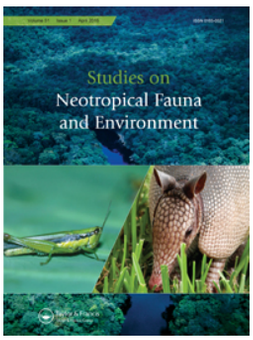


Studies on Neotropical Fauna and Environment

ISSN: 0165-0521 (Print) 1744-5140 (Online) Journal homepage: http://www.tandfonline.com/loi/nnfe20

First record of the endemic Neotropical genus Hyphydrophilus (Chilopoda: Geophilomorpha, Geophilidae) from Argentina, with description of H. minellii sp. nov., a new centipede with small tentorial process, inhabiting the Yungas

Luis Alberto Pereira

To cite this article: Luis Alberto Pereira (2016) First record of the endemic Neotropical genus Hyphydrophilus (Chilopoda: Geophilomorpha, Geophilidae) from Argentina, with description of H. minellii sp. nov., a new centipede with small tentorial process, inhabiting the Yungas, Studies on Neotropical Fauna and Environment, 51:1, 56-67, DOI: 10.1080/01650521.2016.1161949

To link to this article: http://dx.doi.org/10.1080/01650521.2016.1161949

STUDIES ON NEOTROPICAL FAUNA AND ENVIRONMENT, 2016
VOL. 51, NO. 1, 56–67
http://dx.doi.org/10.1080/01650521.2016.1161949

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

First record of the endemic Neotropical genus *Hyphydrophilus* (Chilopoda: Geophilomorpha, Geophilidae) from Argentina, with description of *H. minellii* sp. nov., a new centipede with small tentorial process, inhabiting the Yungas

Luis Alberto Pereira

National Council for Scientific and Technological Research (CONICET) and Natural Sciences Faculty and Museum (Division of Invertebrate Zoology), National University of La Plata, La Plata, Argentina

ABSTRACT

A new miniature species of the endemic Neotropical genus *Hyphydrophilus* (Chilopoda: Geophilomorpha, Geophilidae) is described and illustrated, after the holotype female and paratype female, from the Yungas rainforest of Salta province, northwestern Argentina. *H. minellii* sp. nov. is compared in detail with the other two species currently assigned to the taxon, i.e. *H. adisi* Pereira, Minelli & Barbieri, 1994 and *H. projectus* Pereira, Foddai & Minelli, 2000, both from Brazil, from which it differs by the presence of a small slightly sclerotized and inwards directed process of internal limbs of tentorium. Other unique traits of the new taxon are the relatively high number of leg-bearing segments (59), antennal articles I–IV with numerous large setae on the latero-external side, apical medial edge of forcipular trochanteroprefemur with a well-developed slightly pigmented tooth, dorsal and ventral medial edges of the forcipular tarsungulum slightly serrate, sternal pore-fields present on anterior region of the trunk only. This is the first report of the genus *Hyphydrophilus* from Argentina and the Yungas forests; previously it was only known to occur in Central Brazilian Amazonia, thus the present record represents a remarkable extension of the known range of this taxon.

ARTICLE HISTORY
Received 19 October 2015
Accepted 2 March 2016

KEYWORDS
Chilopoda; Geophilomorpha; Geophilidae; *Hyphydrophilus*; diminutive new species; Neotropical Region; Argentina; Yungas rainforest

Introduction

The endemic Neotropical centipede genus *Hyphydrophilus* Pereira, Minelli and Barbieri, 1994, is one of the less diversified geophilid genera known to occur in South America. Only two species are currently assigned to the taxon, i.e. *H. adisi* Pereira, Minelli & Barbieri, 1994 and *H. projectus* Pereira, Foddai & Minelli, 2000, both from Central Amazonia, Brazil.

A recent examination of unsorted soil samples from the Yungas rainforest of Salta province, northwestern Argentina, and stored at the Division of Invertebrate Zoology, Museo de La Plata, revealed the presence of two tiny specimens, herein identified as belonging to a new species of this genus, which is here described, illustrated, and compared in detail with the two other aforementioned species.

The Yungas is a relatively narrow strip of dense evergreen forest with rainy, humid, and warm climate, covering the eastern slopes of the Andes between 300 and 3500 m altitude, extending from northern Venezuela to northwestern Argentina (Cabrera 1971; Cabrera & Willink 1973; Pereira 2005, 2007; Guilbert & Montemayor 2010).

The Argentinean Yungas is part of the southern Andean Yungas, which begins in southern Bolivia and continues south into northwestern Argentina. The southern Andean Yungas is a humid forest region between the drier Gran Chaco region to the east and the dry, high-altitude Puna grassland region to the west. In Argentina the Yungas forest spans from north to south along over 600 km, occupying nearly 4.5 million ha in Salta, Jujuy, Tucumán and Catamarca provinces, and has an elevation range of 400–3000 m. Regarding its flora and landscape, three altitudinal levels can be recognized: (1) premontane forest (300–600 m); (2) montane forest (600–1500 m); (3) montane cloud forest (1500–3000 m) (Cabrera 1971; Brown 1995; Prado 1995; Guilbert & Montemayor 2010).

Hyphydrophilus minellii sp. nov. is only the third species of geophilomorph centipede reported from the Yungas of Argentina, the others being the geophilids *Plateurytion yungarum* (Pereira, 2005) from Jujuy province, and *Ribautia jakulicai* Pereira, 2007 from Salta province (all three species have been collected in areas of montane forest).

CONTACT Luis Alberto Pereira lpereira@fcnym.unlp.edu.ar

Material and methods

The holotype and paratype herein designated are deposited in the Collection of Myriapodology of the Museo de La Plata, La Plata, Buenos Aires, Argentina (MLP-My, María C. Damborenea and Luis A. Pereira).

The specimens were examined through light microscopy. Temporary mounts have been prepared by direct transfer of the specimens from the preservation liquid (70% ethanol) onto microscopic slides, using undiluted 2-phenoxyethanol = ethylene glycol monophenyl ether (CAS # 122–99–6) as a mounting medium. No additional steps were employed before mounting. A permanent mount has been made, simply by direct mounting of dissected mouth pieces on the temporary slide (previously cleared and dehydrated *in situ* by the action of the 2-phenoxyethanol) into Canada balsam diluted with a small amount of vegetable creosote (refined from beech tar).

Details on these and other procedures for the preparation of geophilomorphs for microscopical examination are described in Pereira (2000) and Foddai et al. (2002). The figures were delineated using a compound microscope equipped with a camera lucida drawing tube attachment (the latter was also employed to draw scale bars with the aid of a glass stage-micrometer). Measurements are given in mm. Terminology for external anatomy follows Bonato et al. (2010). The following abbreviation is used in the text and figure legends: aa, antennal article/articles.

Results

Family **GEOPHILIDAE**

Genus ***Hyphydrophilus*** Pereira, Minelli & Barbieri, 1994

Diagnosis

Cephalic plate distinctly longer than wide; clypeus with a single, median, areolate area. First maxillae without coxosternal lappets, those of telopodites present but rudimentary or vestigial. Second maxillae with coxosternites separated by a non-sclerotized isthmus, anterointernal corners of coxosternites without processes, prominent distally convergent ridges (statuminia *sensu* Crabill 1960) present, first and second articles of telopodites with or without a distoectal process, claw of telopodites simple. Forcipular tergite distinctly narrower than subsequent tergite, forcipular pleuroxosternal sutures extending obliquely to the lateral margins of the pleurae, chitinlines present, nearly complete but not very evident. Sternal pores present. Coxopleura of the ultimate leg-bearing segment each with two internal coxal organs of simple structure ("homogeneous" coxal glands *sensu* Brölemann & Ribaut 1912). Legs of the ultimate pair with seven articles, ultimate pretarsus claw-like, well developed.

Type species of the genus

Hyphydrophilus adisi Pereira, Minelli and Barbieri, 1994, by original designation.

Species (all Neotropical) currently assigned to* Hyphydrophilus *(including the new taxon described below)

H. adisi Pereira, Minelli & Barbieri, 1994 (Brazil)
H. minellii sp. nov. (Argentina)
H. projectus Pereira, Foddai & Minelli, 2000 (Brazil)

Hyphydrophilus minellii sp. nov. (Figures 1–48)

Diagnosis

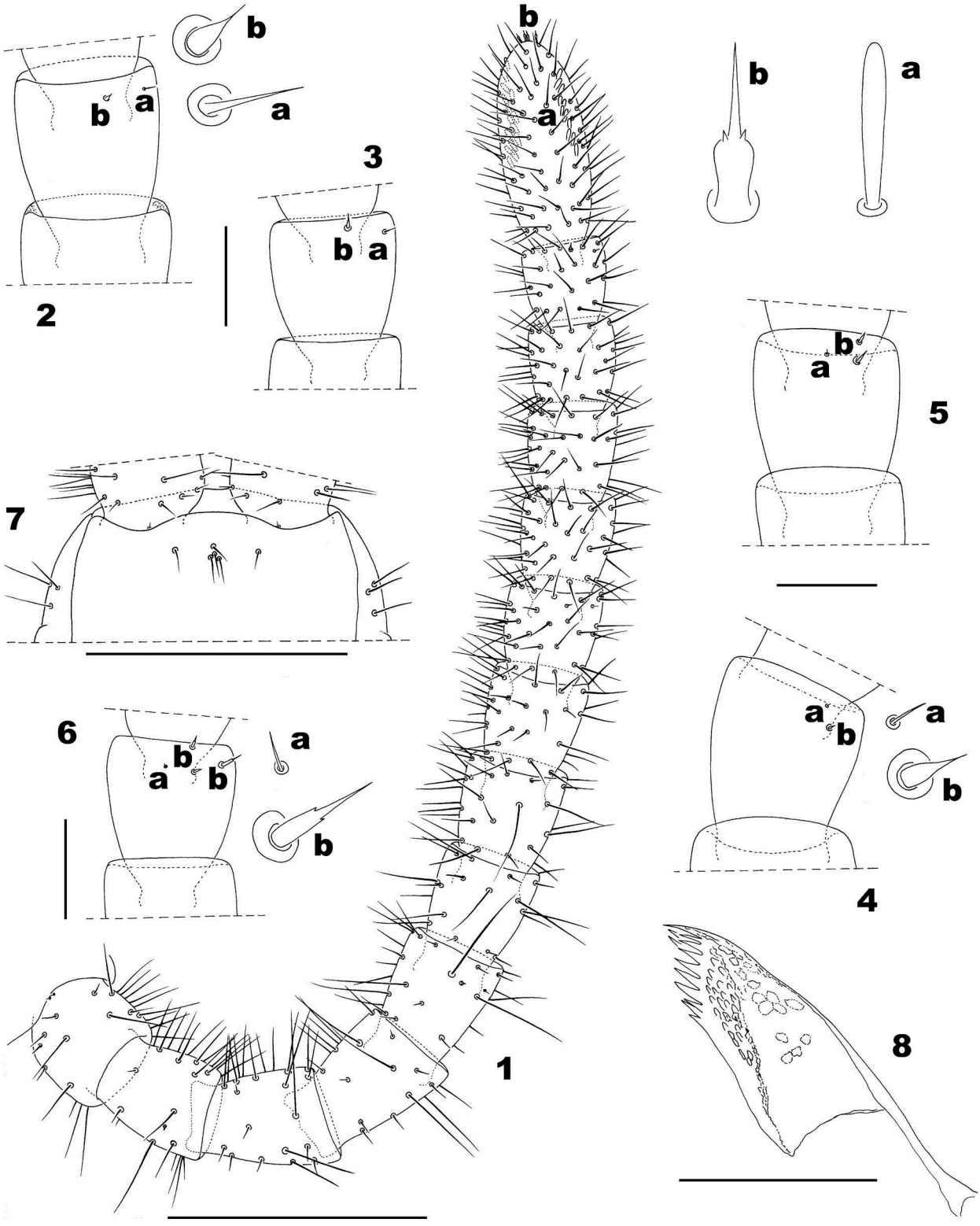
The species can be confidently differentiated from the other two members of the genus by having the following unique traits: 59 leg-bearing segments (female); aa I–IV with numerous large setae on the latero-external side (Figures 1, 43); internal limbs of tentorium bearing a small slightly sclerotized process directed inwards (Figures 10a, 45–47a); apical medial edge of forcipular trochanteroprefemur with a well-developed slightly pigmented tooth (Figures 13–15); dorsal and ventral medial edges of forcipular tarsungulum slightly serrate (Figures 13, 15); sternal pore-fields present on anterior region of the trunk only; leg-bearing segment 1 without sternal pores; legs of pairs 1 to 7–8 with setae of different thickness (Figures 32–33).

Remarks

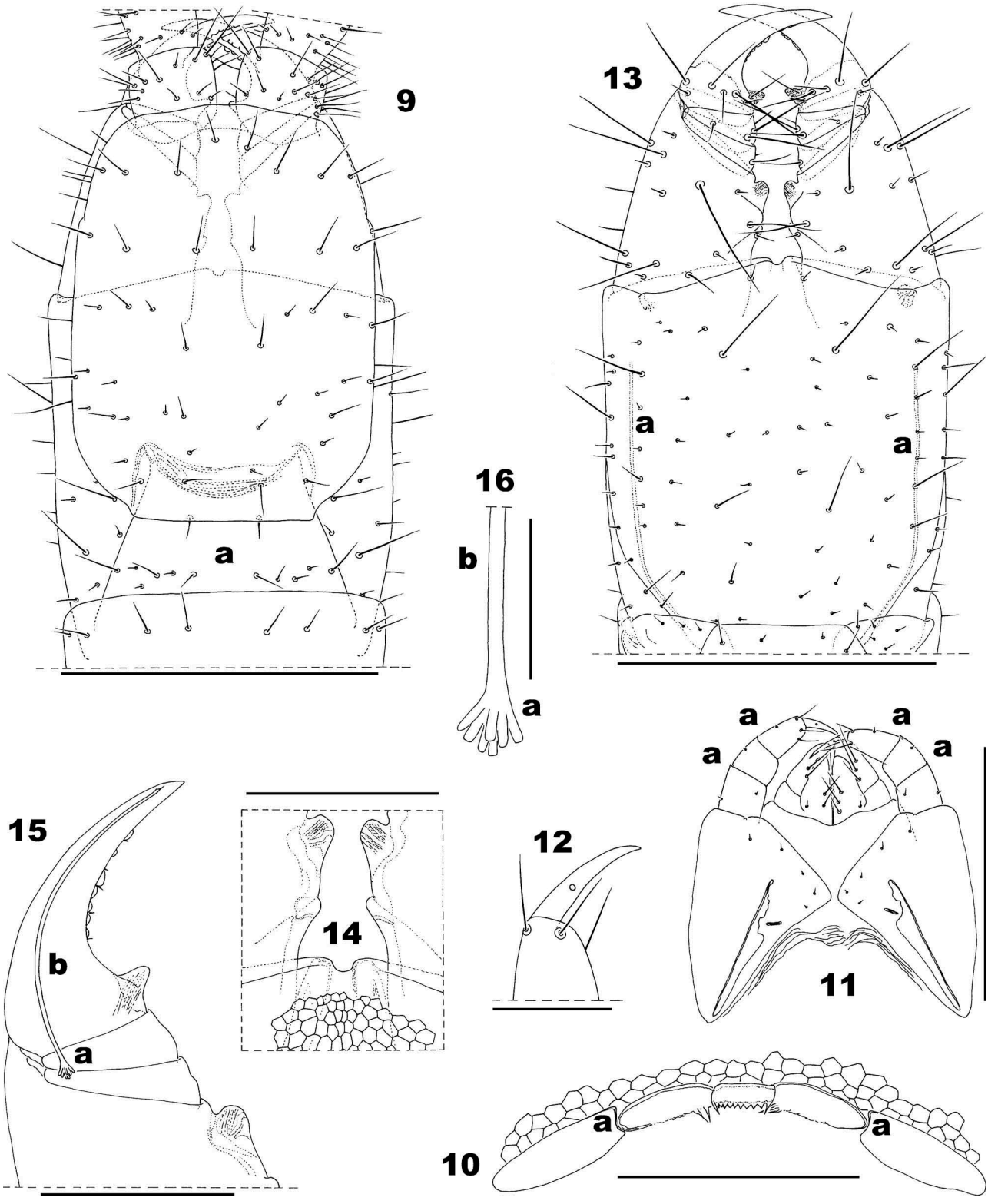
Other morphological traits included in Table 1 differentiate *H. minellii* from *H. adisi* and *H. projectus*. See also the identification key presented below.

Type material examined

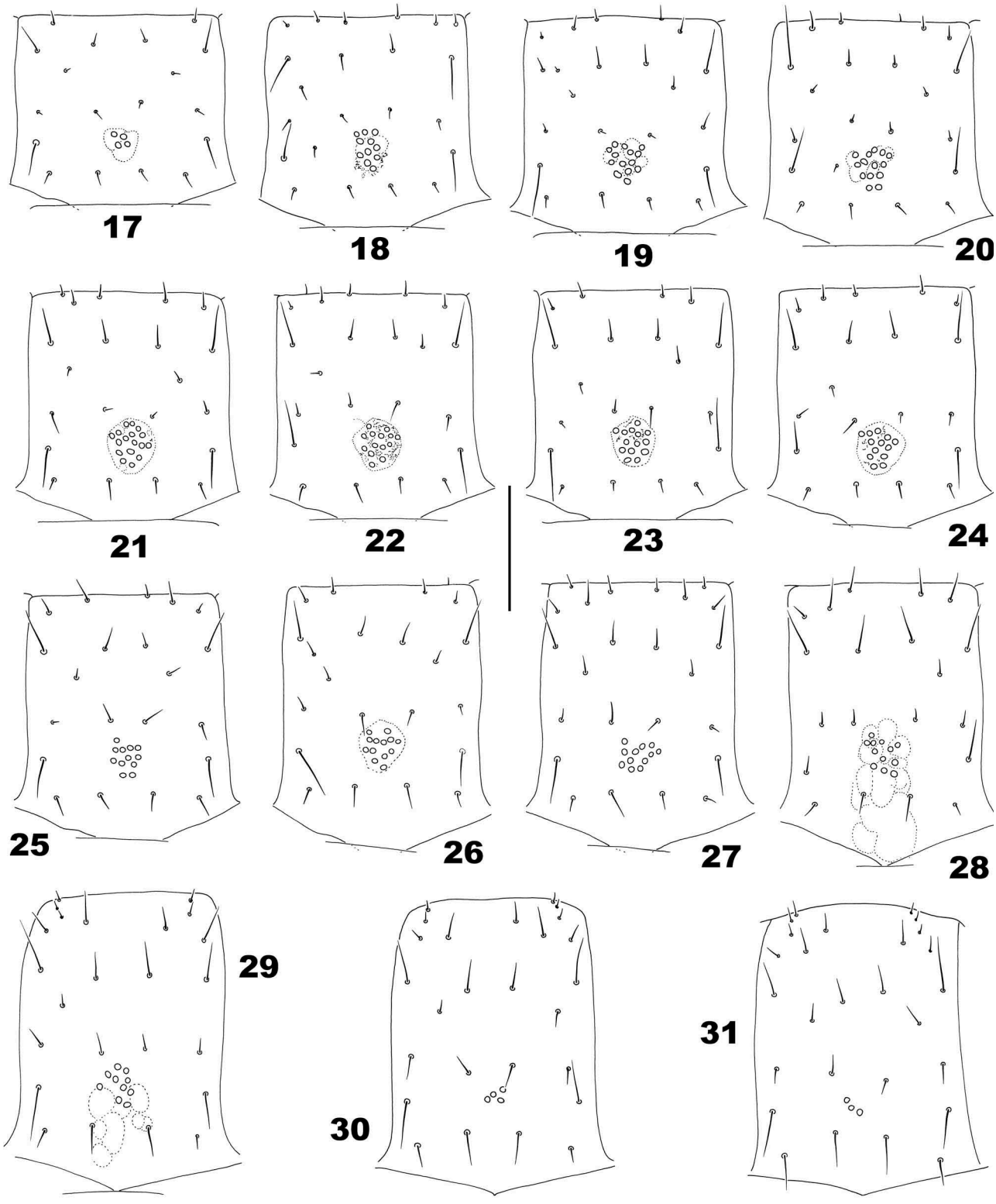
Argentina: Salta Province: Orán Department: *ca.* 25 km northwest of Aguas Blancas, "Finca Jakúlica" (finca Angosto del Pescado), 22° 33′S, 64° 33′W, primary subtropical rainforest, *ca.* 650 m asl, 2 October 1976, L. A. Pereira and C. Grisolía leg.: holotype female 59 leg-bearing segments, body length 14 mm (in alcohol) (MLP-My 19429); paratype female 59 leg-bearing



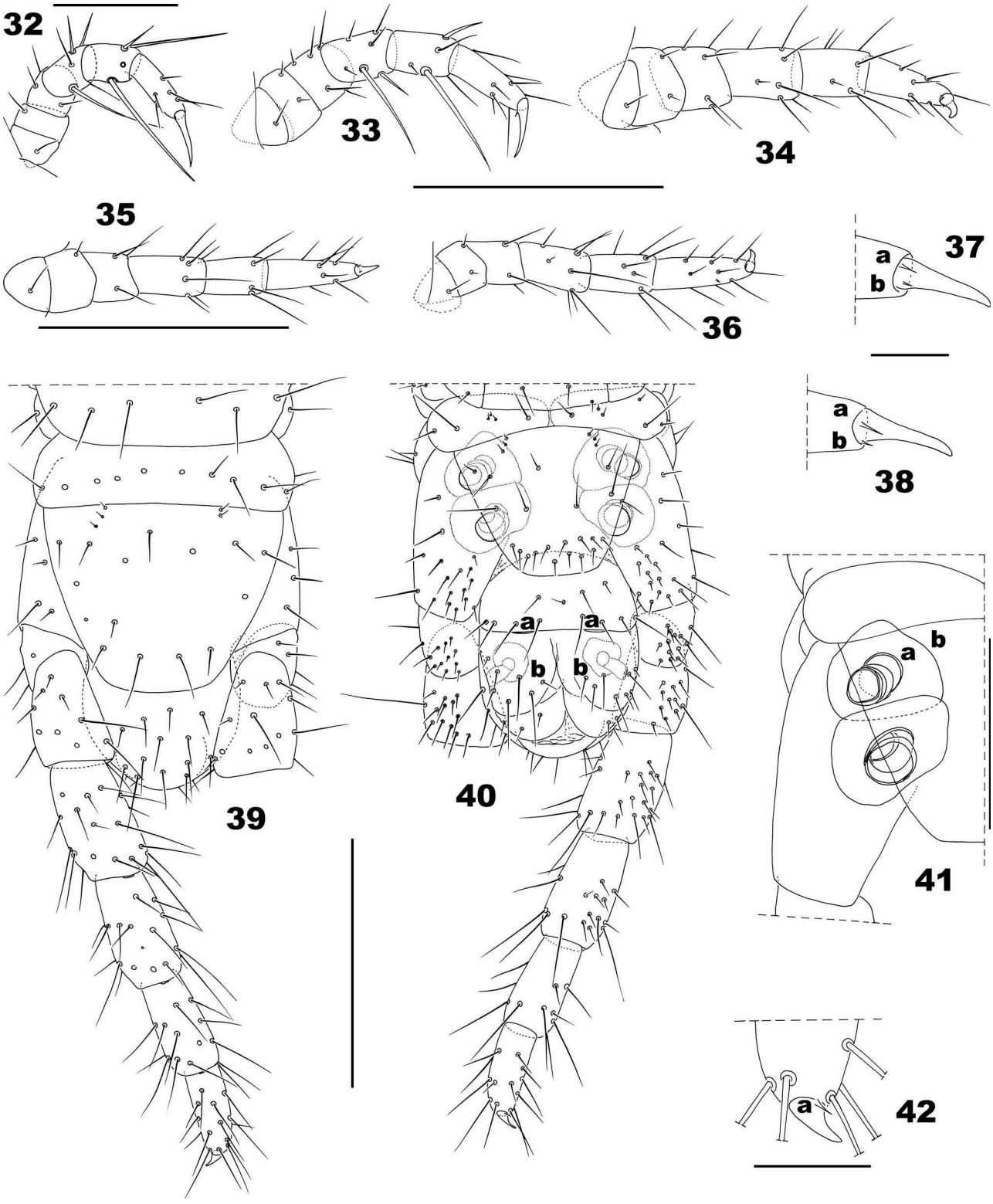
Figures 1–8. *Hyphydrophilus minellii* sp. nov. (female holotype (MLP-My 19429)): 1, right antenna, ventral (a: claviform sensilla, b: apical specialized sensilla); 2, right aa IX, ventral (a, b: *a, b* type sensilla); 3, right aa XIII, ventral (a, b: *a, b* type sensilla); 4, right aa II, dorsal (a, b: *a, b* type sensilla); 5, right aa IX, dorsal (a, b: *a, b* type sensilla); 6, right aa XIII, dorsal (a, b: *a, b* type sensilla); 7, clypeus and bases of antennae; 8, right mandible, dorsal. Scale bars: 0.05 mm (2–6, 8); 0.2 mm (1, 7).



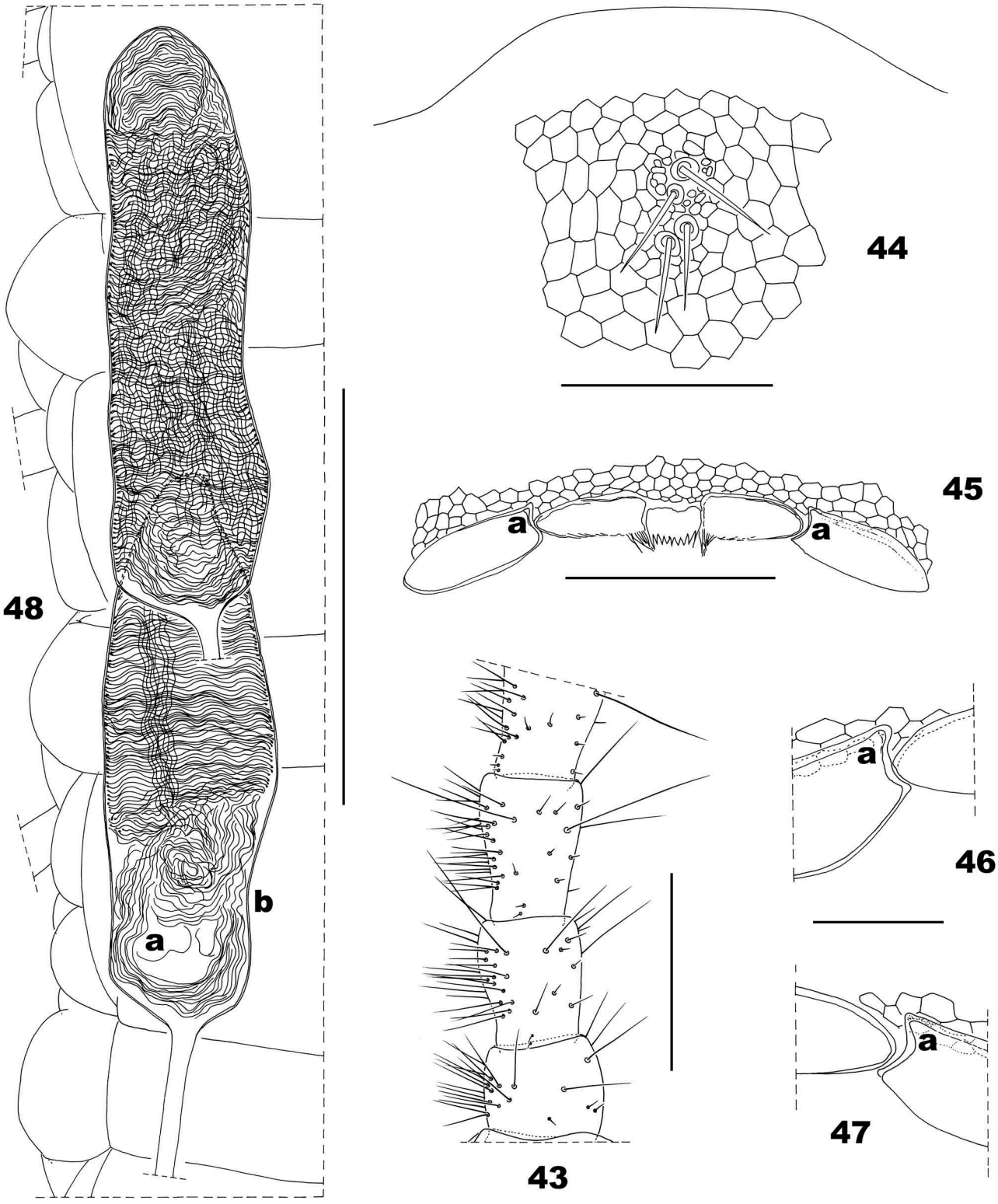
Figures 9–16. *Hyphydrophilus minellii* sp. nov. (female holotype (MLP-My 19429)): 9, dorsal view of anterior region of the body, showing cephalic plate, bases of antennae, forcipular segment, and anterior portion of leg-bearing segment 1 (a: forcipular tergite); 10, labrum (a: process on internal limb of tentorium); 11, first and second maxillae, ventral (a: vestigial distoectal process); 12, claw of right telopodite of second maxillae, ventral; 13, forcipular segment, ventral (a: chitin-lines); 14, middle part of anterior border of forcipular coxosternite and medial edge of forcipular telopodites, ventral; 15, detail of calyx (a), and duct (b) of venom apparatus in right forcipular telopodite, ventral; 16, detail of calyx of poison gland (a) in right forcipular telopodite, ventral (b: duct). Scale bars: 0.02 mm (16); 0.03 mm (12); 0.1 mm (10, 14, 15); 0.2 mm (11); 0.3 mm (9, 13).



Figures 17–31. *Hyphydrophilus minellii* sp. nov. (female holotype (MLP-My 19429)): 17, metasternite 2; 18, metasternite 3; 19, metasternite 4; 20, metasternite 5; 21, metasternite 6; 22, metasternite 7; 23, metasternite 8; 24, metasternite 9; 25, metasternite 10; 26, metasternite 11; 27, metasternite 12; 28, metasternite 13; 29, metasternite 14; 30, metasternite 15; 31, metasternite 16. Scale bar: 0.1 mm.



Figures 32–42. *Hyphydrophilus minellii* sp. nov. (female holotype (MLP-My 19429)): 32, left leg (pair 1), anterior-ventral view; 33, left leg (pair 2), anterior-ventral view; 34, left leg (pair 9), ventral view; 35, left leg (pair 35), ventral view; 36, left leg (pair 58), ventral view; 37, claw of the right leg (pair 21), anteroventral view (a: anterior spine, b: posterior spine); 38, claw of the right leg (pair 51), anteroventral view (a: anterior spine, b: posterior spine); 39, ultimate leg-bearing segment and postpedal segments, dorsal; 40, ultimate leg-bearing segment and postpedal segments, ventral (a: vestigial gonopods, b: anal organs); 41, right coxal organs, ventral (a: mucous layer, b: contour of lobe); 42, claw of left ultimate leg, ventral-internal view (a: single internal spine). Scale bars: 0.02 mm (37, 38); 0.03 mm (42); 0.1 mm (32, 41); 0.2 mm (33–36, 39, 40).



Figures 43–48. *Hyphydrophilus minellii* sp. nov. (female paratype (MLP-My 19430)): 43, right aa I–IV, ventral; 44, clypeal area; 45, labrum (a: process on internal limb of tentorium); 46, detail of process (a) on internal right limb of tentorium; 47, detail of process (a) on internal left limb of tentorium; 48, anterior and posterior spermathecae at level of leg-bearing segments 52–54, dorsal (a: spermatozoa, b: contour of spermatheca). Scale bars: 0.03 mm (46, 47); 0.05 mm (44); 0.1 mm (45); 0.2 mm (43); 0.3 mm (48).

Table 1. Comparative matrix of morphological traits for *Hyphydrophilus minellii* sp. nov., *H. adisi* Pereira, Minelli & Barbieri, 1994, and *H. projectus* Pereira, Foddai & Minelli, 2000.

	H. minellii	*H. adisi*	*H. projectus*
Number of leg-bearing segments	♀: 59 ♂: ?	♀: 41, 43 ♂: 39, 41, 43	♀: 37 (39), 41 ♂: 37, 39, 41
Body length	♀: 15 mm ♂: ?	♀: 19 mm ♂: 16 mm	♀: 10 mm ♂: 10 mm
Aa I–IV with numerous large setae on the latero-external side	Yes (Figures 1, 43)	No	No
Teeth of mid-piece of labrum	With *ca.* 1 + 1 marginal teeth longer than the intermediate ones (Figures 10, 45)	All teeth with similar length	With *ca.* 2 + 2 marginal teeth longer than the intermediate ones
Internal limb of tentorium bearing a small slightly sclerotized process directed inwards	Yes (Figures 10a, 45–47a)	No	No
First and second article of telopodites of second maxillae with a distoectal process	Yes (vestigial, Figure 11a)	No	Yes (distinct)
Medial edge of forcipular trochanteroprefemur	Apically with a well-developed and slightly pigmented tooth, proximally with a small unpigmented denticle (Figures 13–15)	With a small apical and proximal unpigmented denticle	With a small apical unpigmented projection
Dorsal and ventral medial edges of forcipular tarsungulum slightly serrate	Yes (Figures 13, 15)	No	No
Shape of calyx of poison gland	Palmate (Figures 15, 16a)	Subcircular	Palmate
Sternal pore-fields present all along the body	No (on anterior region of the trunk only)	Yes	Yes
All sternal pore-fields, undivided	Yes (Figures 17–31)	No (those of posterior region of the body divided in two areas)	Yes
Leg-bearing segment 1 with a sternal pore-field	No	Yes	Yes
Legs of some anterior pairs with setae of different thickness	Yes (Figures 32, 33)	No	No
Anal organs	Present (Figure 40b)	Present	Absent

segments, body length 15 mm (first and second maxillae in a permanent slide, head capsule with mandibles and trunk in alcohol) (MLP-My 19430).

Depository of type: MLP-My.

Description

Female holotype. Fifty-nine leg-bearing segments, body length 14 mm, maximum body width 0.40 mm, maximum width of cephalic plate 0.28 mm, length of cephalic plate 0.39 mm, maximum width of forcipular coxosternite 0.33 mm. Ground color (of preserved specimen in alcohol) pale yellowish, forcipular segment pale brown.

Antennae. About 3.00 times as long as the cephalic plate, ratio of width of aa II/width of aa XIV 1.12: 1. Aa I nearly as long as wide, remaining aa longer than wide. Length/width ratio of aa XIV 2.5: 1. Aa I–IV with numerous large setae on the latero-external side (Figure 1). Ventral chaetotaxy: setae on aa I–VII of various lengths and relatively few in number, those on aa VIII–XIV progressively shorter and more numerous towards the tip of the appendage (Figure 1). Dorsal chaetotaxy: setae slightly shorter and less numerous than on ventral side. Aa XIV with 15 claviform sensilla on the external margin and 11 on the internal margin (Figure 1a); distal end of this aa with *ca.* 4 very small hyaline specialized sensilla with two small apical branches (Figure 1b). Ventral and dorsal surface of aa II, V, IX and XIII with very small specialized sensilla. Ventrally, sensilla restricted to an apical latero-internal area (Figures 2, 3), and represented by two different types: *a* and *b*. Type *a* sensilla very thin, not split apically (Figure 2a); type *b* sensilla (Figure 2b) thicker than type *a*, not split apically. Specialized sensilla on dorsal side restricted to the apical latero-external and middle area of the specified aa (Figures 4–6) and represented by two different types: *a* similar to *a* of ventral side, but proportionally much shorter (Figures 4, 6a), and *b* similar to *b* of ventral side on aa II (Figure 4b), V, and IX (Figure 5b), but longer and with two very small apical branches on aa. XIII (Figure 6b). Number and distribution of specialized sensilla on ventral and dorsal sides of aa II, V, IX and XIII, as in Table 2.

Cephalic plate. Distinctly longer than wide (length/width ratio *ca.* 1.40:1). Middle part of lateral margins nearly straight to slightly convex; anterior margin

Table 2. Number of type *a* and *b* sensilla on aa II, V, IX and XIII in the female holotype of *Hyphydrophilus minellii* sp. nov.

	Ventral		Dorsal		
	a	*b*	*a*	*b*	Figures
II		1	1	1	4
V	1	1	1	1	
IX	1	1	1	2	2, 5
XIII	1	1	1	3	3, 6

slightly convex at middle, slightly concave at level of the bases of the antennae; posterior margin nearly straight; anterior and posterior sides, curved. Shape and chaetotaxy as in Figure 9.

Clypeus. Two setae located on the clypeal area; posteriorly accompanied by two other setae; and 1 + 1 setae at either side (Figure 7). Clypeal area very small, with sparsely areolate surface. (Compare with Figure 44 illustrating the clypeal area of the female paratype).

Labrum. Mid-piece well developed and pigmented, with 9 short sharp-pointed teeth in the middle and 1 + 1 longer sharply pointed teeth at the sides. Side-pieces with 2 + 2 hyaline filaments (Figure 10).

Tentorium. Internal limb bearing a small slightly sclerotized process directed inwards (Figure 10a). (Compare with Figures 45–47a, illustrating the tentorium of the female paratype).

Mandible. Shape as in Figure 8, pectinate lamella with *ca*. 12 hyaline teeth.

First maxillae. Coxosternite without lappets, telopodites with vestigial lappets. Coxosternite devoid of setae; coxal projections subtriangular, round tipped and provided with 2 + 3 large setae and 1 + 1 small setae (Figure 11). Apical article of telopodites with 2 + 3 large setae on ventral side (Figure 11), and 1 + 1 small sensilla on dorsal side near the external edge.

Second maxillae. Coxosternites medially joined through a narrow, hyaline and non-areolate membranous isthmus only and with 5 + 5 small setae near the internal margins (Figure 11). Antero-internal corners of coxosternites without processes (Figure 11). First and second articles of telopodites with vestigial distoectal processes (Figure 11a); apical claw well developed, a little shorter than the third article, shape as in Figure 12. Chaetotaxy of coxosternites and telopodites as in Figure 11.

Forcipular segment. Telopodites, when extended, attaining the middle part of the aa II (Figure 9). Forcipular tergite trapeziform (Figure 9a), anterior and posterior margins respectively covered by the cephalic plate and the tergite of the first leg-bearing segment; chaetotaxy represented by an irregular transverse row of 11 large and short setae distributed as in Figure 9. Coxosternite with almost complete chitinlines (Figure 13a); anterior border notched in the midline, without denticles (Figures 13, 14). Telopodites: medial edge of trochanteroprefemur apically with a well-developed round-tipped and slightly pigmented tooth (Figures 13–15); proximally near the vestigial suture between trochanter and prefemur with a small unpigmented round pointed denticle (Figures 13, 14). Femur and tibia without denticles. Tarsungulum basally with a well-developed, round tipped and slightly pigmented subtriangular tooth (Figures 13, 15); dorsal and ventral medial edges of forcipular tarsungulum slightly serrate (Figures 9, 13, 15). Calyx of poison gland palmate in shape (Figures 15, 16a). Chaetotaxy of coxosternite and telopodites as in Figure 13.

Metasternites of leg-bearing segments 1 to penultimate. Pore-fields present from metasternite 2 to 16 inclusive, absent in all remaining metasternites. All pore-fields undivided. Shape and relative size of pore-fields changing along the trunk as in Figures 17–31. Number of pores as follows: metasternite 2 (4 pores); 3 (11); 4 (14); 5 (14); 6 (17); 7 (14); 8 (14); 9 (13); 10 (12); 11 (13); 12 (12); 13 (12); 14 (10); 15 (4); 16 (3).

Legs (pair 1 to penultimate). Ratio of length of first pair/length of second pair *ca*. 0.74:1 (relative size as in Figures 32, 33). Legs of pairs 1 to 7–8 with setae of different thickness, which is more evident on pairs 1 to 5 (Figures 32, 33); legs of remaining pairs bearing setae of similar thickness (Figures 34, 36). Distribution, number and relative size of setae as in Figures 32–36. Claws with two thin and pale accessory spines ventrobasally, one anterior (Figures 37, 38a) and one posterior, shorter (Figures 37, 38b).

Ultimate leg-bearing segment. Intercalary pleurites absent at both sides of the ultimate pretergite; ultimate presternite divided along the sagittal plane; length/width of metatergite 0.79:1; length/width of metasternite 0.81:1. Shape and chaetotaxy of metatergite and metasternite as in Figures 39, 40. Coxopleura slightly protruding at distal-internal ventral ends, setae small and numerous distributed on the internal ventral area, the remaining coxopleural surface with few larger setae

(Figures 39, 40). Two single ("homogeneous") coxal organs in each coxopleuron, coxal pores opening near the membrane between coxopleuron and metasternite, partially or totally covered by the latter (Figures 40, 41); internal cuticular structure of coxal organs as in Figure 41 (a: mucous layer, b: contour of lobe). Telopodites of ultimate legs with six somewhat inflated articles, shape and chaetotaxy as in Figures 39, 40. Length of telopodites of ultimate legs/length of metasternite 3.65:1. Ultimate pretarsus unguiform, bearing a single internal spine ventrobasally (Figure 42a).

Postpedal segments. Intermediate tergite with posterior margin strongly convex, bearing a few setae (Figure 39); intermediate sternite seemingly covered by the sternite of the ultimate leg-bearing segment; posterior margin of first genital sternite straight to very slightly concave (Figure 40). Gonopods very poorly developed, vestigial (Figure 40a). Anal organs present (Figure 40b).

Male. Unknown.

Remarks

The adult (and mated) condition of the type specimens is indicated by the presence of spermatozoa in both spermathecae, located at the level of leg-bearing segments 52–54 (Figure 48).

Etymology

The new species is respectfully dedicated to the distinguished colleague, Prof. Dr. Alessandro Minelli (University of Padova, Italy) to express my appreciation for his outstanding contribution to the knowledge of Myriapoda, and many other study areas of life, including Evolutionary Developmental Biology.

Ecology

The specimens were collected in leaf litter in a primary subtropical rainforest environment, located in northwestern Argentina (at about 650 m asl), contiguous to the Baritú National Park and close to the border with Bolivia (biogeographic Yungas province).

Type locality

Argentina: Salta province: Orán Department: *ca*. 25 km northwest of Aguas Blancas.

Known range

Only known from the type locality.

Key to the Neotropical species of *Hyphydrophilus*

1. Female with 59 leg-bearing segments; internal limb of tentorium bearing a small slightly sclerotized process directed inwards (Figures 10a, 45–47a); medial edge of forcipular trochanteroprefemur apically with a well-developed, slightly pigmented tooth (Figures 13–15); dorsal and ventral medial edges of forcipular tarsungulum slightly serrate (Figures 13, 15); sternal pore-fields present on the anterior region of the trunk only ***H. minellii*** sp. nov.
– Female with a maximum of 43 leg-bearing segments; internal limb of tentorium without a process; medial edge of forcipular trochanteroprefemur apically with a small, unpigmented denticle or projection; medial edges of forcipular tarsungulum smooth; sternal pore-fields present all along the body 2
2. Body length 19 mm (female), 16 mm (male); first and second article of telopodites of second maxillae without a distoectal process; sternal pore-fields of posterior region of the trunk divided in two areas; anal organs present ***H. adisi*** Pereira, Minelli & Barbieri, 1994
– Body length 10 mm (female and male); first and second article of telopodites of second maxillae with a distinct distoectal process; sternal pore-fields of posterior region of the trunk undivided; anal organs absent ***H. projectus*** Pereira, Foddai & Minelli, 2000

Discussion

The new species described herein is the first report of the genus *Hyphydrophilus* from Argentina (northwestern region of the country), and the Yungas rainforests; previously, it was only known to occur in Central Amazonia, Brazil, thus the present record represents a remarkable extension of the known range of this taxon.

Hyphydrophilus is one of the geophilid genera including miniature species, and *H. projectus* is only 10 mm long. Extreme body miniaturization evolved repeatedly in the history of the Epimorpha (Lewis 2002; Foddai et al. 2003; Pereira 2013b; Bonato et al. 2015). A detailed account of the epimorphic centipedes, for which the maximum body length measured in adults is 11 mm or less, can be found in Bonato et al.

(2015). Several other species with reduced body size are known to occur for diverse families of the Geophilomorpha (see Crabill 1960; Pereira et al. 1994, 1995, 2000; Foddai & Minelli 1999; Minelli et al. 2000; Foddai et al. 2003; Minelli 2003; Uliana et al. 2007; Pereira 2009, 2011, 2012, 2013a, 2013b, 2013c, 2014a, 2014b; Moretto et al. 2015).

The presence of a small slightly sclerotized process directed inwards in the internal limbs of tentorium of *H. minellii* (Figures 10a, 45–47a) is an unusual trait among geophilids. Similar processes are also present in *Ribautia lewisi* Pereira, 2013, but these latter are distinctly tooth shaped, much more conspicuous and sclerotized (see figures 54–56a in Pereira 2013d). For diverse aspects concerning the preoral chamber in geophilomorph centipedes, see Koch and Edgecombe (2012).

The spermathecae of *H. minellii* (Figure 48) and those of two other tiny geophilids, i.e. *Ribautia paranaensis* Pereira, 2014 (figure 70 in Pereira 2014a), and *R. williamsi* Pereira, 2014 (figure 47 in Pereira 2014b) are conspicuously elongated in shape; conversely those of other diminutive geophilomorph centipedes, *Ityphilus bonatoi* Pereira, 2013 (Ballophilidae) (figure 101 in Pereira 2013c) and *Schendylops ramirezi* Pereira, 2013 (Schendylidae) (figure 27 in Pereira 2013b), are subovoidal in shape and proportionally much smaller. Arrangement of spermatozoa in the spermathecae of the aforementioned taxa also show different particularities (Pereira 2014a). Our current knowledge on morphological features of spermathecae in diverse groups of the Geophilomorpha remains very incomplete, and requires further investigation.

Acknowledgments

The late Domingo Jakúlica provided transportation from the city of Salta to the collecting area in his private property (finca Angosto del Pescado), and made available the best facilities for the fieldwork. An anonymous reviewer and the editor, Anne Zillikens (Universität Tübingen, Germany) helped to improve the manuscript. Hernán L. Pereira and José L. Pereira (La Plata) collaborated in processing the original figures in black ink.

Disclosure statement

No potential conflict of interest was reported by the author.

References

Bonato L, Edgecombe GD, Lewis JGE, Minelli A, Pereira LA, Shelley RM, Zapparoli M. 2010. A common terminology for the external anatomy of centipedes (Chilopoda). Zookeys. 69:17–51.

Bonato L, Minelli A, Drago L, Pereira LA. 2015. The phylogenetic position of *Dinogeophilus* and a new evolutionary framework for the smallest epimorphic centipedes (Chilopoda: Epimorpha). Contr Zool. 84(3):237–253.

Brölemann HW, Ribaut H. 1912. Essai d'une monographie des Schendylina (Myriapodes, Géophilomorphes). Nouv Arch Mus Hist Nat, Paris, Sér. 5. 4(1):53–183.

Brown AD. 1995. Las selvas de montaña del noroeste de Argentina: problemas ambientales e importancia de su conservación. In: Brown AD, Grau AR, editors. Investigación, conservación y desarrollo en selvas subtropicales de montaña. Tucumán (Argentina): Proyecto de Desarrollo Agroforestal-L.I.E.Y. p. 9–18.

Cabrera AL. 1971. Fitogeografía de la Repúblic Argentina. Bol Soc Arg Bot. 14:1–42.

Cabrera AL, Willink A. 1973. Biogeografía de América Latina. Washington: OEA. 120 p. (Serie Biología; 13).

Crabill Jr RE. 1960. Centipedes of the Smithsonian-Bredin Expeditions to the West Indies. Proc U S Nat Mus. 111 (3427):167–195.

Foddai D, Bonato L, Pereira LA, Minelli A. 2003. Phylogeny and systematics of the Arrupinae (Chilopoda Geophilomorpha Mecistocephalidae) with the description of a new dwarfed species. J Nat Hist. 37:1247–1267.

Foddai D, Minelli A. 1999. A troglomorphic geophilomorph centipede from southern France (Chilopoda: Geophilomorpha: Geophilidae). J Nat Hist. 33:267–287.

Foddai D, Minelli A, Pereira LA. 2002. Chilopoda Geophilomorpha. In: Adis J, editor. Amazonian Arachnida & Myriapoda. Sofia: Pensoft Publishers. p. 459–474.

Guilbert É, Montemayor SI. 2010. Tingidae (Insecta, Heteroptera) from the Argentinan Yungas: new records and descriptions of selected fifth instars. Zoosystema. 32 (4):549–565.

Koch M, Edgecombe GD. 2012. The preoral chamber in geophilomorph centipedes: comparative morphology, phylogeny, and the evolution of centipede feeding structures. Zool J Linnean Soc. 165(1):1–62.

Lewis JGE. 2002. The scolopendromorph centipedes of Mauritius and Rodrigues and their adjacent islets (Chilopoda: Scolopendromorpha). J Nat Hist. 36:79–106.

Minelli A. 2003. The development of animal form. Ontogeny, morphology, and evolution. Cambridge: Cambridge University Press. 323 p.

Minelli A, Foddai D, Pereira LA, Lewis JGE. 2000. The evolution of segmentation of centipede trunk and appendages. J Zool Syst Evol Res. 38:103–117.

Moretto M, Minelli A, Fusco G. 2015. Cell size versus body size in geophilomorph centipedes. The Science of Nature. 102:16.

Pereira LA. 2000. The preparation of centipedes for microscopical examination with particular reference to the Geophilomorpha. Bull Br Myriap Group. 16:22–25.

Pereira LA. 2005. A new geophilid centipede of the genus *Eurytion* Attems, 1903 from north-western Argentina (Chilopoda: Geophilomorpha: Geophilidae). Zootaxa. 794:1–12.

Pereira LA. 2007. First record of *Ribautia* Brölemann, 1909 from Argentina, with description of *R. jakulicai* sp. n. a

new Neotropical member from the Yungas with coxal organs grouped in clusters (Myriapoda: Chilopoda: Geophilomorpha). Stud Neotrop Fauna Environ. 42 (2):155–168.

Pereira LA. 2009. A new dwarf species of the genus *Strigamia* Gray, 1843 from the Southern Appalachian Mountains of Western Virginia (Chilopoda: Geophilomorpha: Linotaeniidae). In: Roble SM, Mitchell JC, editors. A lifetime of contributions to myriapodology and the natural history of Virginia: A Festschrift in honor of Richard L. Hoffman's 80th birthday. Martinsville (VA): Virginia Museum of Natural History. p. 209–222. [Special Publication No. 16]

Pereira LA. 2011. A further contribution to the knowledge of *Pectiniunguis minutus* (Demange, 1968), a little known dwarf Schendylid centipede from western equatorial Africa (Chilopoda: Geophilomorpha). Pap Avul Zool. 51 (20):307–323.

Pereira LA. 2012. A new dwarf species, new distribution records, and supplementary descriptive notes of the centipede genus *Ityphilus* Cook, 1899 (Chilopoda: Geophilomorpha: Ballophilidae) from central Amazonia, Brazil. Pap Avul Zool. 52(25):291–309.

Pereira LA. 2013a. A new species of *Ityphilus* (Chilopoda: Geophilomorpha: Ballophilidae) from the tropical rainforest of French Guiana, northern South America. Stud Neotrop Fauna Environ. 48(1):13–24.

Pereira LA. 2013b. Discovery of a second geophilomorph species (Myriapoda: Chilopoda) having twenty-seven leg-bearing segments, the lowest number recorded up to the present in the centipede order Geophilomorpha. Pap Avul Zool. 53(13):163–185.

Pereira LA. 2013c. Further contribution to the knowledge of *Ityphilus calinus* Chamberlin, 1957, a poorly known ballophilid centipede from Colombia, with description of *Ityphilus bonatoi*, a new diminutive geophilomorph species from Brazil (Myriapoda: Chilopoda: Geophilomorpha). Zootaxa. 3716(4):501–527.

Pereira LA. 2013d. *Ribautia lewisi* sp. nov., a new centipede from Argentina with unusual tentorial process (Chilopoda: Geophilomorpha, Geophilidae). Zootaxa. 3630(2):225–242.

Pereira LA. 2014a. First report of geophilid centipedes of the genus *Ribautia* (Myriapoda: Chilopoda: Geophilomorpha) from the Atlantic Forest biome, with description of a new miniature species from Misiones Province, Northeastern Argentina. Zootaxa. 3779(4):433–455.

Pereira LA. 2014b. A new species of *Ribautia* Brölemann, 1909 (Chilopoda: Geophilomorpha: Geophilidae) from Peruvian Amazonia, with a key to the Neotropical species of the genus with coxal organs grouped in clusters. Stud Neotrop Fauna Environ. 49(2):114–126.

Pereira LA, Foddai D, Minelli A. 2000. New taxa of Neotropical Geophilomorpha (Chilopoda). Amazoniana. 16(1–2):1–57.

Pereira LA, Minelli A, Barbieri F. 1994. New and little known geophilomorph centipedes from Amazonian inundation forests near Manaus, Brazil (Chilopoda: Geophilomorpha). Amazoniana. 13(1–2):163–204.

Pereira LA, Minelli A, Barbieri F. 1995. Description of nine new centipede species from Amazonia and related matters on Neotropical geophilomorphs (Chilopoda: Geophilomorpha). Amazoniana. 13(3–4):325–416.

Prado DE. 1995. Selva pedemontana: contexto regional y lista florística de un ecosistema en peligro. In: Brown AD, Grau HR, editors. Investigaciones, Conservación y Desarollo en Selvas Subtropicales de montaña. Tucumán: Laboratorio de Investigaciones Ecológicas de las Yungas (UNT). p. 19–52.

Uliana M, Bonato L, Minelli A. 2007. The Mecistocephalidae of the Japanese and Taiwanese islands (Chilopoda: Geophilomorpha). Zootaxa. 1396:1–84.