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REDESCRIPTION OF *PECTINIUNGUIS GAIGEI* (CHAMBERLIN, 1921) FROM GUYANA, WITH NEW DISTRIBUTIONAL DATA AND COMPLEMENTARY DESCRIPTIVE NOTES ON SIMILAR NEOTROPICAL SPECIES (CHILOPODA: GEOPHILOMORPHA: SCHENDYLIDAE)

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ABSTRACT

Pectiniunguis gaigei (Chamberlin, 1921) from Guyana, (Chilopoda: Geophilomorpha: Schendylidae) is here redescribed and illustrated on the basis of type material. The species is characterized by the absence of pore-field on the first sternum; presence of undivided ventral pore-fields in an uninterrupted series along the whole trunk length; parunguis of walking legs thin and pale; and last leg praetarsus as a small tubercle with numerous spines. All these combined traits are shared by three other Neotropical members of the genus (*P. geayi* (Brölemann & Ribaut, 1911) from Brazil; *P. ducalis* Pereira, Minelli & Barbieri, 1995 from Brazil; and *P. roigi* Pereira, Foddai & Minelli, 2001 from Ecuador), with which *P. gaigei* is here compared in detail. New distributional records for *P. ducalis* and *P. geayi*, together with complementary descriptive notes and new diagnoses for these species and *P. roigi*, are also given.

KEYWORDS: *Pectiniunguis*; Taxonomy; Chilopoda; Geophilomorpha; Schendylidae.

INTRODUCTION

The geophilomorph centipede genus *Pectiniunguis* Bollman, 1889 is one of the most diversified and widespread of the schendylid genera in the Neotropics. *Pectiniunguis* can be distinguished from all other genera currently recognized in the family Schendylidae by the following unique combination of features: (1) pleurites of second maxillae not fused to coxosternum; (2) apical claw of telopodites of second maxillae pectinate on both dorsal and ventral edges; (3) sterna of leg-bearing segments with pore-fields; (4) last pair of legs with seven podomeres; (5) last legs with praetarsus in the form of a small hirsute tubercle, replaced by a small spine, or altogether absent; (6) coxopleura of the last leg-bearing segment with 2+2 coxal organs

of composite structure ("heterogeneous coxal glands" *sensu* Brölemann & Ribaut 1912).

In its present circumscription, the genus comprises twenty three species. One occurs in mainland Africa (Gabon), one in the Oceania Region (Fiji Islands), while the remaining twenty-one taxa are distributed in southern North America (U.S.A), Central America (Mexico), Caribbean Islands (Cuba and Cayo Sombrero (Venezuela)), South American mainland (Colombia, Guyana, continental Ecuador, Brazil and Argentina), and the Galapagos Islands.

The purpose of the present contribution is to redescribe a poorly known South American member, which was insufficiently described by Chamberlin (1921) from Guyana, under the name of *Adenoschendyla gaigei*. The original description lacks information

on important characters of specific value and only includes a few and inadequately detailed figures. The same author (1923) transferred it to the genus *Pectiniunguis*, but except for a new figure of the labrum, no additional morphological data were given. Subsequently, no other authors treated this species, which remained poorly known up to the present. The opportunity to revise type material allows for a detailed redescription with new illustrations, towards a better understanding of the species and closely similar ones.

P. gaigei is characterized by the absence of pore field on the first sternum; presence of undivided pore fields in an uninterrupted series along the entire body length; parunguis of walking legs thin and pale; and last leg praetarsus as a small tubercle with numerous spines. All these combined traits are shared by three other members of the genus (*P. geayi* (Brölemann & Ribaut, 1911) from Brazil; *P. ducalis* Pereira, Minelli & Barbieri, 1995 from Brazil and *P. roigi* Pereira, Foddai & Minelli, 2001 from Ecuador), with which *P. gaigei* is hereby compared in detail.

New distributional records are also given for *P. geayi* and *P. ducalis* on the basis of additional specimens collected in Brazilian Amazonia, but not cited in previous publications.

The latest contributions to the knowledge of *Pectiniunguis* can be found in Pereira & Coscarón (1975(1976)); Pereira *et al.* (1994, 1995, 1999, 2000, 2001); and Shear & Peck (1992).

MATERIAL AND METHODS

The new material herein reported is currently deposited at the Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA), and the Museo de La Plata (MLP); the type materials herein revised are housed at the Museum of Comparative Zoology, Harvard University (MCZ) and the MLP, as indicated under each species.

All specimens were examined through a light microscope equipped with a drawing tube attachment, which was used to delineate the figures and measure directly in mm, from a micrometer objective. Temporary mounts have been prepared by direct transfer of the specimens from the preservation liquid (70 per cent ethanol) onto microscopic slides, using as a mounting medium undiluted 2-Phenoxyethanol. Details on preparation of microscope slides and employed dissection procedures are described in Pereira (2000, 2008, 2009) and Foddai *et al.* (2002). All measurements are given in mm. The following abbreviation is used in the text and figure legends: a.a., antennal article.

RESULTS

Family Schendylidae

Genus *Pectiniunguis* Bollman, 1889

Type species of the genus: Pectiniunguis americanus Bollman, 1889, by original designation.

Remarks: A detailed synonymic list of the Neotropical species of *Pectiniunguis*, can be found in Foddai *et al.*, 2000. All species currently assigned to the genus are listed in Minelli, 2006.

Redescription

Pectiniunguis gaigei (Chamberlin, 1921)

(Figs. 1-50)

Adenoschendyla gaigei Chamberlin, 1921:18-20.

Pectiniunguis gaigei: Chamberlin, 1923:394; Attems, 1929:81-82; Crabill, 1959:326; Pereira & Coscarón 1975(1976):72; Pereira *et al.*, 1994:174; Pereira *et al.*, 1995:338; Pereira *et al.*, 1997:85; Pereira *et al.*, 1999:177; Pereira *et al.*, 2000:3, 54; Foddai *et al.*, 2000:128, 179; Pereira *et al.*, 2001:143, 144, 146.

Diagnosis: A Neotropical species of *Pectiniunguis* without pore-field on the first sternum; all pore-fields undivided; pore-fields in an uninterrupted series along all the body length; parunguis of walking legs thin and pale; last leg praetarsus as a small tubercle with numerous spines. Among the Neotropical species of the genus, all these combined traits are also present in *P. geayi*, *P. ducalis*, and *P. roigi*, from which *P. gaigei* is differentiated by the following unique traits (characters for *P. geayi*, *P. ducalis*, and *P. roigi* are given in parentheses): a.a. XIV with claviform sensilla on the external margin only (on the external and internal margins); ratio length of telopodite of last legs/length of last sternum of male last leg-bearing segment, *ca.* 7.2: 1 (*ca.* 5.6 to 6.5: 1); ratio width of trochanter/width of praefemur of male last legs 1: 1.05 (1: 1.20).

Morphological traits in Table 1 differentiate *P. gaigei* from *P. geayi*, *P. ducalis*, and *P. roigi*.

Type material examined: Paratype female MCZ TC-161, 55 leg-bearing segments, body length 35 mm (Reference *Adenoschendyla gaigei* Chamberlin), from

TABLE 1: Comparative matrix of morphological traits for *Pectiniunguis gaigei*, *P. geayi*, *P. ducalis*, and *P. roigi*.

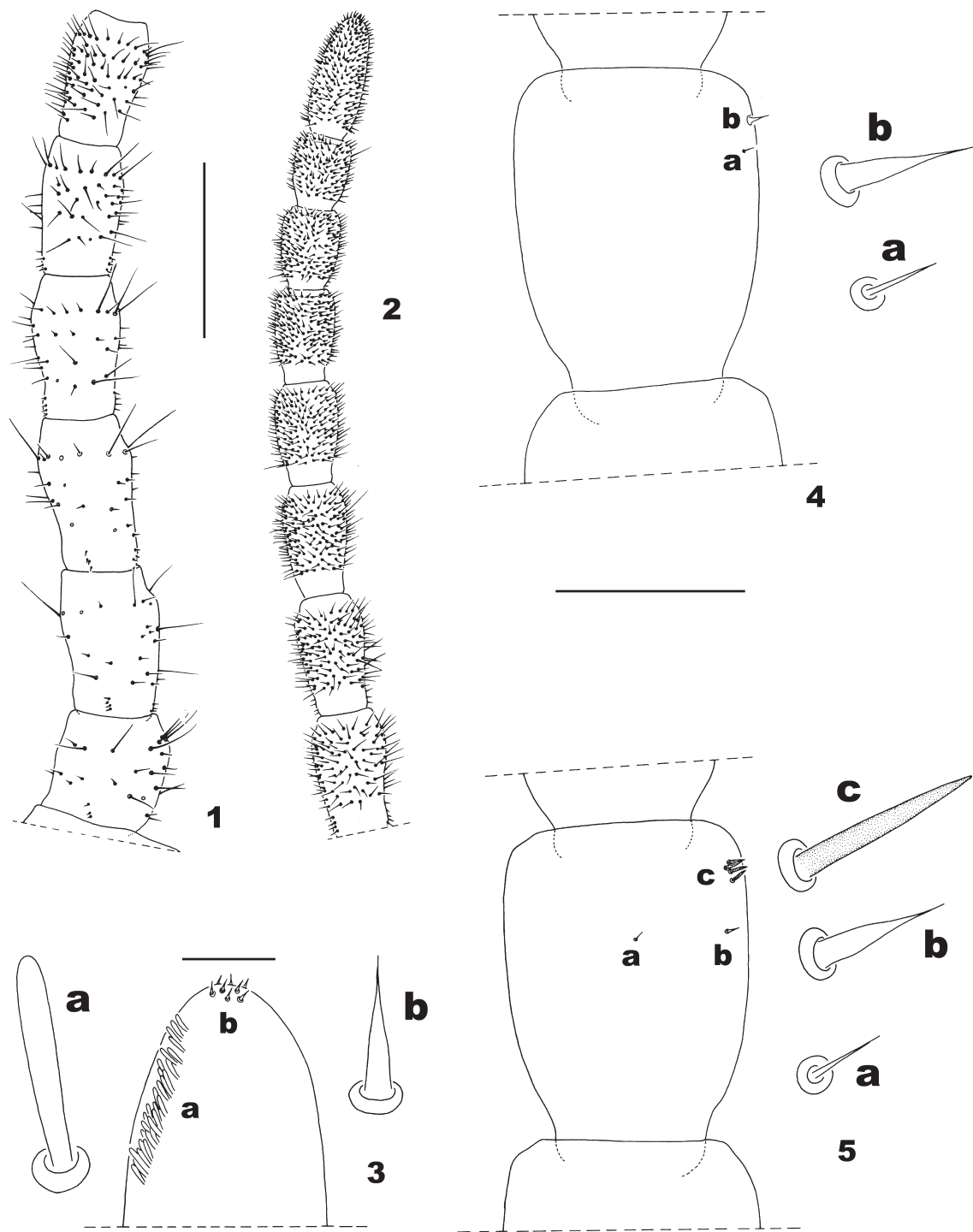
	<i>P. gaigei</i>	<i>P. geayi</i>	<i>P. ducalis</i>	<i>P. roigi</i>
Number of leg-bearing segments	male: 53, (55?), 57 female: 55	male: 49, 51, 53 female: 51, (53?), 55	male: 63, 65, 67, 69, 71 female: 65, 67, 69, 71, 73	male: 57 female: ?
Body length	45 mm	31 mm	67 mm	30.5 mm
Ratio length of antennae/length of cephalic shield	ca. 3.3: 1	ca. 2.9: 1	ca. 4.3: 1	ca. 3.2: 1
Ratio length of apical specialized sensilla/length of claviform sensilla on a.a. XIV	0.5-1.0: 1 (Fig. 3)	0.5-1.0: 1	0.5-1.0: 1	2.0: 1 (Fig. 85)
Claviform sensilla on a.a. XIV	Only present on the external side (Fig. 3)	Present on the external and internal sides	Present on the external and internal sides Fig. 71	Present on the external and internal sides (Fig. 84)
Small setae on male antennae	On a.a. V-VI to XIV (Figs. 40, 41)	On a.a. III to XIV (Fig. 54)	On a.a. VII to XIV (Figs. 69, 70)	On a.a. VI to XIV (Fig. 83)
Clypeal setae				
Postantennal	2	2	2	2
Medial	ca. 9	ca. 13	ca. 18	ca. 7
Praelabral	2	2	2	2
Shape of teeth of lateral pieces of labrum	Subtriangular with a sharp medial extension (Fig. 9)	Subtriangular with a sharp medial extension (Fig. 55)	As long hyaline filaments (Fig. 72)	Subtriangular with a sharp medial extension (Fig. 86)
Number of setae on coxosternum of first maxillae	ca. 8 (Fig. 12)	ca. 4 (Fig. 56)	ca. 7	ca. 4
Number of setae on coxosternum of second maxillae	ca. 29 (Fig. 12)	ca. 13 (Fig. 56)	ca. 31	ca. 22
Shape of postero-external region of second maxillae	As in Figs. 12, 14, 15	As in Figs. 56, 66	As in Fig. 73	As in Fig. 87
Ratio greatest length/greatest width of forcipular trochanteropraefemur	ca. 1.30: 1 (longer than wide), Fig. 18	ca. 1.40: 1 (longer than wide), Fig. 57	ca. 1.47: 1 (longer than wide), Fig. 74	ca. 0.94: 1 (wider than long), Fig. 88
Internal edge of forcipular trochanteropraefemur	With a small unsclerotized and pale tooth on apical part (Figs. 18, 19)	With an apical small and pale tooth, with round tip (Fig. 57)	With an apical small, pale, round-tipped tooth (Fig. 74)	With a small unsclerotized and pale prominence on apical part (Fig. 88)
Forcipular ungulum unusually curved inwards	No (Figs. 18, 19)	No (Figs. 57, 58)	No (Figs. 74, 75)	Yes (Figs. 88, 89)
Posterior limit of ventral pore-field series	Antepenultimate sternum	Antepenultimate sternum	Penultimate sternum	Penultimate sternum
Last praetergum completely fused to the pleurites	No (Figs. 36, 44)	Yes (Figs. 59, 62)	Yes (Figs. 76, 82)	No (Fig. 90)
Shape and pilosity of male last leg-bearing segment and terminal segments	As in Figs. 44, 45	As in Figs. 59, 60	As in Figs. 76, 77	As in Figs. 90, 91
Shape and pilosity of female last leg-bearing segment and terminal segments	As in Figs. 30, 36	As in Figs. 62, 63	As in Figs. 81, 82	?
Aspect of coxal organs in adult specimens	As in Figs. 32, 33	As in Fig. 64	As in Fig. 78	As in Fig. 92
Ratio length of telopodite of last legs/length of last sternum of male last leg-bearing segment	ca. 7.2: 1	ca. 5.6: 1	ca. 5.4: 1	ca. 6.50: 1
Ratio width of trochanter/width of praefemur of male last legs	1: 1.05	1: 1.20	1: 1.20	1: 1.20
Number of spines of praetarsus of last legs	ca. 6 (Figs. 31, 46, 47)	ca. 11 (Fig. 65)	ca. 9-13 (Fig. 79)	ca. 4 (Fig. 93)
Penis	With 2+2 apical setae (Fig. 49)	Apparently without setae (Fig. 61)	With 1+1 setae (Fig. 80)	With 2+2 setae (Fig. 94)

GUYANA: Dunoon: “first mourie”, 27 August 1914, F.M. Gaige leg. (Mandibles in a permanent slide, but rest of the body in alcohol). Paratypes MCZ TC-162 (here individualized as A, B and C): paratype male (A),

53 leg-bearing segments, body length 29 mm; paratype female (B), 55 leg-bearing segments, body length 26 mm; paratype male (C), 57 leg-bearing segments, body length 28 mm. (Reference *Adenoschendyla gaigei*

Chamberlin), from GUYANA: Dunoon, Sand-hill forest, 27 August 1914, F.M. Gaige leg. (Paratype A with head and mouth parts in a permanent slide, but

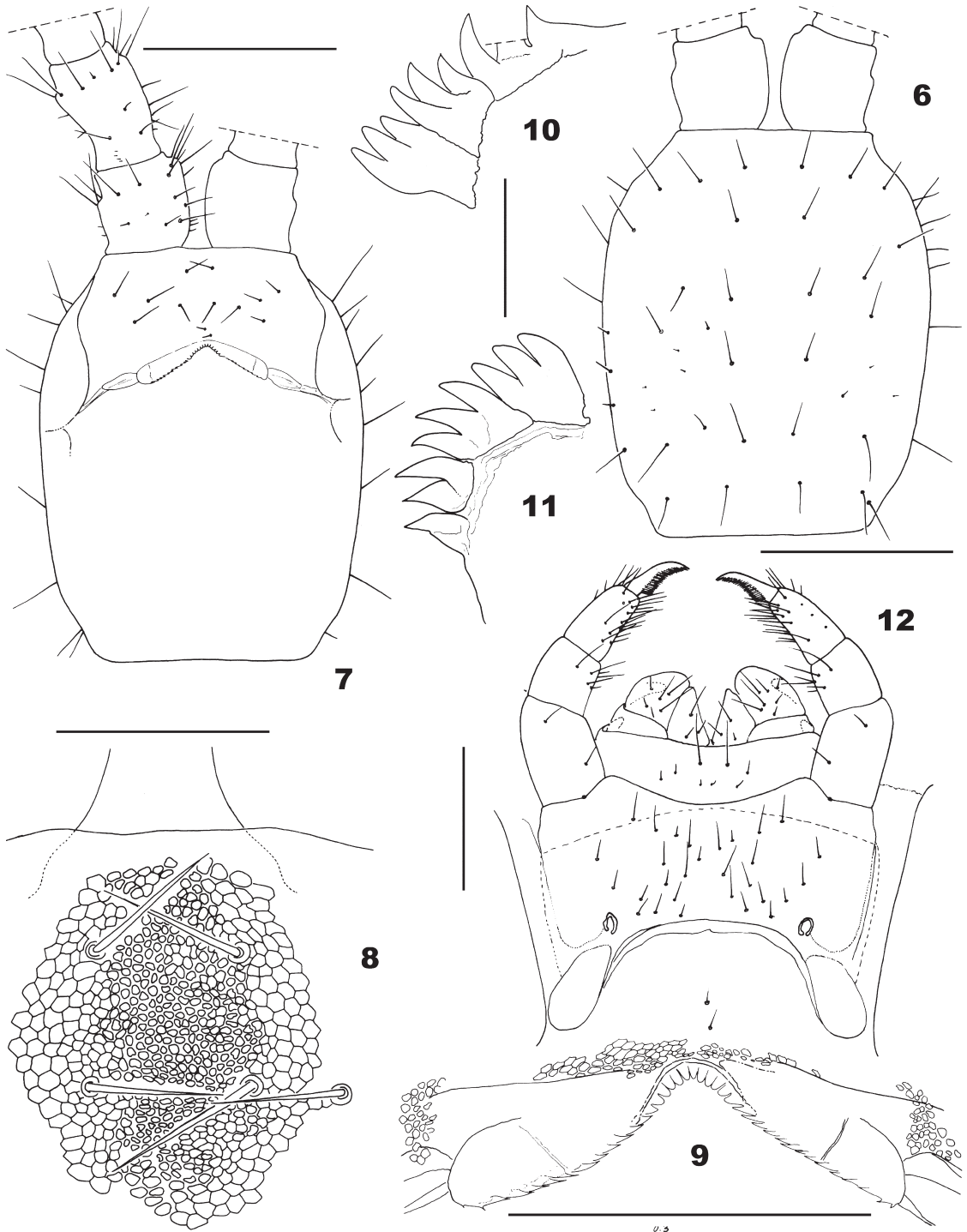
trunk in alcohol. Paratypes B and C in alcohol). Antennal articles II-XIV missing from both antennae of paratype C.



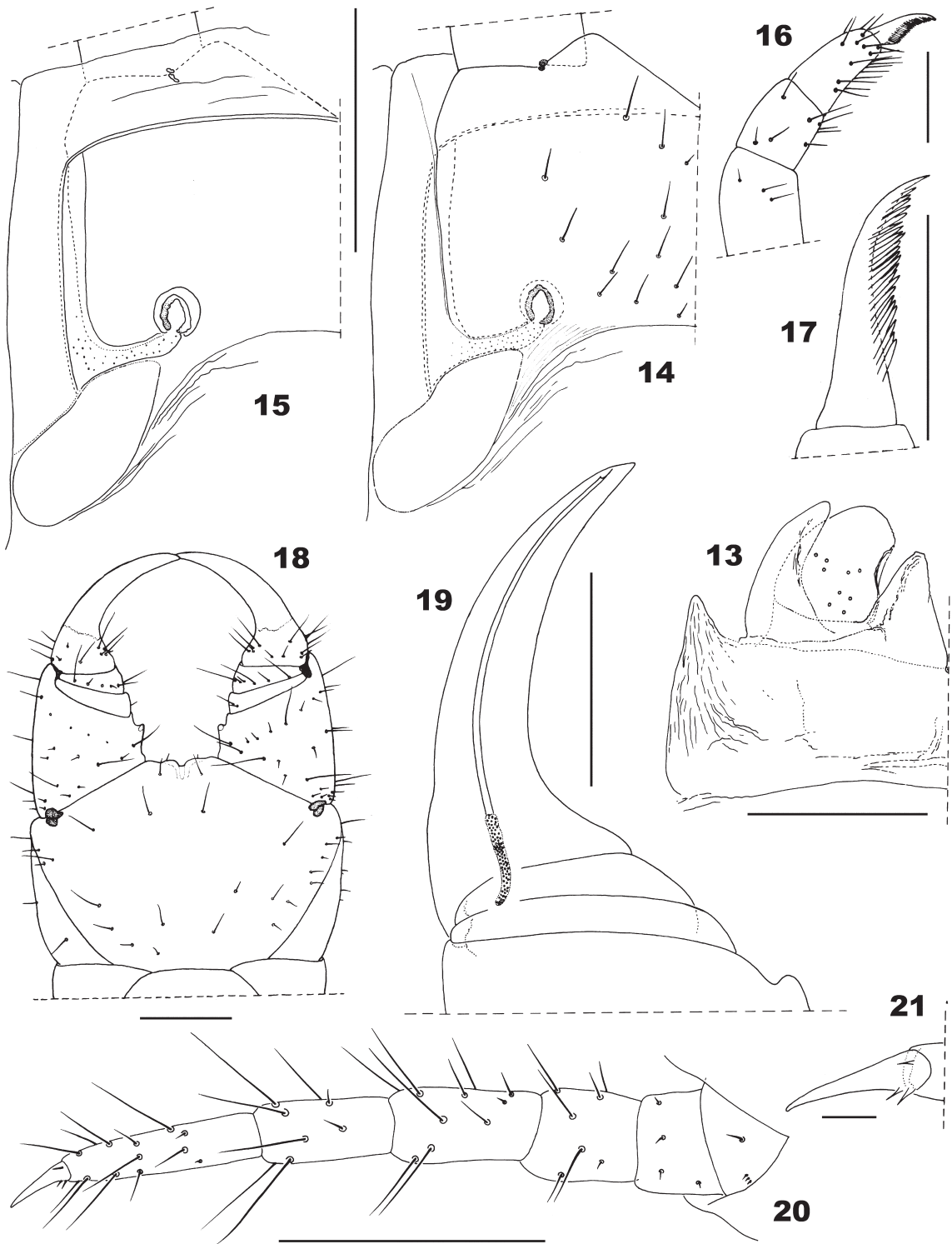
FIGURES 1-5: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (1) Right a.a. I-VI, ventral; (2) Right a.a. VII-XIV, ventral; (3) Distal portion of right a.a. XIV, ventral (a: claviform sensilla, b: apical specialized sensilla); (4) Right a.a. XIII, ventral (a, b: a, b type sensilla); (5) Right a.a. XIII, dorsal (a, b, c: a, b, c type sensilla). Scale bars: 0.4 mm (1, 2); 0.05 mm (3); 0.1 mm (4, 5).

Remark: The holotype M.C.Z., 2182 (sex not specified), mentioned by Chamberlin in the original description, was not received for revision.

Female (paratype MCZ, TC-161): Fifty-five leg-bearing segments, body length 35 mm, maximum body width 1 mm, length of cephalic shield 1.05 mm,



FIGURES 6-12: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZTC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (6) Cephalic shield and basis of antennae; (7) head capsule and basis of antennae, ventral; (8) clypeal area; (9) labrum; (10) dentate lamella of left mandible; (11) dentate lamella of right mandible; (12) first and second maxillae, ventral. Scale bars: 0.5 mm (6, 7); 0.1 mm (8); 0.3 mm (9, 12); 0.05 mm (10, 11).



FIGURES 13-21: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (13) Left first maxilla, dorsal; (14) Detail of coxosternum and pleurites of right second maxilla, ventral; (15) Detail of coxosternum and pleurites of left second maxilla, dorsal; (16) Telopodite of left second maxilla, dorsal; (17) Claw of telopodite of right second maxilla, ventral; (18) Forcipular segment, ventral; (19) Detail of conduct and calyx of poison gland, in left forcipular telopodite, dorsal; (20) Right leg I, ventral; (21) Claw of right leg I, ventral. Scale bars: 0.2 mm (13); 0.3 mm (14, 15, 19, 20); 0.15 mm (16); 0.1 mm (17); 0.4 mm (18); 0.03 mm (21).

width of forcipular coxosternum 1.36 mm. Ground color (of preserved specimen in alcohol) orange yellow, (forcipular segment and leg-bearing segments I to VIII dark orange).

Antennae: ca. 3.3 times as long as the cephalic plate, distally slightly attenuate; all articles, except the first, longer than wide. Setae on a.a. I to IV-V of various lengths, few in number, those of remaining articles progressively shorter and more numerous towards the tip of the appendage (Figs. 1, 2). Terminal a.a. with ca. 29 claviform sensilla on the external border and absent on the internal border (Fig. 3). Distal end of this a.a. with ca. 8 very small specialized sensilla apparently not split apically (Fig. 3). Right antenna: dorsal and ventral surface of a.a. II, V, IX and XIII (Figs. 4, 5) with very small specialized sensilla. On the ventral side, these sensilla are restricted to an internal latero-apical area and are represented by two different types: *a* and *b*. Type *a* sensilla are very thin and not split apically (Fig. 4a); type *b* sensilla (Fig. 4b) are very similar to those on the apex of the terminal a.a. Specialized sensilla on dorsal side represented by three different types: *a* and *b*, similar to *a* and *b* of ventral side (Fig. 5a, b); and type *c* sensilla much bigger,

not divided apically and darker (brownish-ochreous) in color (Fig. 5c). Number and distribution of specialized sensilla on right a.a. II, V, IX and XIII, as in Table 2.

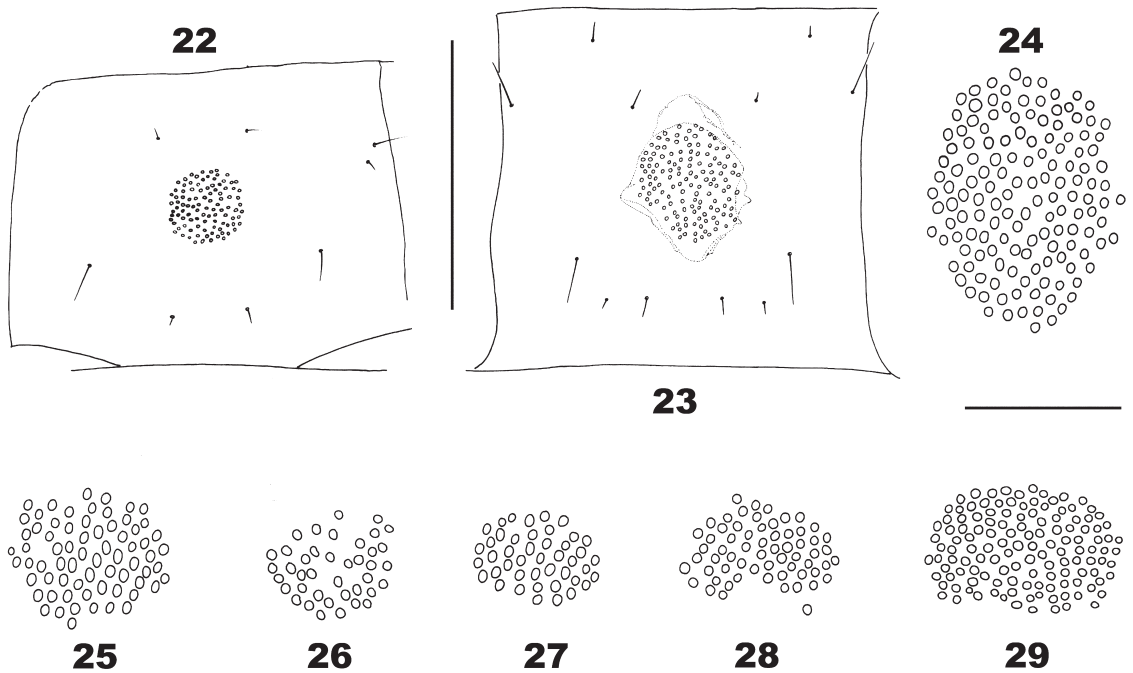
Left antenna, abnormal (with 15 a.a.); number and distribution of specialized sensilla as in Table 3.

Cephalic plate: longer than wide (ratio ca. 1.2: 1), shape and chaetotaxy as in Fig. 6.

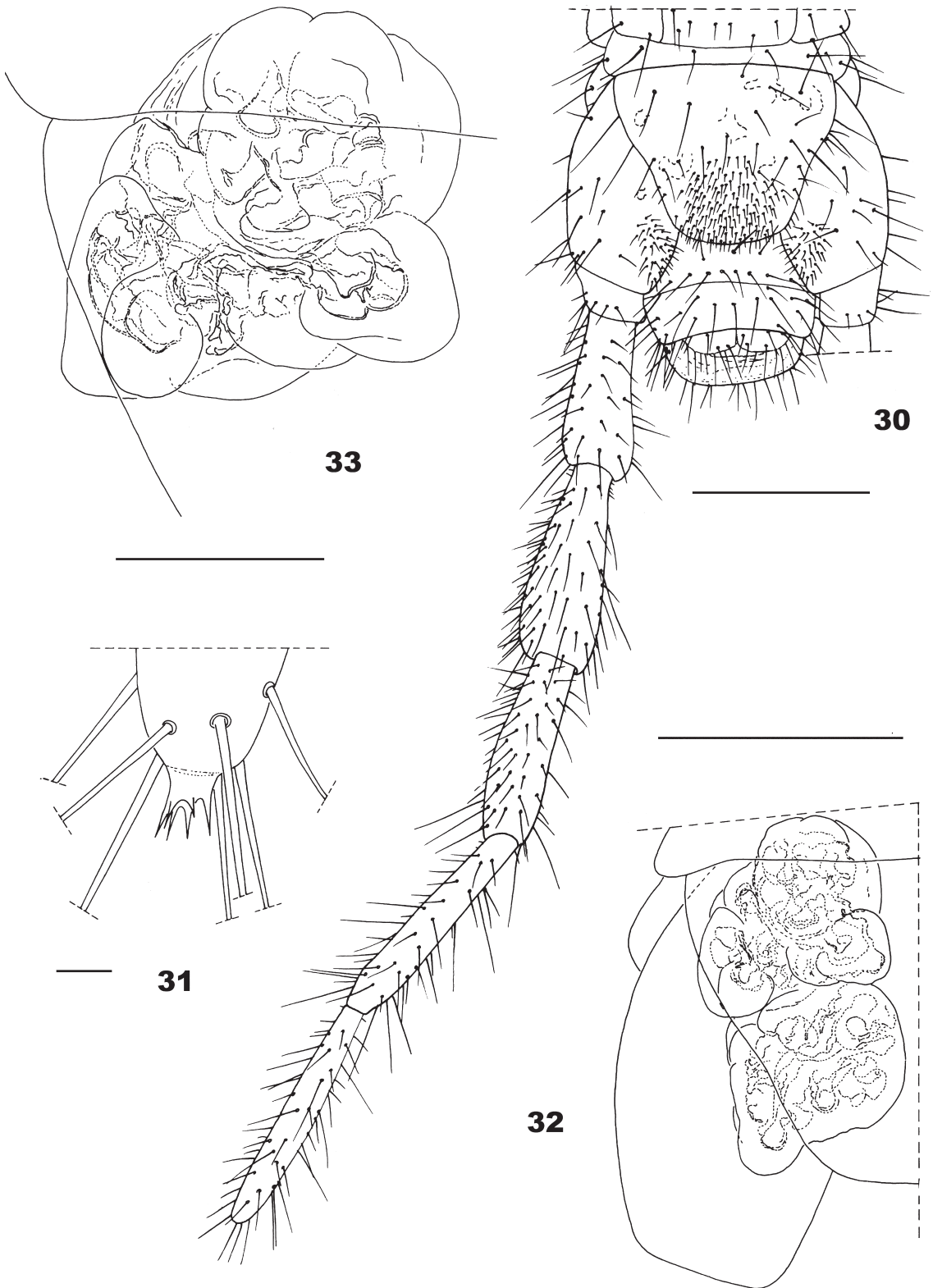
Clypeus: with 1+1 postantennal setae, 4+5 medial setae and 1+1 praelabral setae (Fig. 7). Anterior middle part bearing a subcircular area with surface densely reticulated (Fig. 8).

Labrum: with 39 teeth, those of central arc dark and round tipped, the lateral ones less sclerotized, each with a relatively long and very sharp medial extension (Fig. 9).

Mandible: dentate lamella subdivided into three-four distinct blocks; left mandible (Fig. 10) with 3,3,3 teeth and right mandible (Fig. 11) with 3,3,2,1 teeth. Pectinate lamella with ca. 23 hyaline teeth.



FIGURES 22-29: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (22) Sternum II; (23) Sternum VII; (24) Pore field on sternum VIII; (25) Pore field on sternum XXIV; (26) Pore field on sternum XXVI; (27) Pore field on sternum XXXII; (28) Pore field on sternum XLVIII; (29) Pore field on sternum LIII. Scale bars: 0.4 mm (22, 23); 0.1 mm (24-29).

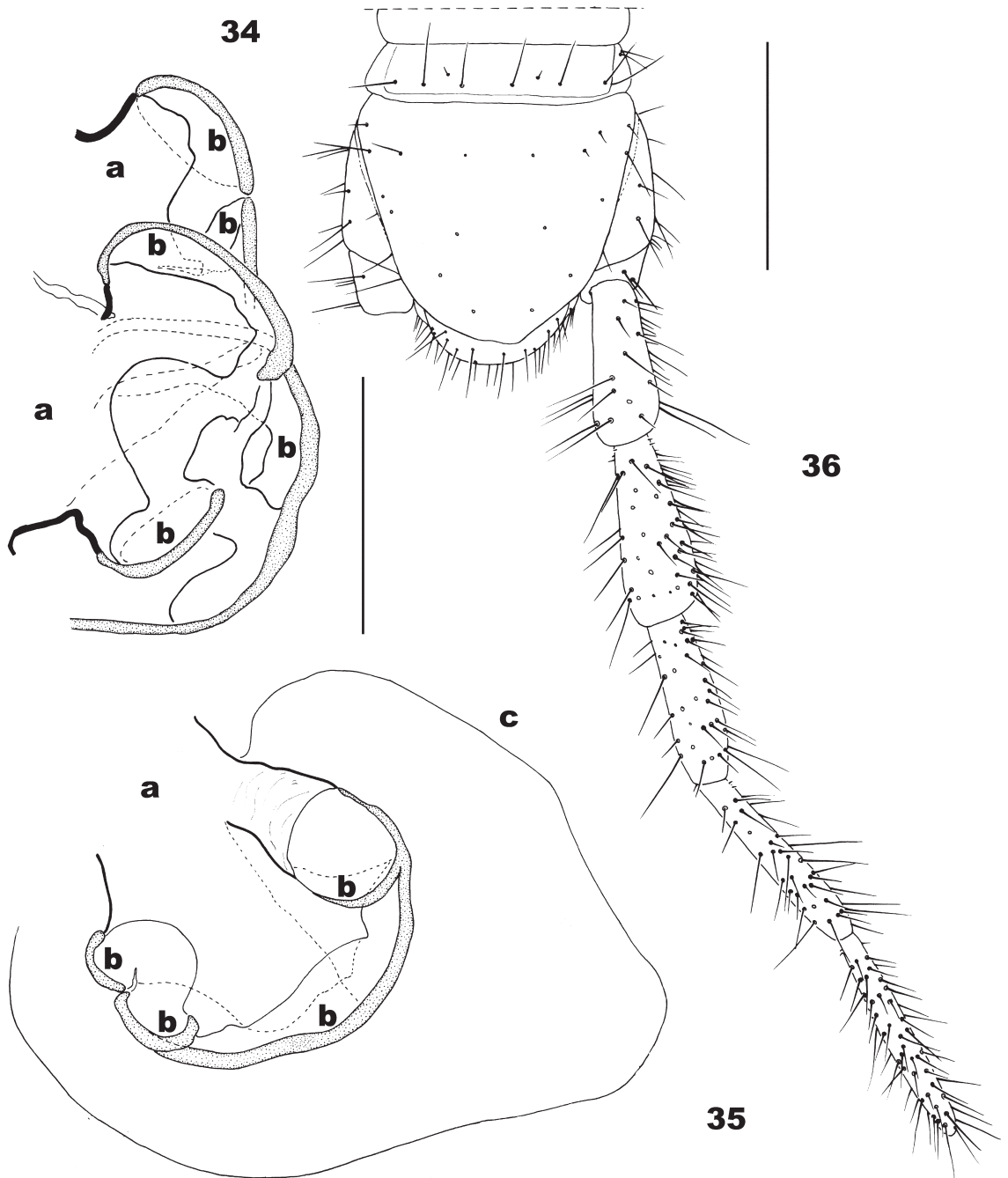


FIGURES 30-33: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (30) Last leg-bearing segment and terminal segments, ventral; (31) Detail of distal end of last podomere of right last leg, ventral; (32) Right coxal organs, ventral; (33) Right anterior coxal organ, ventral. Scale bars: 0.3 mm (30, 32); 0.1 mm (33); 0.01 mm (31).

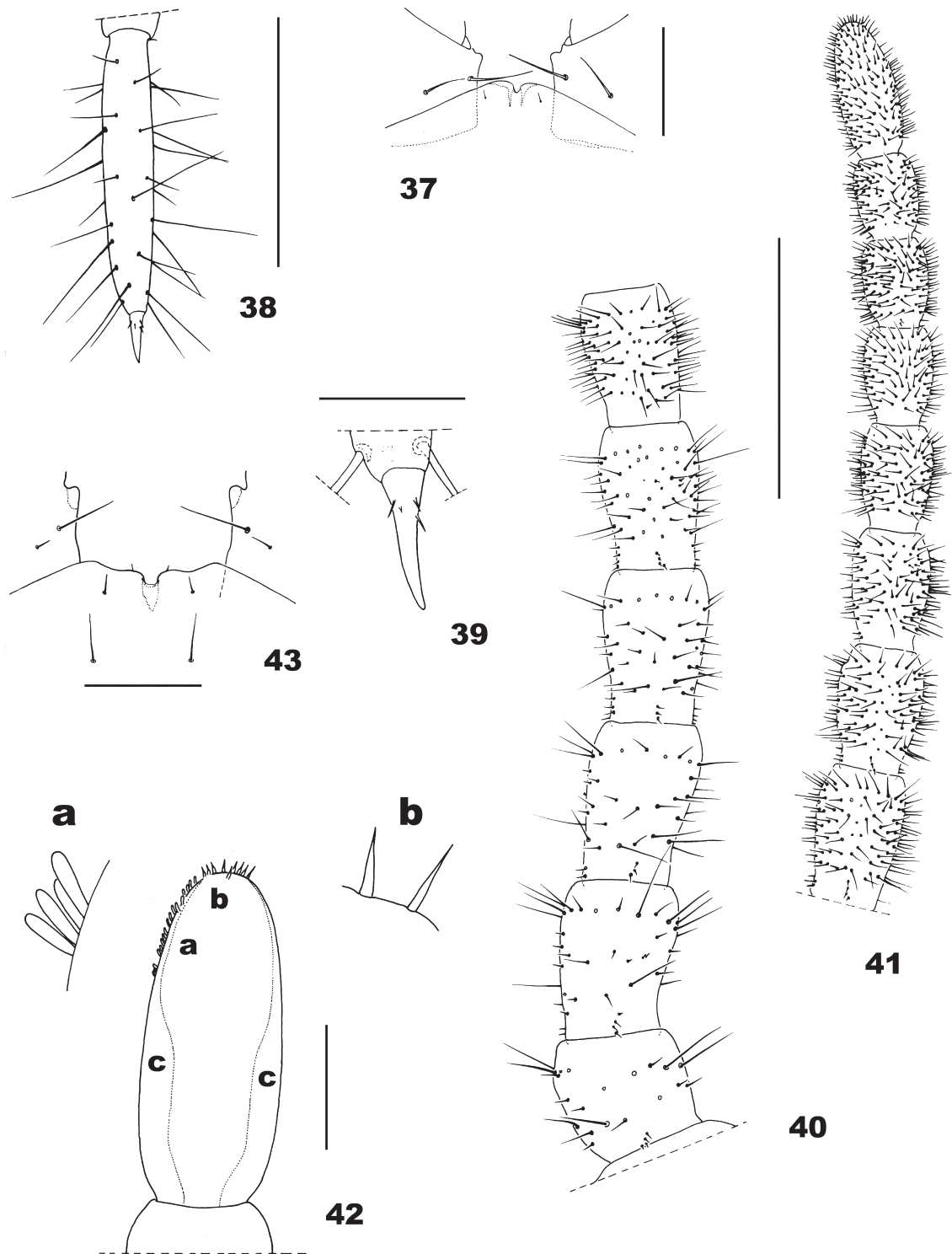
First maxillae: with lappets on both coxosternum and telopodites (Fig. 13). Coxosternum with 1+1 large setae and 3+3 small setae, median projections of coxosternum subtriangular, well developed and provided with 3+3 setae. Article II of telopodite

with 6+7 ventral setae and *ca.* 9+8 dorsal sensilla (Figs. 12, 13).

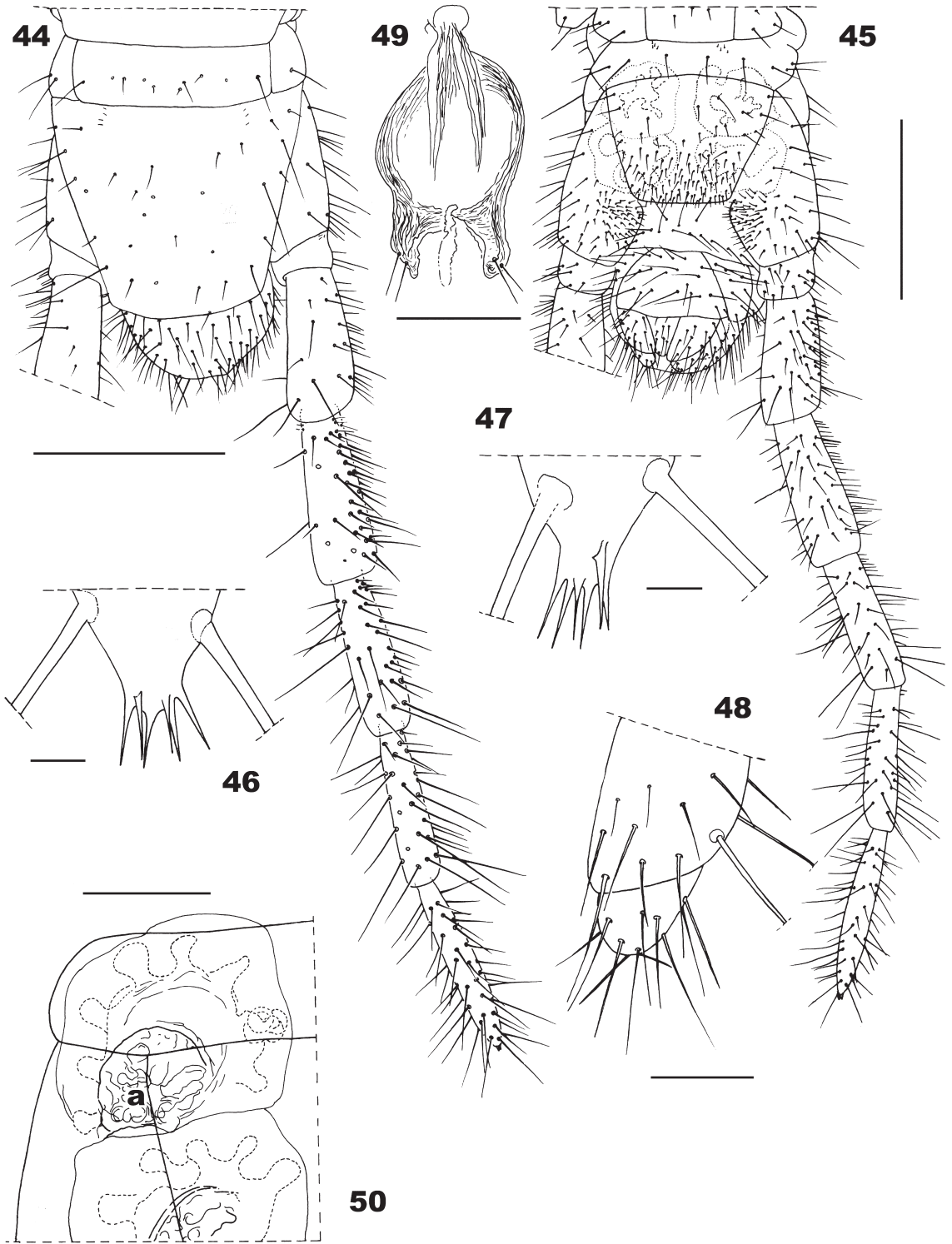
Second maxillae (Figs. 12, 14-17): with 15+14 setae on the coxosternum, arranged as in Figs. 12, 14.



FIGURES 34-36: *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-161; GUYANA: Dunoon), (Reference *Adenoschendyla gaigei*): (34) Detail of internal cuticular structure of two lobes on right anterior coxal organ, ventral (a: common channels; b: individualized areas of mucous layer; (external contour of lobes not delineated)); (35) Detail of internal cuticular structure of a lobe on right anterior coxal organ, ventral (a: common channel; b: individualized areas of mucous layer; c: contour of lobe); (36) Last leg-bearing segment and terminal segments, dorsal. Scale bars: 0.05 mm (34, 35); 0.4 mm (36).



FIGURES 37-43: (37-39): *Pectiniunguis gaigei* (Chamberlin, 1921), (female paratype MCZ TC-162 (B), GUYANA: Dunoon: Sand-hill forest), (Reference *Adenoschendyla gaigei*): (37) Detail of anterior margin of forcipular coxosternum and basal internal edge of trochanteropraefemur; (38) Apical article of left last leg with abnormal (claw-like) praetarsus, ventral; (39) Detail of abnormal praetarsus of left last leg, ventral. (40-43): *Pectiniunguis gaigei* (Chamberlin, 1921), (male paratype MCZ TC-162 (A), GUYANA: Dunoon, Sand-hill forest), (Reference *Adenoschendyla gaigei*): (40) Right a.a. I-VI, dorsal; (41) Right a.a. VII-XIV, dorsal; (42) Detail of right a.a. XIV, ventral (a: claviform sensilla, b: apical specialized sensilla, c: internal chitinous thickening); (43) Detail of anterior margin of forcipular coxosternum and basal internal edge of trochanteropraefemur. Scale bars: 0.2 mm (37, 38, 43); 0.04 mm (39); 0.5 mm (40, 41); 0.1 mm (42).



FIGURES 44-50: (44-49): *Pectiniunguis gaigei* (Chamberlin, 1921), (male paratype MCZ TC-162 (A), GUYANA: Dunoon, Sand-hill forest), (Reference *Adenoschendyla gaigei*): (44) Last leg-bearing segment and terminal segments, dorsal; (45) Last leg-bearing segment and terminal segments, ventral; (46) Detail of distal end of last podomere of left last leg, ventral; (47) Detail of distal end of last podomere of right last leg, ventral; (48) Left gonopod, ventral; (49) Penis, dorsal. (50): *Pectiniunguis gaigei* (Chamberlin, 1921), (male paratype MCZ TC-162 (C), GUYANA: Dunoon: Sand-hill forest), (specimen collected during an incomplete moulting cycle), (Reference *Adenoschendyla gaigei*): Right anterior coxal organ and anterior half of right posterior coxal organ, ventral (a: exuvial remnants). Scale bars: 0.3 mm (44, 45); 0.1 mm (49, 50); 0.05 mm (46, 47, 48).

TABLE 2: Number of type *a*, *b*, and *c* sensilla on antennal articles II, V, IX and XIII of right antenna, in the female Paratype MCZ (TC-161) of *Pectiniunguis gagei* (Chamberlin, 1921) from Guyana: Dunoon, (Reference *Adenoschendyla gagei*)

	Ventral		Dorsal			Figs.
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>c</i>	
II		2	1	2		
V	1	1	1	2		
IX	1	1	1	?	2	
XIII	1	1	1	1	4	4, 5

TABLE 3: Number of type *a*, *b*, and *c* sensilla on antennal articles II, V and VI-XIV of left antenna (abnormal, with 15 a.a.), in the female Paratype MCZ (TC-161) of *Pectiniunguis gagei* (Chamberlin, 1921) from Guyana: Dunoon, (Reference *Adenoschendyla gagei*).

	Ventral		Dorsal		
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>c</i>
II		2	1	2	
V	?	2	1	1	1
VI					1
VII					1
VIII					2
IX	?	?	?	?	4
X					2
XI					3
XII					2
XIII	?	?	?	1	4
XIV				1	2

Apical claw of telopodites well developed, bipectinate, ventral edge with *ca.* 23 teeth (Fig. 17), dorsal edge with *ca.* 30 teeth.

Forcipular segment: when closed, the telopodites do not extend beyond the anterior margin of the head; tergum with an irregular transverse median row of *ca.* 9 large setae and a few additional smaller setae scattered on the remaining surface. Telopodites: trochanteropraefemur with ratio greatest length/greatest width equal to *ca.* 1.30: 1 (Fig. 18), bearing a small, not sclerotized, and pale pigmented tooth on apical medial edge (Figs. 18, 19). All remaining articles lack teeth. Calyx of poison gland cylindrical (Fig. 19). Chaetotaxy of coxosternum and telopodites as in Fig. 18.

Walking legs: with similar chaetotaxy along entire body length; distribution, number, and relative size of setae as in Fig. 20. Claws with three thin and pale ventrobasal parunguis, one anterior and two posterior of similar size (Fig. 21).

TABLE 4: Number of type *a*, *b*, and *c* sensilla on antennal articles II, V and IX-XIV of left antenna (abnormal, with 15 articles), in the male Paratype MCZ (TC-162) (A), of *Pectiniunguis gagei* (Chamberlin, 1921) from Guyana: Dunoon, Sand-hill forest, (Reference *Adenoschendyla gagei*).

	Ventral		Dorsal		
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>c</i>
II		2	1	2	
V	1	1	1	1	2
IX	1	1	1	1	3
X					2
XI				2	1
XII				1	2
XIII				1	2
XIV				1	1

TABLE 5: Number of type *a*, *b*, and *c* sensilla on antennal articles II, V, IX and XIII of right antenna, in the male Paratype MCZ (TC-162) (A), of *Pectiniunguis gagei* (Chamberlin, 1921), from Guyana: Dunoon, Sand-hill forest, (Reference *Adenoschendyla gagei*).

	Ventral		Dorsal		
	<i>a</i>	<i>b</i>	<i>a</i>	<i>b</i>	<i>c</i>
II		2	1	2	
V	1	1	1	1	1
IX	1	1	1	1	2
XIII	1	1	1	1	4

Sterna: pore-fields present in an uninterrupted series, from the second to the antepenultimate sternum. All pore-fields undivided. Form of fields changing along the trunk as in Figs. 22-29. Number of pores on selected sternum: sternum II (99); VII (132); VIII (142); XXIV (69); XXVI (40); XXXII (44); XLVIII (63); LIII (130).

Last leg-bearing segment: with pleurites at the sides of praeternum. Praeternum not divided along the sagittal plane; shape and chaetotaxy of sternum and tergum as in Figs. 30, 36. Coxopleura slightly protruding at their distal internal ventral ends, setae small and numerous on distal internal ventral area, remaining surface with few bigger setae. Two compound ("heterogeneous") coxal organs in each coxopleuron (Fig. 32); internal cuticular structure of each outer lobe with *ca.* two-four individualized areas of mucous layer joined to a common channel (Figs. 33; 34, 35b). Coxal organs open on the membrane between coxopleuron and sternum, covered by the latter (Fig. 32). Last legs with seven podomeres, shape and chaetotaxy as in Figs. 30, 36. Praetarsus as a very small tubercle with *ca.* 6 small apical spines (Fig. 31).

Terminal segments: intermediate tergum with posterior margin convex (Fig. 36), intermediate sternum with posterior margin slightly concave (Fig. 30); first genital sternum with posterior margin concave. Gonopods uniarticulate (Fig. 30).

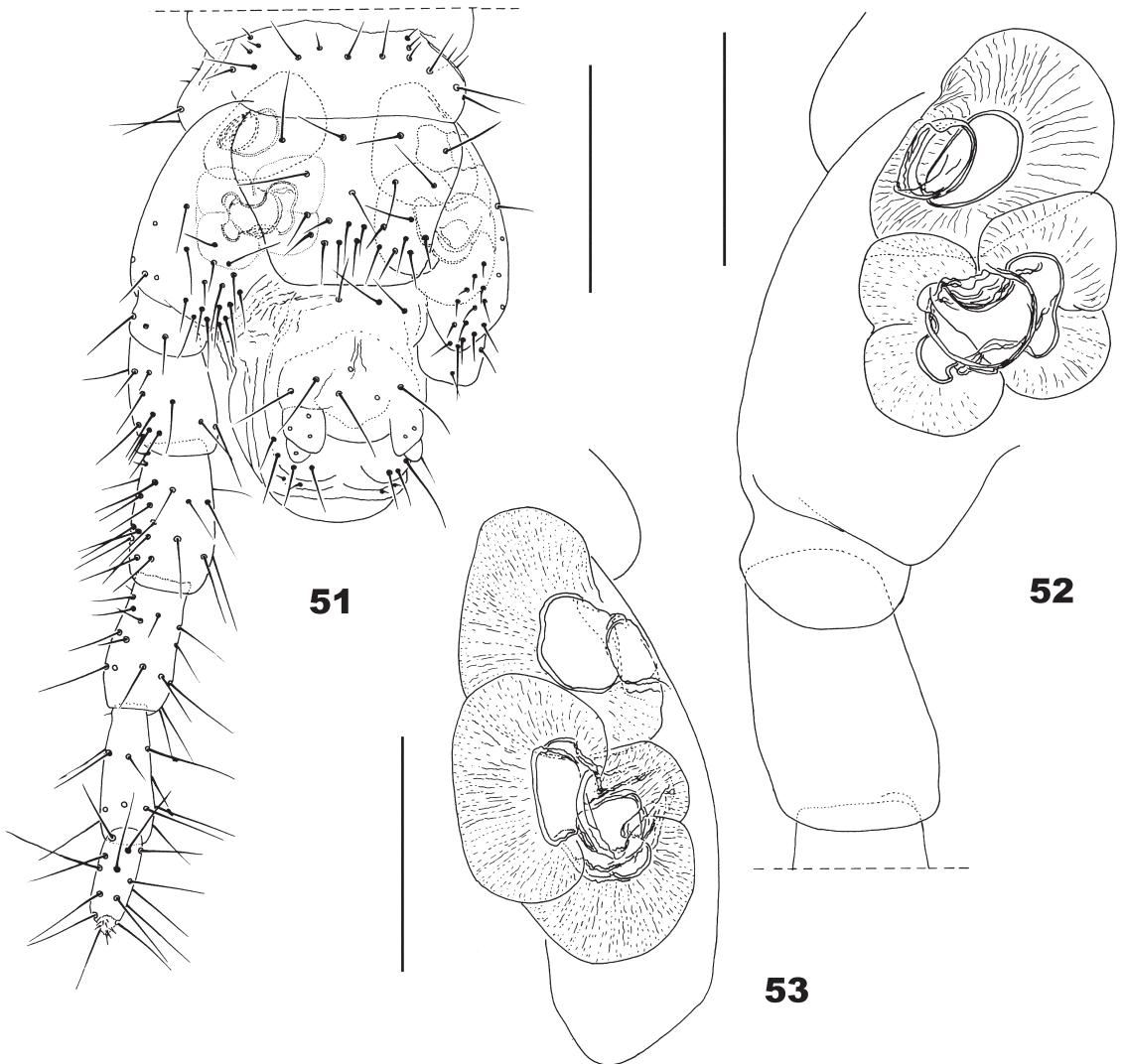
Male (paratype MCZ, TC-162 (A)): Fifty-three leg-bearing segments, body length 29 mm, maximum body width 0.9 mm. All features similar to those in the female except for the shape and chaetotaxy of the last leg-bearing segment and terminal segments.

Last leg-bearing segment: form and chaetotaxy of tergum and sternum as in Figs. 44, 45. Coxopleura very slightly protruding at their distal-internal ventral

ends, setae numerous on distal-internal ventral area, remaining surface with few setae. Podomeres of terminal legs with shape and chaetotaxy as in Figs. 44, 45. (Praefemur, femur and tibia proportionally narrower than those in the female).

Terminal segments: intermediate tergum with posterior margin convex (Fig. 44); first genital sternum with posterior margin medially convex, laterally concave (Fig. 45). Gonopods biarticulate, basal article with ca. 12 setae and distal with ca. 10 setae (Figs. 45, 48); penis with 2+2 dorsal apical setae (Fig. 49).

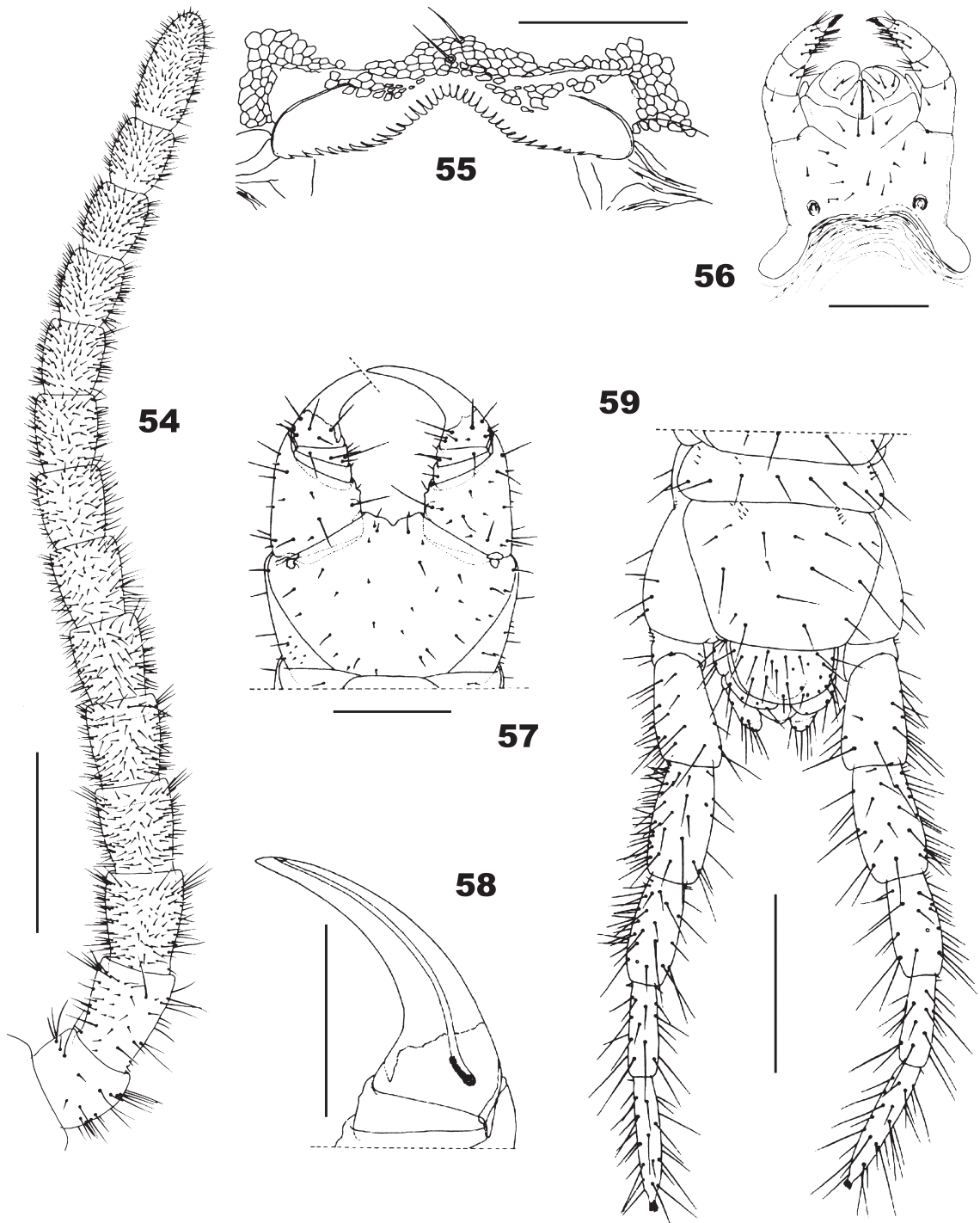
Variation: One of the two males herein revised, has 53 leg-bearing segments and the remaining has 57



FIGURES 51-53: *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (male juvenile; BRAZIL: Amazonas: Manaus): (51) Last leg-bearing segment and terminal segments, ventral; (52) Detail of right coxal organs, ventral; (53) Detail of left coxal organs, ventral. Scale bars: 0.2 mm (51); 0.1 mm (52, 53).

(probably males with 55 leg-bearing segments also occur in nature); the two revised females have 55 leg-bearing segments (but possibly, other numbers exist for this sex).

Clypeus with 0+1 or 1+1 prelabral setae. (The original description only mentions two prelabral setae).

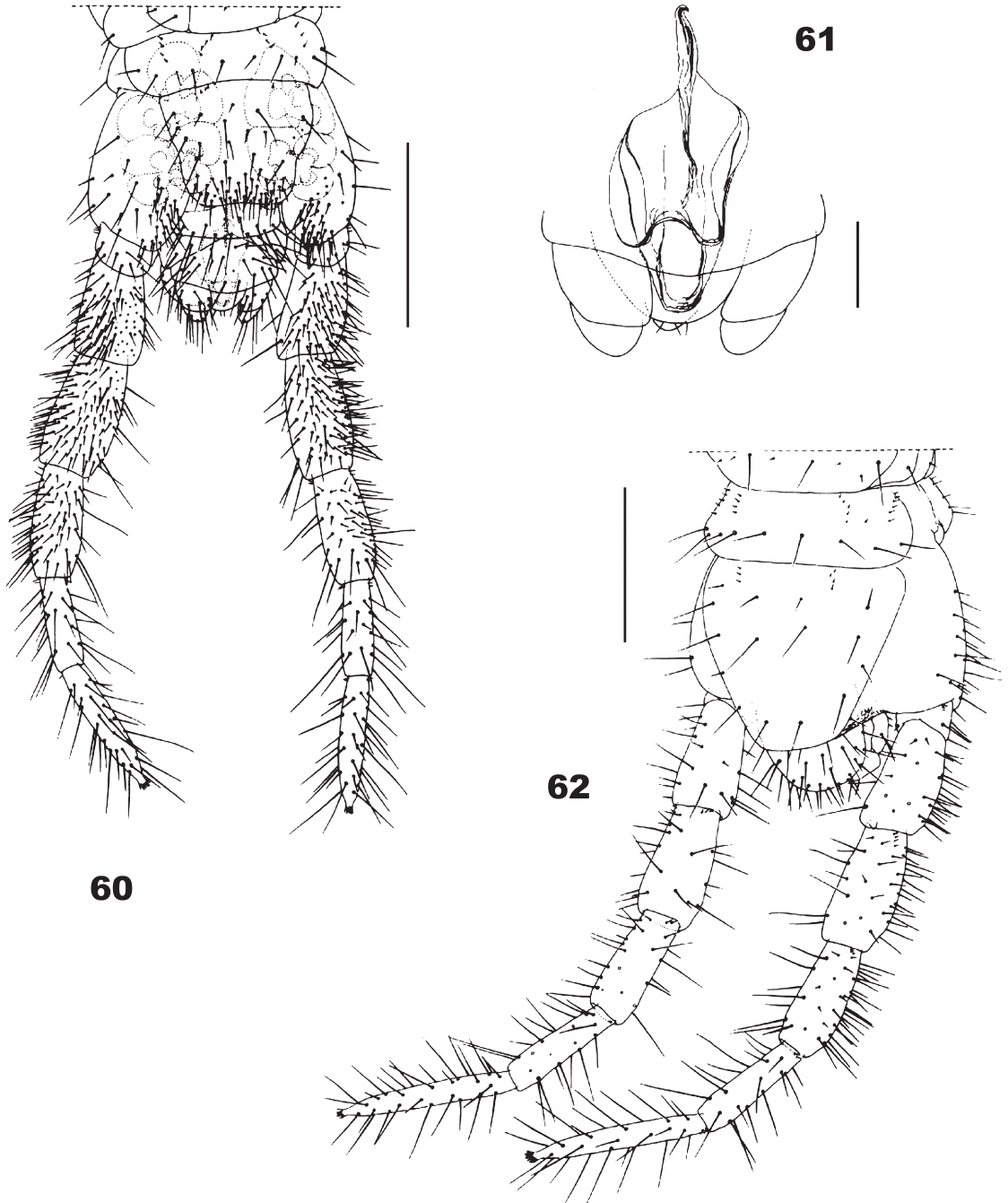


FIGURES 54-59: *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (male (specimen A); BRAZIL: Amazonas: Lago Janauari): (54) Right antenna, ventral; (55) Labrum; (56) First and second maxillae, ventral; (57) Forcipular segment, ventral; (58) Detail of calyx and conduct of poison gland in left forcipular telopodite, ventral; (59) Last leg-bearing segment and terminal segments, dorsal. (After Pereira *et al.*, 2000). Scale bars: 0.3 mm (54, 57, 59); 0.1 mm (55); 0.2 mm (56, 58).

Female paratype MCZ, TC-161 with posterior coxal organs having *ca.* 5-6 outer lobes on ventral side and *ca.* 4-6 on dorsal side; anterior coxal organs relatively smaller, with *ca.* 4-5 lobes on ventral side (number of dorsal lobes not stated). (For details on

fine structure and function of coxal organs, see Rosenberg & Seifert (1977); Lewis (1981); and Rosenberg (1982, 1983)).

The maximum body length given for this species is 45 mm (sex not specified).



FIGURES 60-62: (60-61): *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (male (specimen A); BRAZIL: Amazonas: Lago Janauari): (60) Last leg-bearing segment and terminal segments, ventral; (61) Penis and gonopods, ventral. (62): *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (female (specimen B); BRAZIL: Amazonas: Lago Janauari): Last leg-bearing segment and terminal segments, dorsal. (After Pereira *et al.*, 2000). Scale bars: 0.3 mm (60, 62); 0.05 mm (61).

Remarks: Chamberlin mentions the following material in his original description: “British Guiana, Du-noon: Labba Creek sand hills, July 27; clay jungle by first landing on Labba Creek, August 12; sand-hill forest, August 14, 17, 18, 22, 24, 27, September 4; east trail along river September 2, 1914; F.M. Gaige. Many specimens collected under leaves and logs, in rotten wood and damp earth, etc. Type, M.C.Z., 2182”. The author states: “Pairs of legs in the male, fifty-three; in the female, fifty-five”. But it is striking that among the “many specimens” he mentions only those numbers were represented (in fact, one of the male paratypes here revised, has 57).

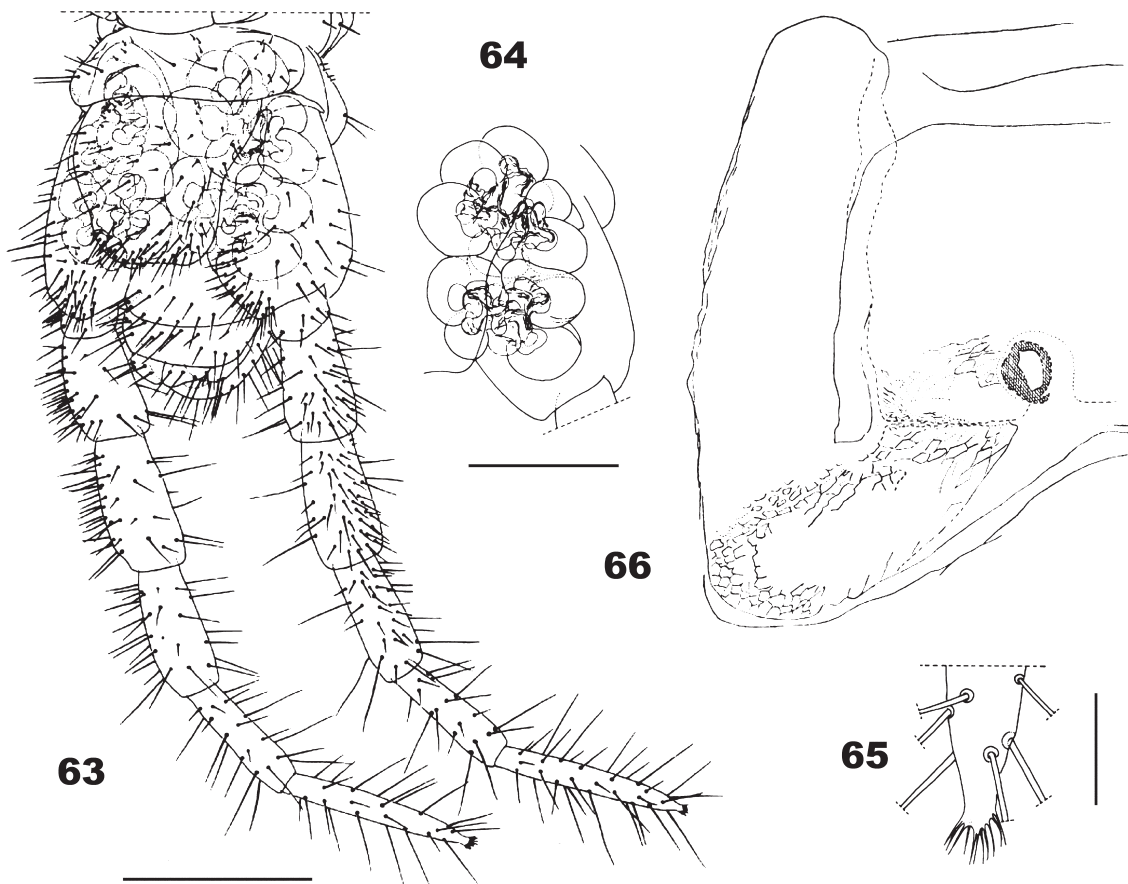
The original description of Chamberlin does not refer to a specimen in particular. It only includes 4 figures (head and forcipular segment in dorsal view; forcipular segment in ventral view; labrum; and coxosternum of second maxillae), and lacks information

on the specialized sensilla of antennal articles; relative size of pore fields; details of structure of coxal organs; form of last leg praetarsus; etc.

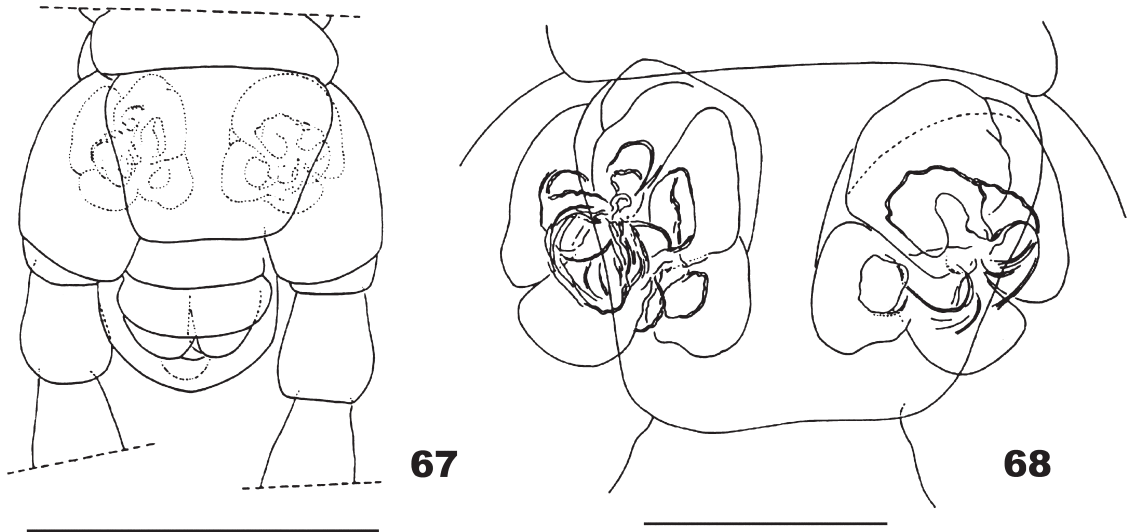
About sexual dimorphism, the author only mentions “Anal legs alike in stoutness and pilosity in the two sexes” (but this was in error, because the praefemur, femur and tibia of the male last legs are proportionally narrower than those in the female). On the other hand, no morphological details are given for the terminal segments of any sex.

The female paratype MCZ TC-162 (B) and male paratype MCZ TC-162 (C) were collected during an incomplete moulting cycle (on temporary microscopic slides, the new cuticle can be observed by transparency underlying the external exuviae – which is not damaged and nor yet detached).

The exuviae of the female paratype MCZ TC-162 (B) shows an abnormal (claw-like) praetarsus on the left last leg (Figs. 38, 39), being remarkable in that this



FIGURES 63-66: (63-65): *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (female (specimen B); BRAZIL: Amazonas: Lago Janauari): (63) Last leg-bearing segment and terminal segments, ventral; (64) Left coxal organs ventral; (65) Detail of distal end of last podomere of left last leg, dorsal. (After Pereira *et al.*, 2000). (66): *Pectiniunguis geayi* (Brölemann & Ribaut, 1911), (BRAZIL: Bas Carsévène), (Reference *Adenoschendyla geayi*): Detail of coxosternum of right second maxilla, ventral. (After Brölemann & Ribaut 1912). Scale bars: 0.2 mm (63, 64); 0.05 mm (65); no scale available (66).



FIGURES 67-68: *Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995, (female juvenile (A); BRAZIL: Amazonas: Reserva Florestal A. Ducke): (67) Last leg-bearing segment and terminal segments showing coxal organs, ventral; (68) Detail of coxal organs, ventral. (After Pereira *et al.*, 1995). Scale bars: 0.3 mm (67); 0.1 mm (68).

praetarsus appears tubercle-like (normal condition) in the corresponding underlying new exoskeleton.

The left antenna of the male paratype MCZ TC-162 (A) is abnormal, having 15 articles (distribution of specialized sensilla as in Table 4).

Right antenna of same specimen with 14 articles (distribution of specialized sensilla as in Table 5).

In all specimens examined, the claviform sensilla are absent on the internal side of the a.a. XIV. This trait is also confirmed on the two specimens in the moulting process cited above (in which these sensilla are absent on the exuviae as well as on the underlying new cuticle).

Ecology: The specimens of *Pectiniunguis gaigei* were collected in jungle environments under leaves and logs, in rotten and damp earth.

Type locality: 'British Guiana, Dunoon: Labba Creek sand hills'.

Known range: GUYANA: Dunoon, Labba Creek; Sand hills.

Morphological similarities of *Pectiniunguis gaigei* (Chamberlin, 1921) with other Neotropical species of the genus

As stated in the diagnosis of *P. gaigei*, this species is similar to *P. geayi* (Brölemann & Ribaut, 1911); *P. ducalis* Pereira, Minelli & Barbieri, 1995 and *P. roigi*

Pereira, Foddai & Minelli, 2001. New distributional records for *P. geayi* and *P. ducalis* from Brazilian Amazonia, together with complementary descriptive notes and new specific diagnoses for these species and *P. roigi*, follow below.

***Pectiniunguis geayi* (Brölemann & Ribaut, 1911) (Figs. 51-66)**

Adenoschendyla Geayi Brölemann & Ribaut, 1911:219.

Adenoschendyla geayi: Brölemann & Ribaut, 1912:108-109; Chamberlin, 1914:153, 201, 204; Chamberlin, 1921:19, 20.

Pectiniunguis geayi: Attems, 1929:81; Bücherl, 1942a:205; Bücherl, 1942b:351; Crabbill, 1959:325, 326; Pereira & Coscarón, 1975(1976):68, 72; Adis *et al.*, 1996:168, 169; Pereira *et al.*, 1999:177; Pereira *et al.*, 2000:3-5, 54; Foddai *et al.*, 2000:128, 179; Pereira *et al.*, 2001:143-144, 146; Foddai *et al.*, 2002:473.

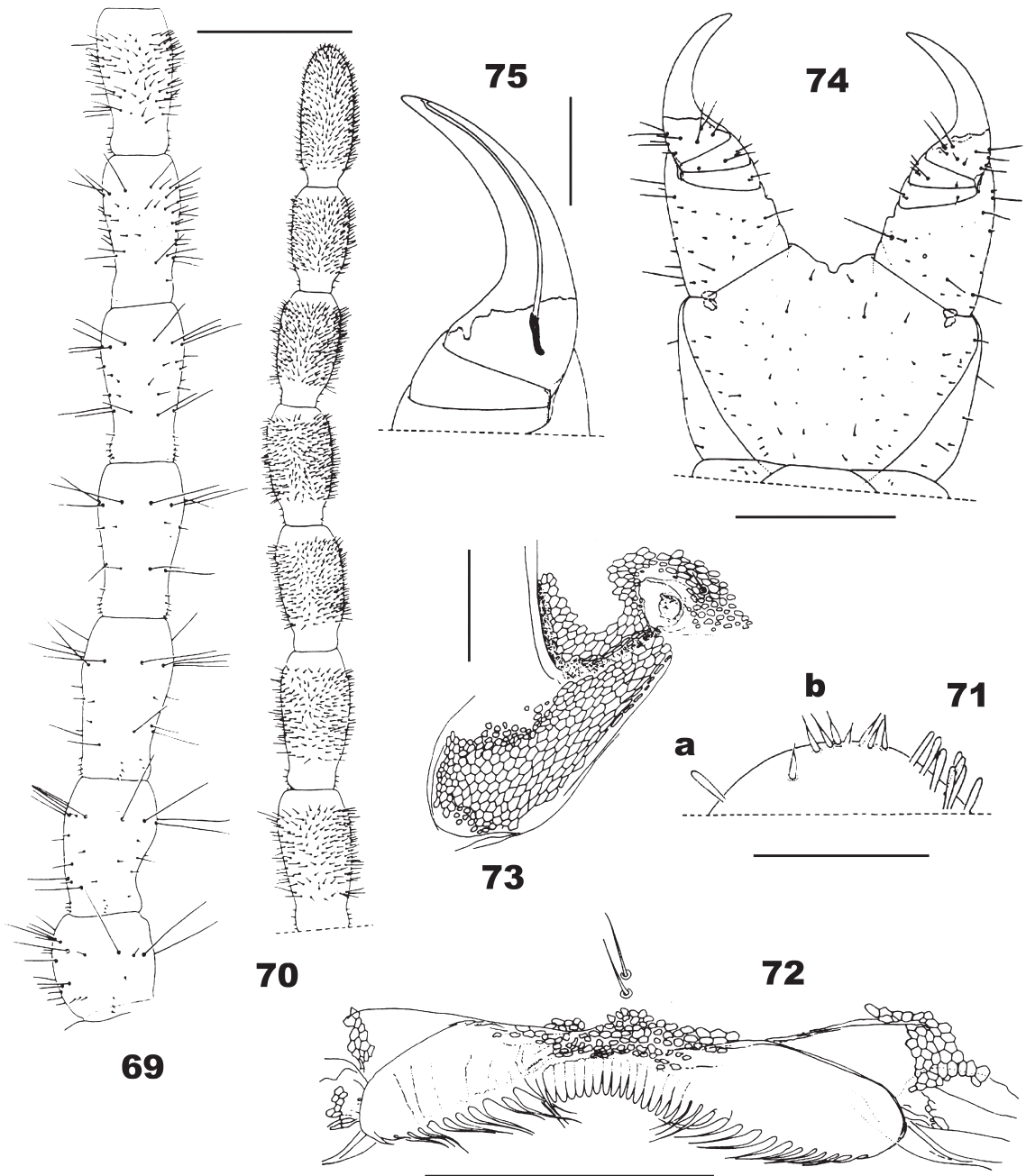
Diagnosis: Similar to *P. gaigei*, *P. ducalis*, and *P. roigi* (cf. Table 1), from which it is differentiated by the following unique traits (characters for *P. gaigei*, *P. ducalis*, and *P. roigi* are given in parentheses): male lowest number of leg-bearing segments: 49 (53, 63, 57?); coxosternum of second maxillae with ca. 13 setae (with ca. 22-31 setae); penis apparently devoid of setae (with 1+1 or 2+2 apical setae).

Morphological traits in Table 1 differentiate *P. geayi* from *P. gaigei*, *P. ducalis*, and *P. roigi*.

New material examined: BRAZIL: Amazonas: Manaus: INPA, (terra firme, secondary upland forest, (unburned)) (Kempson soil extraction) 03°08'S,

60°01'W, 24 April 1986, J. Adis *et al.* leg.: 1 male juvenile, 49 leg-bearing segments, body length 17 mm (INPA).

Remarks: The locality of Manaus: INPA, is new for the geographical distribution of this species.

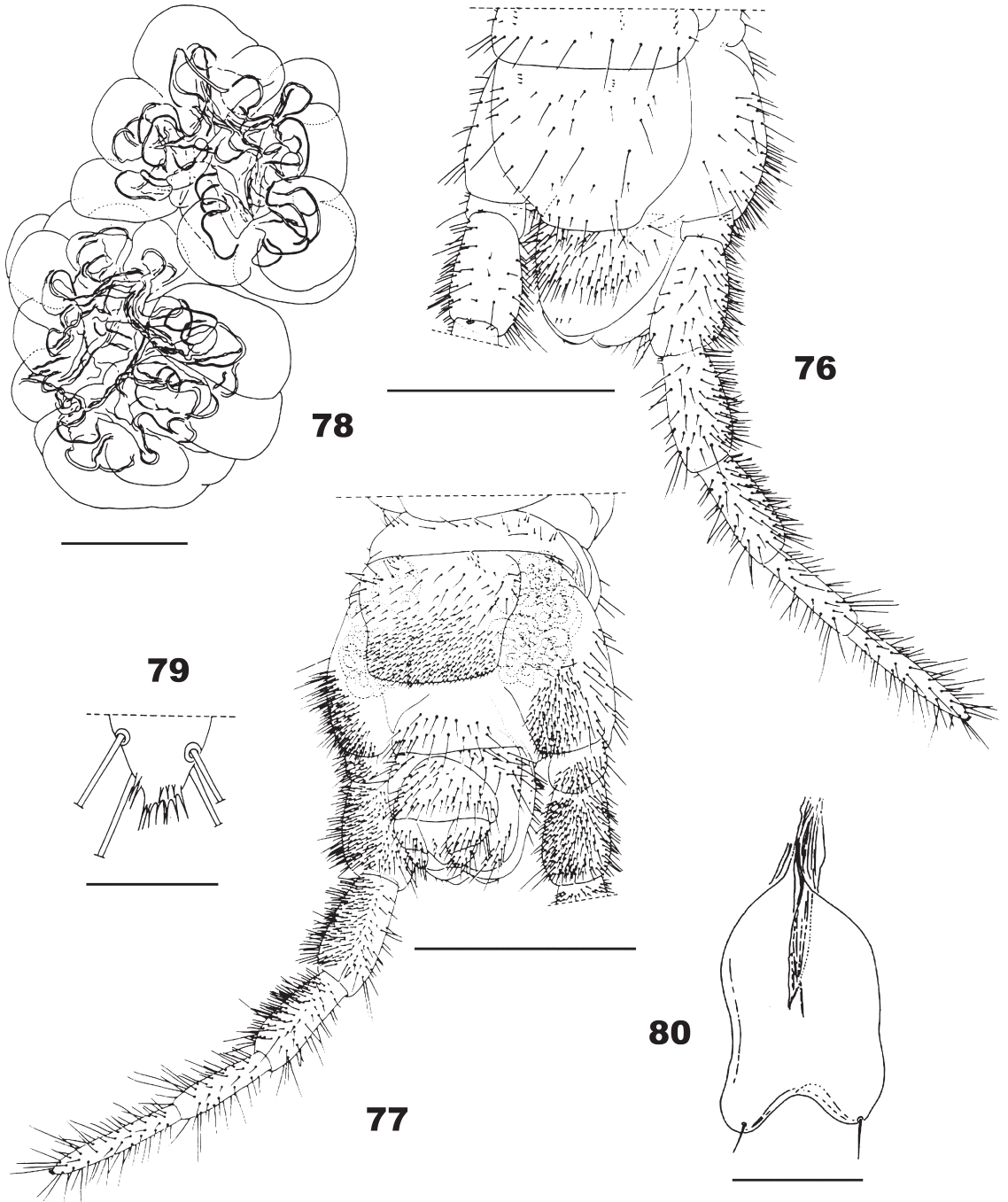


FIGURES 69-75: *Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995, (male holotype; BRAZIL: Amazonas: Reserva Florestal A. Ducke): (69) Left a.a. I-VII, ventral; (70) Left a.a. VIII-XIV, ventral; (71) Detail of distal end of right a.a. XIV, dorsal (a: claviform sensilla, b: apical specialized sensilla); (72) Labrum; (73) Detail of posterior external region of right second maxilla, ventral; (74) Forcipular segment, ventral; (75) Detail of calyx and conduct of poison gland in left forcipular telopodite, ventral. (After Pereira *et al.*, 1995). Scale bars: 0.4 mm (69, 70); 0.05 mm (71); 0.2 mm (72, 75); 0.1 mm (73); 0.6 mm (74).

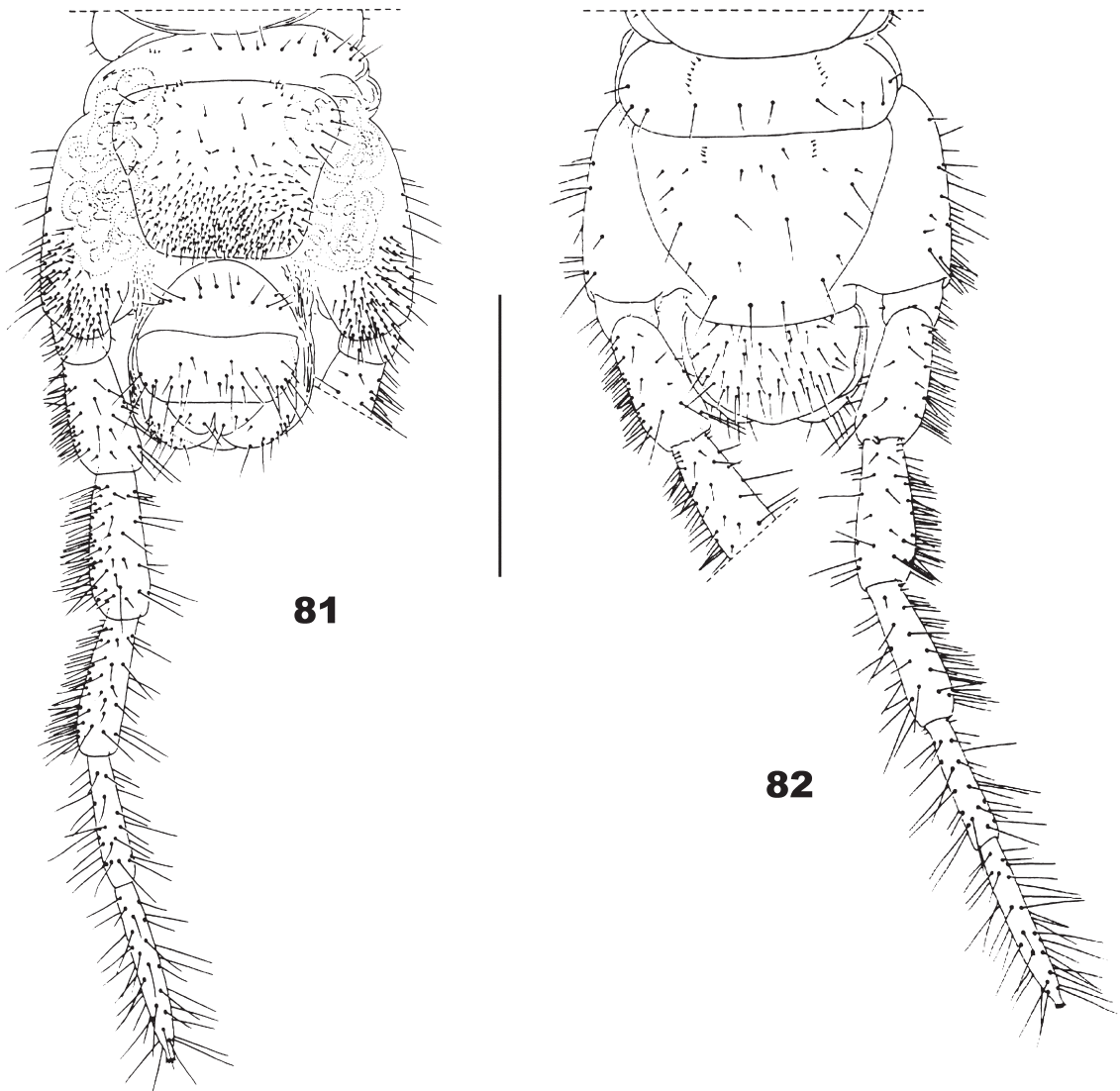
Postembryonic variation of coxal organs: The juvenile specimen cited above has the coxal organs incompletely developed (Figs. 51-53): the anterior organs have the aspect of “homogeneous” (instead of “heterogeneous” = adult condition); in contrast the posterior

ones are clearly heterogeneous but still incompletely developed (Figs. 51-53).

Characteristics of anterior and posterior coxal organs in adult specimens are shown in Fig. 64.



FIGURES 76-80: *Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995, (male holotype; BRAZIL: Amazonas: Reserva Florestal A. Ducke): (76) Last leg-bearing segment and terminal segments, dorsal; (77) Last leg-bearing segment and terminal segments, ventral. (78) Left coxal organs, ventral; (79) Detail of distal end of last podomere of right last leg, ventral; (80) Penis, dorsal. (After Pereira *et al.*, 1995). Scale bars: 0.6 mm (76, 77); 0.1 mm (78, 80); 0.05 mm (79).



FIGURES 81-82: *Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995, (female allotype; BRAZIL: Amazonas: Reserva Florestal A. Ducke): **(81)** Last leg-bearing segment and terminal segments, ventral; **(82)** Last leg-bearing segment and terminal segments, dorsal. (After Pereira *et al.*, 1995). Scale bar: 0.6 mm (81, 82).

Type locality: BRAZIL: Para: Bas Carsévène.

Known range: BRAZIL: Para: Bas Carsévène. BRAZIL: Amazonas: Rio Tarumá Mirím; Lago Janauari; Manaus: INPA.

***Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995
(Figs. 67-82)**

Pectiniunguis ducalis Pereira, Minelli & Barbieri, 1995:325, 338-340; Adis *et al.*, 1996:166, 168, 169; Pereira *et al.*, 1997:85;

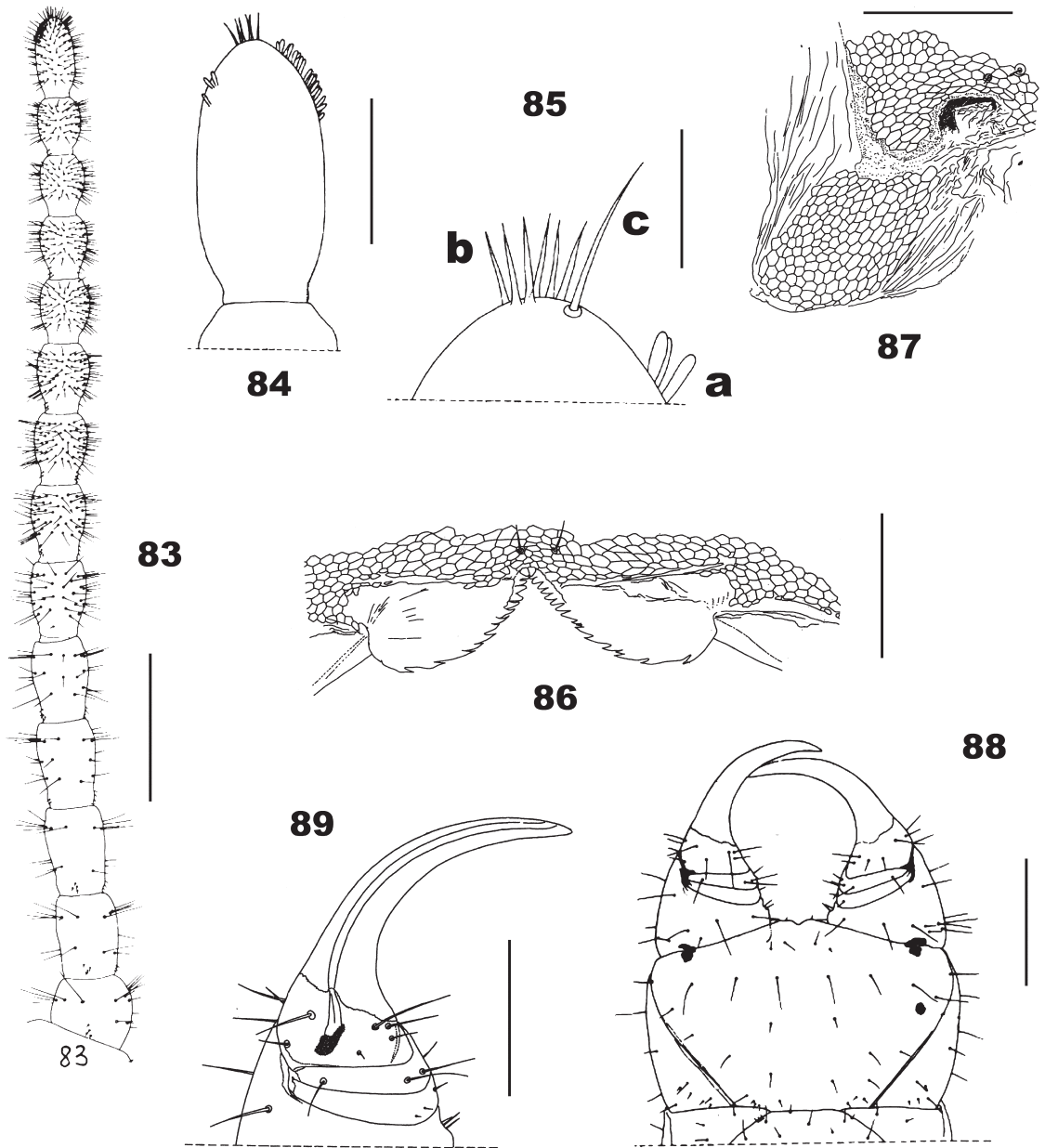
Pereira *et al.*, 1999:177; Pereira *et al.*, 2000:3, 54; Foddai *et al.*, 2000:128, 179; Pereira *et al.*, 2001:143, 144, 146; Foddai *et al.*, 2002:473.

Diagnosis: Similar to *P. gaigei*, *P. geayi*, and *P. roigi* (cf. Table 1), from which it is differentiated by the following unique traits (characters for *P. gaigei*, *P. geayi*, and *P. roigi* are given in parentheses): males with 63, 65, 67, 69, 71 and females with 65, 67, 69, 71, 73 leg-bearing segments (males with 49, 51, 53, (55?), 57 and females with 51, (53?), 55 leg-bearing segments); body length up to 67 mm (up to 45 mm); ratio length of antennae/length of cephalic shield, *ca.* 4.3: 1 (*ca.* 2.9-3.3: 1); clypeus with *ca.* 18 medial setae (with

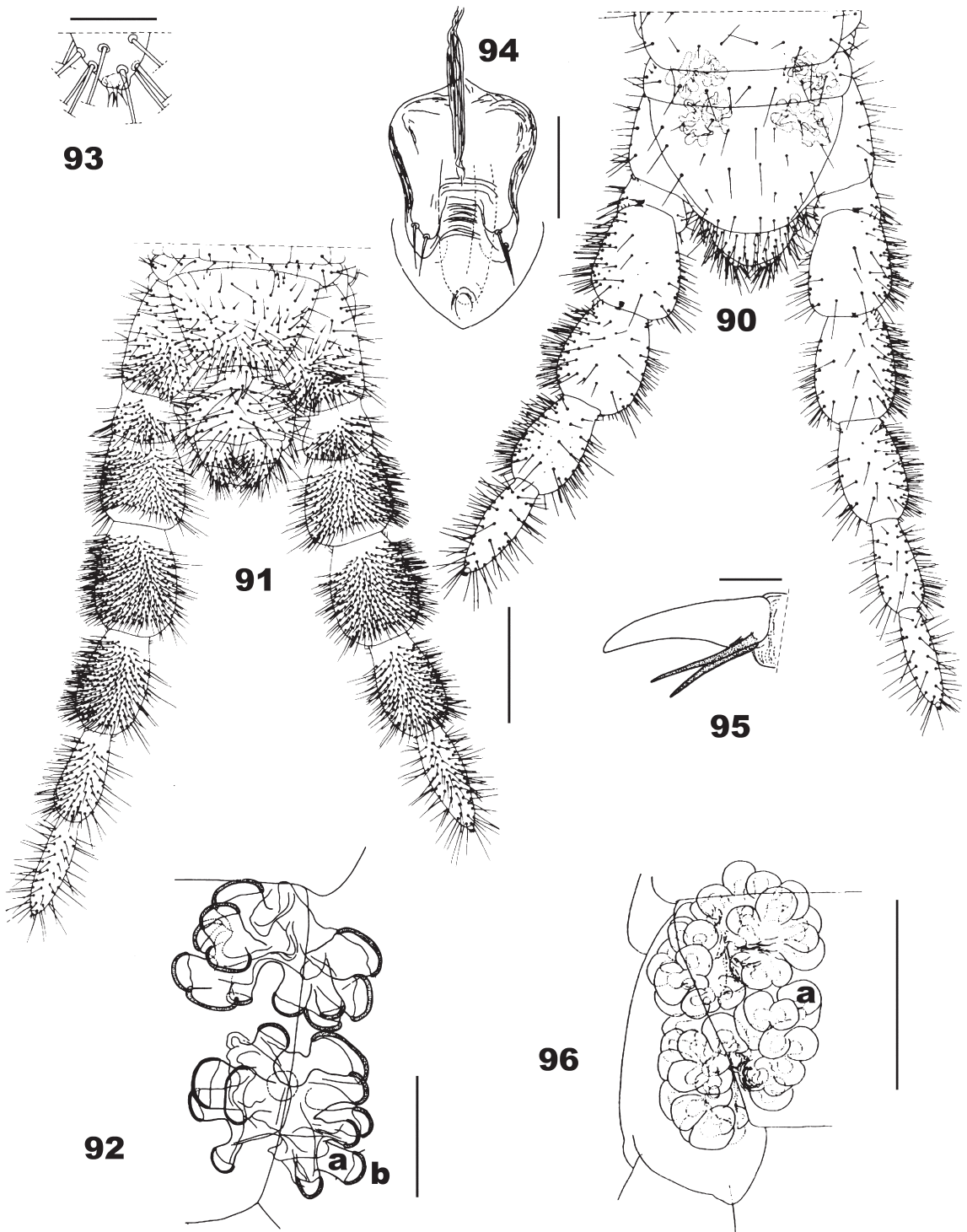
ca. 7-13 medial setae); teeth of lateral pieces of labrum as long hyaline filaments, Fig. 72 (subtriangular with a sharp medial extension, Figs. 9, 55, 86); ratio greatest length/greatest width of forcipular trochanteropraefemur, ca. 1.47: 1 (ca. 1.30: 1; ca. 1.40: 1; ca. 0.94: 1).

Morphological traits in Table 1 differentiate *P. ducalis* from *P. gaigei*, *P. geayi*, and *P. roigi*.

New material examined: BRAZIL: Amazonas: Reserva Florestal A. Ducke (terra firme, primary upland forest), (Kempson soil extraction), 1 April 1987, J. Adis *et al.* leg.: 1 male juvenile with 1+1 coxal organs only, 63 leg-bearing segments, body length 18 mm (MLP). BRAZIL: Amazonas: Manaus: INPA, terra firme, secondary upland forest, (unburned), Kempson soil extraction, 03°08'S, 60°01'W, 24 April 1986, J. Adis *et al.* leg.: 1



FIGURES 83-89: *Pectiniunguis roigi* Pereira, Foddai & Minelli, 2001 (male holotype; ECUADOR: Napo: Limoncocha): (83) Right antenna, ventral; (84) Right a.a. XIV, dorsal; (85) Detail of apex of left a.a. XIV, ventral (a: claviform sensilla, b: apical specialized sensilla; c: small seta); (86) Labrum (form of central arc altered by squashing); (87) Detail of posterior external region of right second maxilla, ventral; (88) Forcipular segment, ventral, (89) Detail of calyx and conduct of poison gland in right forcipular telopodite, ventral. (After Pereira *et al.*, 2001). Scale bars: 0.3 mm (83, 88); 0.1 mm (84, 86, 87); 0.03 mm (85); 0.2 mm (89).



FIGURES 90-96: (90-94): *Pectiniunguis roigi* Pereira, Foddai & Minelli, 2001 (male holotype; ECUADOR: Napo: Limoncocha): (90) Last leg-bearing segment and terminal segments, dorsal (left leg is anomalous having the telopodite of only five articles); (91) Last leg-bearing segment and terminal segments, ventral; (92) Left coxal organs, ventral (a: individual channel; b: mucous layer; (external contour of lobes, not delineated)); (93) Detail of distal end of last podomere of right last leg, ventral; (94) Penis, dorsal. (After Pereira *et al.*, 2001). (95): *Pectiniunguis chazaliei* (Brölemann, 1900) (male holotype; COLOMBIA: Gairaca: Santa Marta): Claw and parunguis of left leg XXX, postero-ventral. (After Pereira *et al.*, 2001). (96): *Pectiniunguis bollmani* Pereira, Minelli & Foddai, 1999 (male holotype; VENEZUELA: Falcón state: Morrocoy National Park: Cayo Sombrero): Right coxal organs, ventral (a: lobe). (After Pereira *et al.*, 1999). Scale bars: 0.3 mm (90, 91); 0.1 mm (92, 94); 0.05 mm (93, 95); 0.4 mm (96).

female with the two spermathecae full of spermatozoa and with mature ova, 73 leg-bearing segments, body length 67 mm; 11 juveniles with 1+1 coxal organs only: 4 females with 71 leg-bearing segments, body length 21.5, 22, 23, 23 mm; 2 females with 73 leg-bearing segments, body length 21, 21.5 mm; 3 males with 69 leg-bearing segments, body length 20.5, 21.5, 22 mm; 2 males with 71 leg-bearing segments, body length 21, 22 mm (MLP). BRAZIL: Amazonas: Rio Tarumá Mirim, capoeira (soil extraction), 30 January 1983, J. Adis legit: 1 female with the two spermathecae full of spermatozoa, 71 leg-bearing segments, body length 66 mm (INPA). BRAZIL: Amazonas: Lago Janauari, secondary upland forest (pitfall traps), (03°20'S, 60°17'W), 7 March 1996, J. Adis *et al.* leg.: 1 female with the two spermathecae full of spermatozoa, 67 leg-bearing segments, body length 31 mm (INPA).

Remarks: The localities of Manaus: INPA; Rio Tarumá Mirim; and Lago Janauari (all in BRAZIL: Amazonas), are new for the geographical distribution of *P. ducalis*.

Sixty-three, 69 and 71 leg-bearing segments for the males; 71 and 73 leg-bearing segments for the females, are new for this species.

Up to the present, the maximum body length known for adult females was 52 mm, but from the above cited material, it is up to 67 mm.

Postembryonic variation of coxal organs: aspect of the unique two (anterior) coxal organs present in a female juvenile (with 67 leg-bearing segments, body length 15 mm), as shown in Figs. 67, 68. (Posterior organs absent, due to the juvenile condition of the specimen).

Characteristics of the coxal organs in adult specimens are shown in Fig. 78.

Type locality: BRAZIL: Amazonas: Reserva Florestal A. Ducke.

Known range: BRAZIL: Amazonas: Reserva Florestal A. Ducke; Rio Tarumá Mirim; Manaus: INPA; Lago Janauari.

***Pectiniunguis roigi* Pereira, Foddai & Minelli, 2001
(Figs. 83-94)**

Pectiniunguis roigi Pereira, Foddai & Minelli, 2001:144-147; Foddai *et al.*, 2002:473.

Diagnosis: Similar to *P. gaigei*, *P. geayi*, and *P. ducalis* (*cf.* Table 1), from which it is differentiated by

the following unique traits (characters for *P. gaigei*, *P. geayi*, and *P. ducalis* are given in parentheses): ratio length of apical specialized sensilla/length of claviform sensilla on a.a. XIV, 2.0: 1 (0.5-1.0: 1); forcipular trochanteropraefemur wider than long, with ratio greatest length/greatest width, *ca.* 0.94: 1 (longer than wide, with ratio greatest length/greatest width *ca.* 1.30: 1; *ca.* 1.40: 1; *ca.* 1.47: 1); forcipular unguulum unusually curved inwards, Figs. 88, 89 (not so, Figs. 18, 57, 74).

Morphological traits in Table 1 differentiate *P. roigi* from *P. gaigei*, *P. geayi*, and *P. ducalis*.

Type material examined: Holotype male, 57 leg-bearing segments, body length 30.5 mm, from ECUADOR: Napo: Limoncocha (0°24'S, 76°38'W), 7 April 1984, A. Roig Alsina leg. (MLP).

Remarks: The following complementary information can be given on the male holotype: length of cephalic shield: 0.73 mm; width of forcipular coxosternum: 0.75 mm; ratio greatest length/greatest width of forcipular trochanteropraefemur, *ca.* 0.94: 1; forcipular unguulum unusually curved inwards (Figs. 88, 89).

Type locality: ECUADOR: Napo: Limoncocha.

Known range: Only known from the type locality.

DISCUSSION

Our present understanding of *Pectiniunguis* is still far from satisfactory; some species currently assigned to it remain insufficiently known and need revision. The importance of several distinctive morphological traits should be evaluated, including the shape and color of the parunguis of walking legs, which in some species are thin and pale (*e.g.*, *P. gaigei*, Fig. 21), and in others strong and dark (*e.g.*, *P. chazalie*, Fig. 95); the form of the internal cuticular structure of the outer lobes of coxal organs, which according to the different taxa, is either provided with a single area of mucous layer, joined to an individual channel (*e.g.*, in *P. roigi*, Fig. 92; and *P. bollmani*, Fig. 96), or having *ca.* two-four individualized areas of a mucous layer joined to a common channel (*e.g.*, in *P. gaigei*, Figs. 33-35); etc. A comprehensive, synoptic overview of the species in the genus (including an identification key) is needed. Phylogenetic (and biogeographic) affinities cannot be established until appropriate analyses be performed (which are outside the scope of the present contribution).

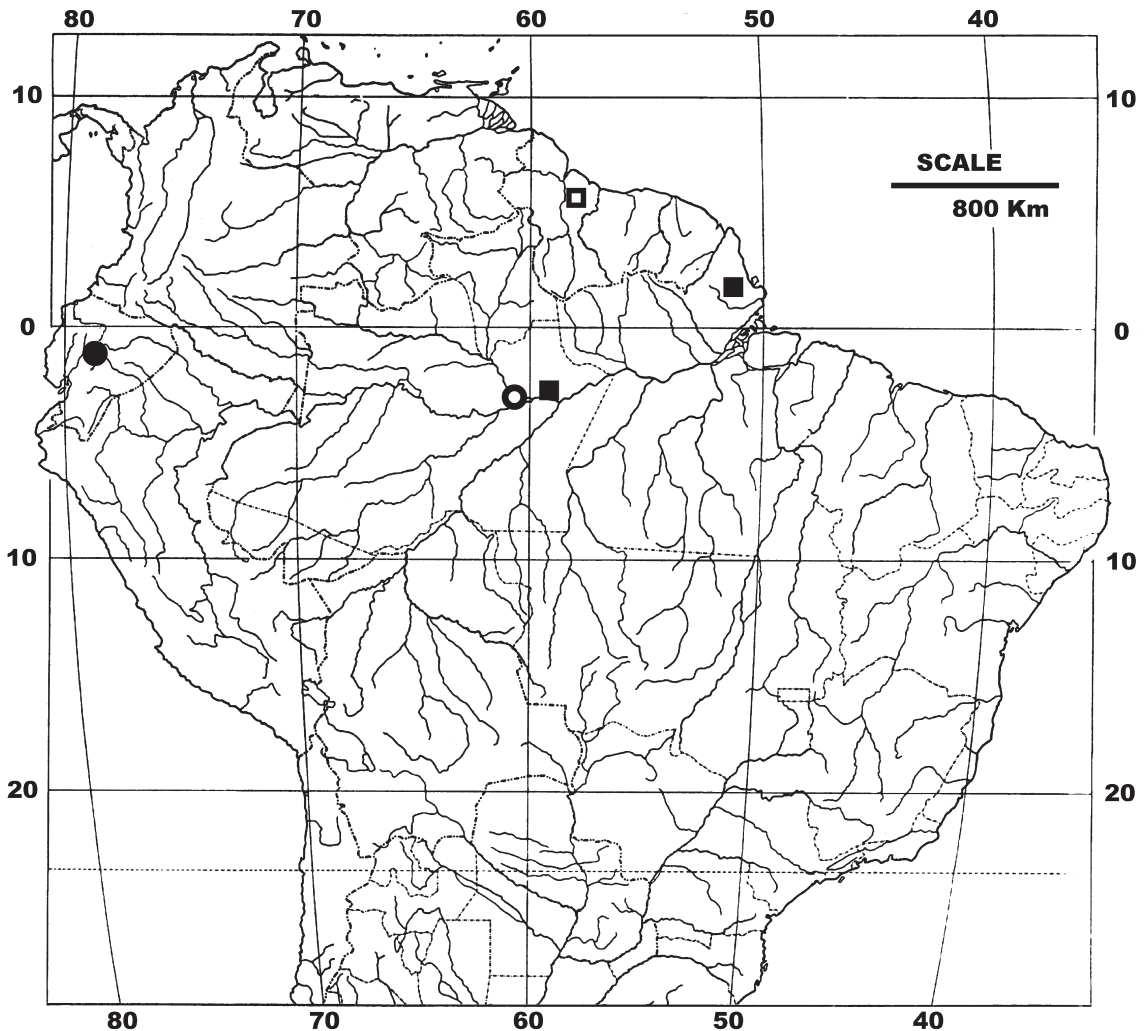


FIGURE 97: Geographical distribution of *Pectiniunguis gaigei* (Chamberlin, 1921) (white square); *Pectiniunguis geayi* (Brölemann & Ribaut, 1911) (black squares); *Pectiniunguis ducalis* Pereira, Minelli & Barbieri, 1995 (white dot) and *Pectiniunguis roigi* Pereira, Foddai & Minelli, 2001 (black dot).

RESUMEN

Pectiniunguis gaigei (Chamberlin, 1921) de Guyana, (Chilopoda: Geophilomorpha: Schendylidae) es aquí redescrita e ilustrada en base a material tipo. La especie se caracteriza por la ausencia de campo de poros en el primer esternito; presencia de campos de poros ventrales simples en una serie continua a lo largo de todo el tronco; parunguis de las patas ambulatorias finos y de coloración pálida; y pretarso del último par de patas en forma de un pequeño tubérculo provisto de numerosas espinas. Todos estos caracteres combinados son compartidos por otros tres miembros neotropicales del género (*P. geayi* (Brölemann & Ribaut, 1911) de Brasil; *P. ducalis* Pereira, Minelli & Barbieri, 1995 de Brasil; y *P. roigi* Pereira, Foddai & Minelli, 2001 de Ecuador), con los cuales *P. gaigei* es aquí comparada en detalle. Nuevos registros de distribución

geográfica para *P. ducalis* y *P. geayi*, junto con notas descriptivas complementarias y nuevas diagnósis para estas especies y *P. roigi*, son también brindados.

PALABRAS-CLAVE: *Pectiniunguis*; Taxonomía; Chilopoda; Geophilomorpha; Schendylidae.

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