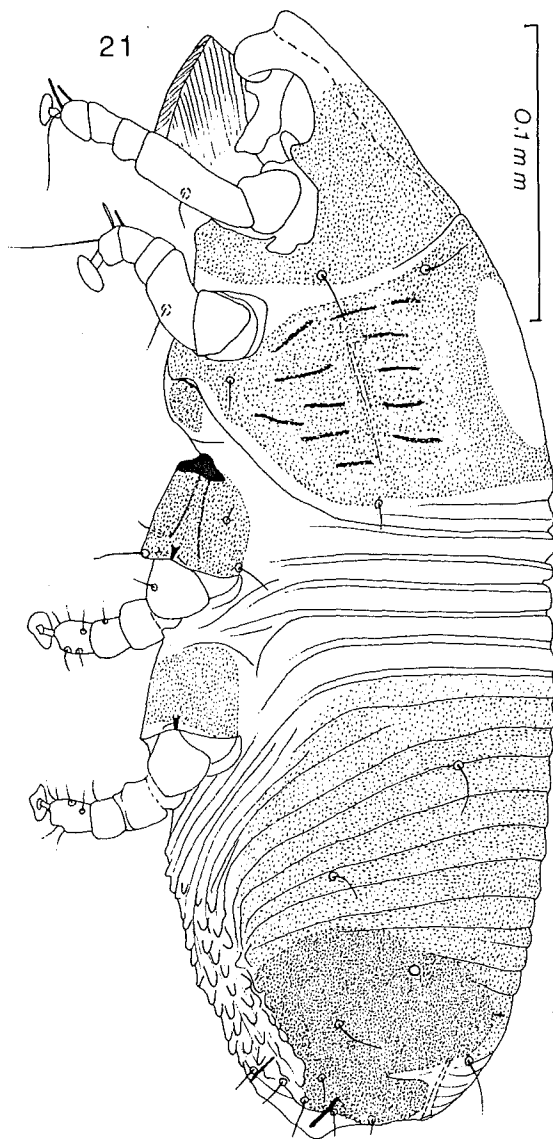


Fig. 21. *Prolistrophorus (Aprolistrophorus) cuzcoensis* Fain & Lukoschus. Female, lateral view.

five narrow transverse dark bands of which the four posterior are interrupted in their middle by an oblique groove. Hysteronotum punctate in its posterior two thirds, the posterior third bearing at each side a large bilobed shield. These shields bear the oil gland orifices and the setae *l3*, *l4*, *d4* and *d5*. Bursa very short, its opening at 40–45 μ behind the anus. Opisthogaster scaly.

Male. Unknown.

Host and locality. Holotype and 2 paratypes female from *Lestoros inca*, Cuzco, Peru, 17.VII.1953. Host No. 75587 in FMNH (coll. Kalinowski). Holotype in FMNH.

Remark

This species belongs to the group 'lestoros'. It is close to *P. postscutatus* but differs from it by the size and the shape of the two postero-lateral shields of opisthosoma, which are larger, different in shape and orientated transversely (and not obliquely as in *P. postscutatus*).

13. *Prolistrophorus (Aprolistrophorus) curvistriatus* n.sp.

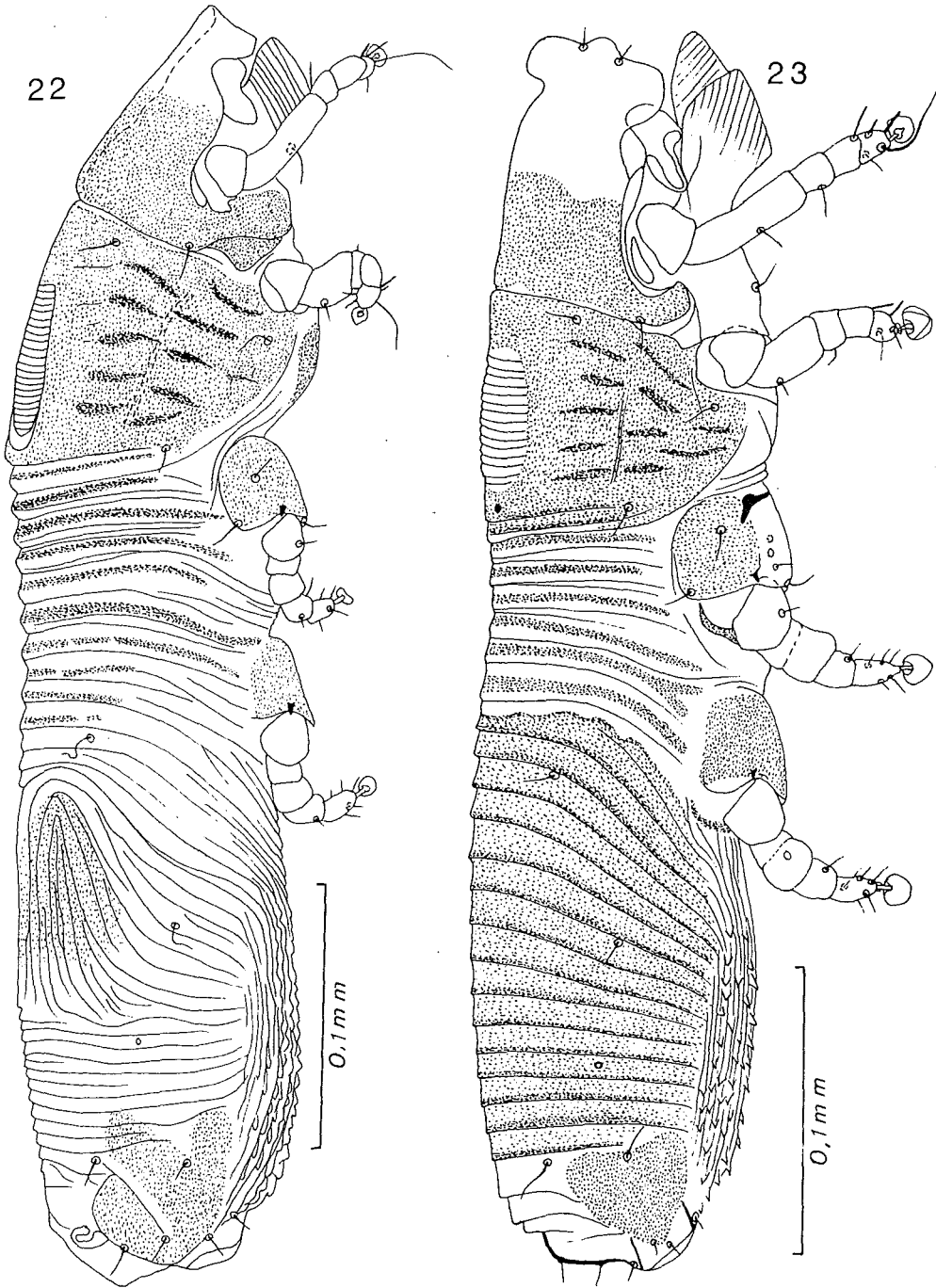
Female (Fig. 22). Holotype 468 μ long and 105 μ wide in lateral view. Postscapular shield 92 μ long, with a median soft area 60 μ long and bearing laterally at each side, five dark and thick bands interrupted in their middle by an oblique groove. Opisthonotum bearing in its anterior half a median punctate area where the striations are oblique or longitudinal. Posterior part of opisthonotum with a pair of lateral, more or less trilobed shields. Bursa poorly sclerotized.

Male: Unknown.

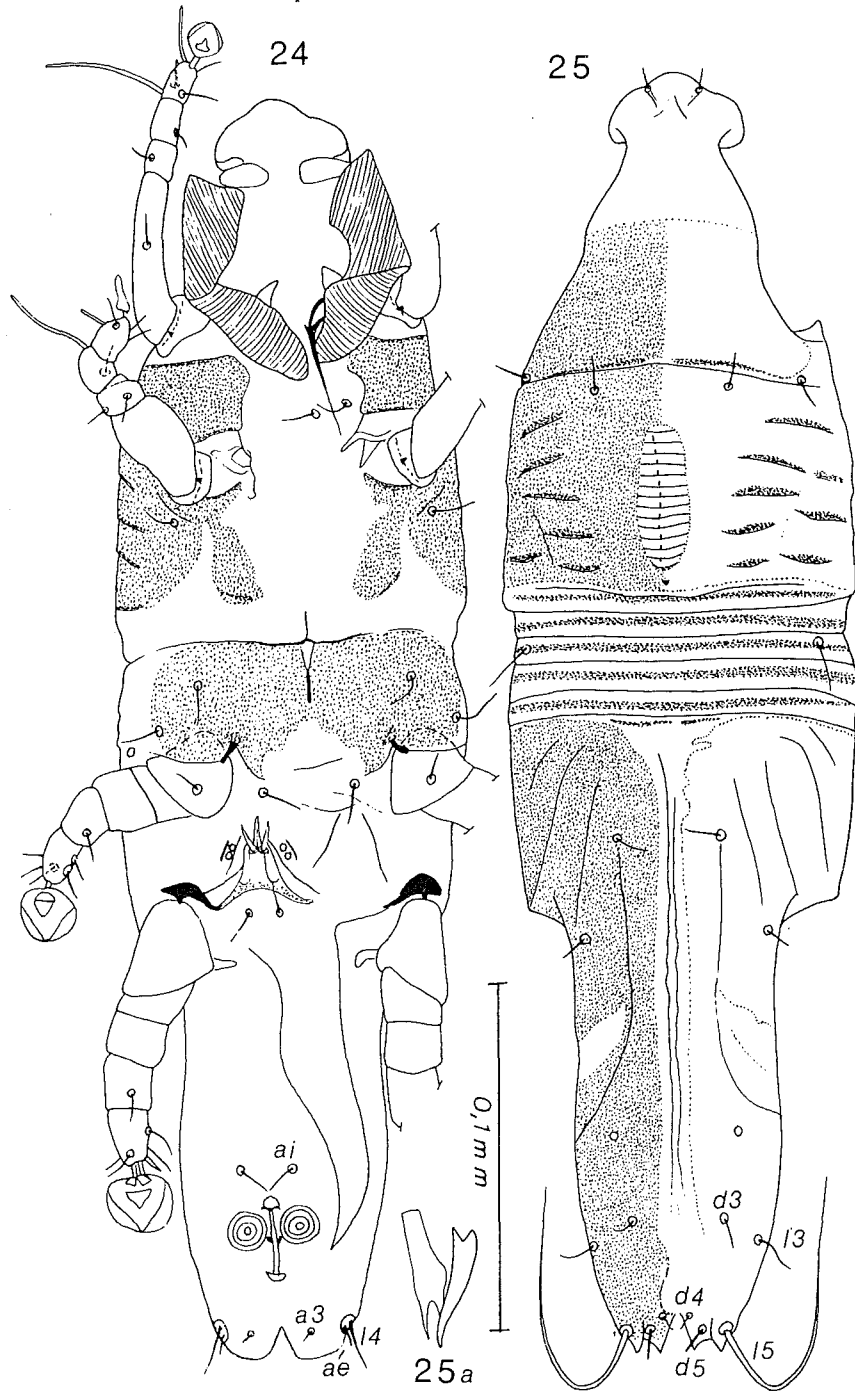
Host and locality. Holotype and only known specimen from *Lestoros inca*, Cuzco, Peru, 17.VII.1953. Animal in FMNH, No. 75587. Holotype in FMNH.

Remark

This species belongs to the group 'lestoros'. It is clearly distinct from the other species of this group by the unique aspect of the opisthonotal striations.



Figs 22–23. *Prolistrophorus* (*Aprolistrophorus*) *curvistriatus* n.sp. Fig. 22. Female, dorso-lateral view. Fig. 23. *Prolistrophorus* (*Aprolistrophorus*) *akodon* Fain & Lukoschus. Fig. 23. Female, lateral view.



Figs. 24–25. *Prolistrophorus* (*Aprolistrophorus*) *akodon* Fain & Lukoschus. Fig. 24. Male, ventral view. Fig. 25. Male, dorsal view.

14. *Prolistrophorus* (*Aprolistrophorus*) *akodon* Fain & Lukoschus, 1982 nom.emend.
Prolistrophorus (*Aprolistrophorus*) *akadon* Fain & Lukoschus, 1982, p. 100

The name of this species was misspelled in the original description. Therefore we emend here the name 'akadon' to 'akodon'.

Female (Fig. 23). Holotype 420 μ long and 108 μ wide in lateral view. In two paratypes: 415 \times 109 μ and 428 \times 110 μ . Postscapular shield 78 μ long, with a median soft area 50 μ long. Lateral parts of this shield with at both sides five thick and dark transverse lines interrupted in their middle by an oblique depression. Hysteronotum without a shield in front of setae *d2*, but bearing posteriorly two small lateral shields. Opisthonotum in front of these shields slightly punctate. Opisthogaster scaly.

Male (Figs. 24–25). A paratype is 363 μ long and 102 μ wide in ventral view. Opisthosoma 112 μ long. Postscapular shield as in female, 66 μ long, with a median soft area 39 μ long. Hysteronotal shields bearing in their anterior half 4 unequal oblique lines. Posterior extremity with two rather short lobes ending each in two small triangular processes. Adanal suckers round, 12 μ wide. Penis short, with a thick base. Posterior part of genital sclerite connected at both sides to the basal sclerite of coxae IV forming a W-shaped sclerite. Coxae III slightly dilated, fused in midline. Legs III shorter than legs IV but not modified. Tarsi III without apico-dorsal projection. Legs IV shorter than opisthosoma. Setae *d4* very small, setae *d5* short but thick and rodlike, *ae* very small, close to *l4*.

Host and locality. Holotype and paratypes (13 females and 3 males) from *Akodon urichi* (female), Icebaru at 45 km NE Santa Lucia de Suruku, Boliver, Venezuela (4° 33' N, 61° 25' W). Animal in USNM, No. 495663 (coll. A. Tuttle, 1968, Smithsonian Venezuelan Project DA 49-MD-2788).

Remarks

This species presents some characters of the group 'lestores' (e.g., slight dilation of coxae III in male, presence of an oblique furrow on lateral regions of postscapular shield, aspect of the hysteronotum in both sexes). It differs however from the species of this group mainly by the normal aspect of the legs III in the male. This species constitutes a link between the 'lestoros' group and the other species of subgenus *Aprolistrophorus*.

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