



## Two new species of the enigmatic genus *Stenophareus* (Opiliones: Laniatores: Stygnidae) from the Venezuelan Guiana Shield

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### Abstract

Two new species of *Stenophareus* are described from the Guiana Shield region of Venezuela. *S. aonda* **sp. n.** (type-locality: Auyán-tepui, Bolívar) is characterized by ocular and tegumentary depigmentation and by extreme pedipalp and leg elongation, representing the first troglomorph stygnid. *S. guerreroi* **sp. n.** (type-locality: Chimantá-tepui, Bolívar) is distinguished by a swollen proximal-most tarsomere of leg I and by the presence of an anterior tubercle on the anal opercle. Putative phylogenetic affinities of the genus *Stenophareus* within the Stygninae are discussed.

### Resumen

Se describen dos especies nuevas del género *Stenophareus* provenientes de la región del escudo guayanés de Venezuela. *S. aonda* **sp. n.** (localidad tipo: Auyán-tepui, Bolívar) es caracterizado por depigmentación ocular y del tegumento y pedipalpo y patas extremadamente largos, representando el primer estígnido troglomorfo. *S. guerreroi* **sp. n.** (localidad tipo: Chimantá-tepui, Bolívar) es diagnosticado por el engrosamiento del tarsómero más proximal de la pata I y presencia de un tubérculo anterior en el opérculo anal. Las afinidades filogenéticas putativas del género *Stenophareus* dentro de la subfamilia Stygninae son discutidas.

**Key words:** Arachnida, Stygninae, *Phareus*, taxonomy, biospeleology, tepuys

### Introduction

Laniatorean harvestmen are mostly nocturnal arachnids, frequently associated to humid habitats. These characteristics probably facilitate colonization of hemiedaphic and hypogean environments, as suggested by their relatively common presence in karstic systems. A total of 24 species of Laniatores have been recorded for a great number of caves in Venezuela (Pérez & Mendes 2003). Among these, only two troglobitic species are known: *Trinella bordoni* (Muñoz-Cuevas) (Agoristenidae) from Cueva Francisco Zea in the karstic region of Perijá, northwestern Venezuela and *T. troglobia* Pinto-da-Rocha from Cueva de los Laureles, which also lies in the Perijá region. Two other undescribed species of the family Stygnommatidae with clear adaptations to hypogean life were reported by Pérez & Mendes (2003) for the Andean foothills and the coastal range.

In the present work we describe two new stygnid species from the mountains Auyán-tepui and Chimantá-tepui in the Venezuelan Guiana Shield and we place them in *Stenophareus* Goodnight & Goodnight, a poorly known genus of the subfamily Stygninae. This genus previously included only a single species, *S. roraimus*

Goodnight & Goodnight, from the summit of Roraima-tepui, which is also located in the Guiana Shield. One of the new species represents the first stygnid exhibiting truly troglomorphic characters: depigmentation of eyes and tegument, and elongation of appendages.

## Material and methods

The material examined is deposited in the Opiliones collection of the Museo de Historia Natural La Salle (MHNLS IV). Measurements were taken with an ocular micrometer and are expressed in millimeters. Illustrations were made under a stereomicroscope with camera lucida attachment. Mesotergal areas refer to areas I–IV of the opisthosomal part of the dorsal scute (not including area V). Cheliceral segments II and III are herein referred to as the hand. Setiferous tubercles (i = small, I = large) on pedipals are given in proximal to distal order. In the tarsal formula the number of articles comprising the distitarsus (=distal group of tarsalia) is added in parentheses; hyphens denote missing legs. Subparallel condition of tarsal claws III and IV refers to claws almost parallel to each other, following the definition proposed by Pinto-da-Rocha (1997). Terminology of genital structures and associated setae, and their delimitations, follow Pinto-da-Rocha (1997).

Abbreviations: APW, anterior prosoma margin width; Ba, basichelicerite; Co, coxa; DSL, dorsal scute length; Fe, femur; Ha, hand; ID, interocular distance; MDW, maximum dorsal width; MF, movable finger; Mt, metatarsus; Pa, patella; PL, prosoma length; Ta, tarsus; Ti, tibia; Tr, trochanter.

## Taxonomy

### *Stenophareus aonda* Villarreal, DoNascimento & Rodríguez, sp. n.

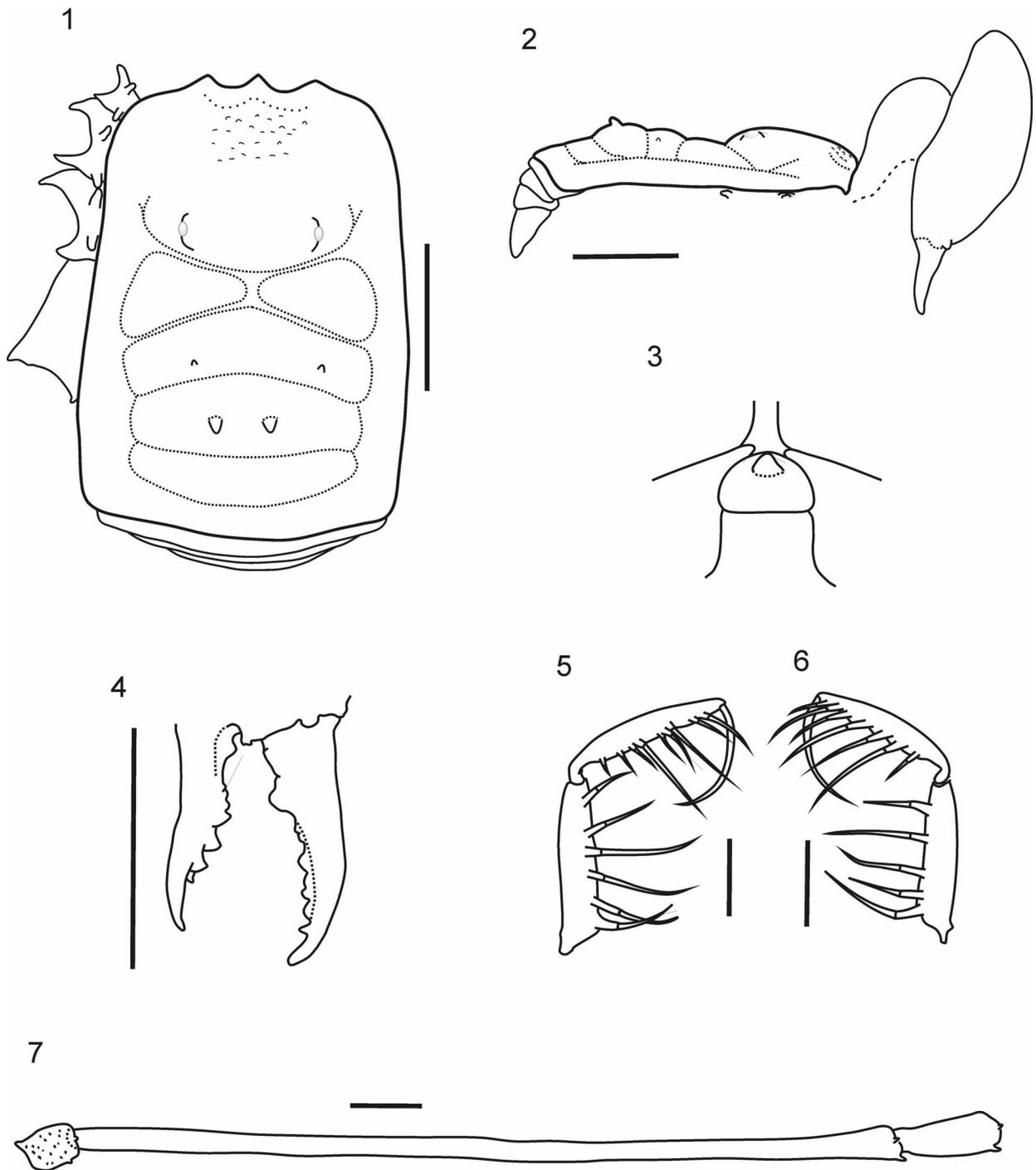
Figs 1–7, 15–17

**Type material.** Male holotype (MHNLS IV-230), Venezuela, Bolívar State, Auyán-tepui, 1650 m; 21 August 1992; leg. Giuliano Trezzi. Paratypes: 2 males (MHNLS IV-228, MHNLS IV-229); 1 female (MHNLS IV-231); all collected together with the holotype.

**Etymology.** A name in apposition, in reference to the cave system Aonda Superior, where the types were collected.

**Diagnosis.** This species is distinguishable from the other two congeneric species by completely depigmented eyes and tegument (vs eyes and tegument with pigmentation), elongated pedipals (pedipalp length/DSL: 5.98 vs 2.83 and 1.41 for *S. guerreroi* sp. n. and *S. roraimus*, respectively) and elongated legs (I/DSL: 6.23 vs 4.44 and 1.81; II/DSL: 17.67 vs 9.03 and 3.21; III/DSL: 9.8 vs 5.86 and 2.36; IV/DSL: 13.12 vs 7.5 and 3.17), dorsal scute rectangular (vs slightly wider between grooves I–II), genital opercle with a large and conspicuous tubercle (vs no tubercles on genital opercle) and anterior area of prosoma granular (vs smooth). The new species is further distinguished from *S. guerreroi* sp. n. by the disposition of basal setae of the penis (aligned vs not aligned) and from *S. roraimus* by the size of the spines on mesotergal area III (reduced to small tubercles in *S. aonda* sp. n. vs well-developed in *S. roraimus*), absence of dorsal tubercles of coxa IV and ornamentation of femur IV (smooth vs with two ventral rows of tubercles).

**Description of male (holotype).** Dorsum (Figs 1–2). Anterior margin of dorsal scute smooth, area behind it granular. Eye mounds widely separated from each other, adjacent to posterior margin of prosoma. Four mesotergal areas in dorsal scute. Mesotergal areas I and IV unarmed, II with a pair of granules, III with a pair of small tubercles. Posterior margin of dorsal scutum with several minute setiferous granules. Free tergites smooth. Coxae I–III each with two tubercles.



**FIGURES 1–7.** *Stenophareus aonda* sp. n., male holotype (1–3, 5–7), male paratype (4). 1. Dorsal scute: dorsal view. 2. Same: lateral view. 3. Genital opercle: external view. 4. Cheliceral fingers: frontal view (MHNLS IV-228) 5. Right pedipalp: ectal view. 6. Same: mesal view. 7. Trochanter, femur and patella of right leg IV: dorsal view. Scale bars 1 millimeter.

Venter. Coxa I with a median row of 6–7 tubercles and two distal tubercles; coxa II with a median row of 5–7 small granules and with 1–2 granules distally; coxa III with a median row of 3–4 setiferous granules, 2–3 anterior granules and two distal granules. Free sternites with rows of minute setae. Genital opercle with a large anterior tubercle (Fig. 3).

Chelicera (Fig. 2). Basichelecerite elongated and distally swollen. Fixed finger with five conspicuous and three inconspicuous teeth. Movable finger with a large proximal tooth followed by seven smaller teeth, the distal-most of them high and triangular.

Pedipalp (Figs 5–6). Coxa with a dorsoproximal tubercle. Trochanter unarmed. Femur unarmed, straight and extremely long (DSL/pedipalpal femur length: 0.44), its distal region swollen and curved. Patella very long (DSL/pedipalpal patella length: 0.53) and distally swollen. Tibia elongated, ectal with iiii (3=4>1=2>5>6); mesal with liili (4>1>3>5>2). Tarsus ectal with iiiiii (4>7>9>6=8>5>3=2>1); mesal with iiii (4=2>6>3>5=7>1).

Legs (Fig. 7). Trochanters I–IV with minute dorsal granules. Femora I–IV with longitudinal rows of minute setiferous granules, III–IV each with two dorsodistal tubercles, the retrolateral one largest. Patellae I–III each with a distal tubercle; IV with two distal tubercles. Tibiae, metatarsi and tarsi I–IV unarmed. Tarsal articles cylindrical, long and without scopula. Claws subparallel and smooth. Tarsal process well-developed. Tarsal formula (from leg I to IV): 10(3)/-6-7/7.

Penis (Figs 15–17). Apex of truncus with three long basal setae aligned in an oblique row on each side. Ventral plate on each side with three long distal setae close to each other, plus one long seta situated more ventrally and one short seta intermediate to the group of three setae; lateral margins slightly concave; distal margin with a wide U-shaped cleft. Glans without dorsal process.

Coloration. Uniformly light yellowish brown, slightly darker on posterior border of prosoma and dorsal surface of leg coxae. Eyes depigmented. Pedipalp, tibiae, patellae, metatarsi and tarsi of legs lighter.

**Female.** As the male; no sexual dimorphism discernible.

**Intraspecific variation.** Mesotergal area II with 1–2 dorsolateral granules. Coxa I with 4–7 median tubercles ventrally and 1–2 tubercles dorsally. Distal tubercle on patellae I–III present or absent.

### ***Stenophareus guerreroi* Villarreal & DoNascimento, sp. n.**

Figs 8–14, 18–20

**Type material.** Male holotype (MHNLS IV-245), Venezuela, Bolívar State, Chimantá-tepui; leg. Charles Brewer-Carías & Ricardo Guerrero.

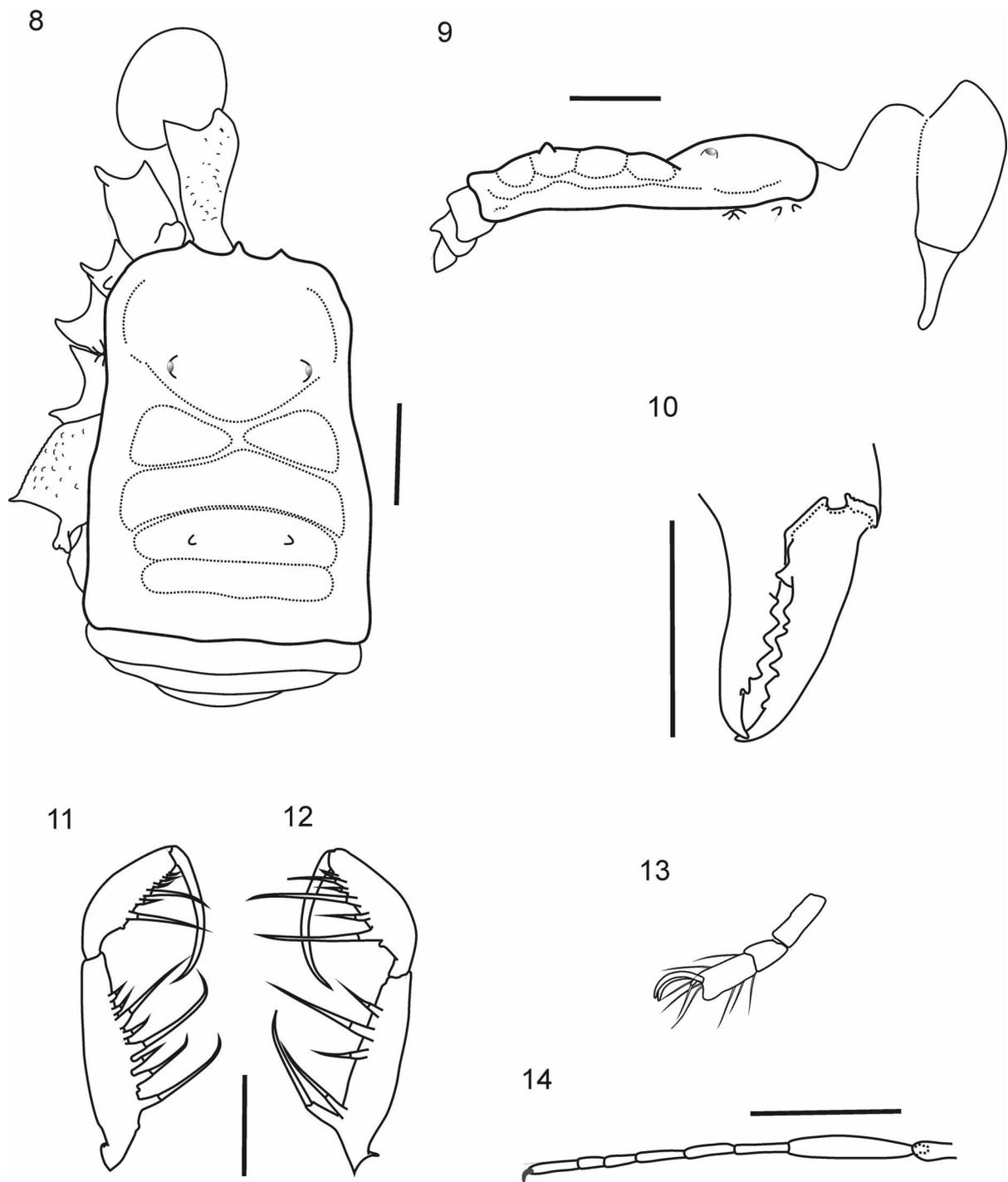
**Non type material.** 1 juvenile (MHNLS IV-246), collected together with the holotype.

**Etymology.** This species is dedicated to Ricardo Guerrero for providing the specimens examined, for his significant collecting efforts and for his contributions to our knowledge of the tepuy fauna.

**Diagnosis.** *Stenophareus guerreroi* sp. n. is distinguished from *S. aonda* sp. n. by eyes and tegument pigmented, mesotergal area II smooth, proximal-most tarsal article of leg I swollen, and dorsal-most seta of basal row on apex penis situated clearly more proximally than all others. The new species can be separated from *S. roraimus* by the size and orientation of spines on mesotergal area III (reduced to two small upright tubercles in *S. guerreroi* sp. n. vs strongly developed and pointing backwards in *S. roraimus*), dorsal tubercle on coxa IV absent, number of tarsomeres on legs I/II (7/26 vs 6/16) and wide black spots behind prosoma absent.

**Description of the male (holotype).** Dorsum (Figs 8–9). Dorsal scute rectangular, widest at mesotergal area II, without granules in anterior portion. Mesotergal areas I, II and IV, and anal opercle smooth. Mesotergal area III with two small tubercles. Free tergites unarmed. Coxa I with one tubercle; coxa II with one proterodorsal and one retrolateral tubercle; coxa III with one prolateral tubercle in contact with prolateral tubercle of coxa II; coxa IV with one retrolateral tubercle fused to first opisthosomal sternite.

Venter. Coxa I with one anterior tubercle, four median and four distal granules; coxa II with 5–6 median and three distal granules; coxa III with 7–8 median granules, distally unarmed. Free sternites each with a row of minute granules. Genital opercle with a low protuberance carrying five granules (three anteriors and two posteriors) associated to bases of setae.



**FIGURES 8–14.** *Stenophareus guerreroi* sp. n., male holotype. 8. Dorsal scute: dorsal view. 9. Same: lateral view. 10. Cheliceral fingers: frontal view. 11. Right pedipalp: ectal view. 12. Same: mesal view. 13. Distal tarsal articles of right leg IV: prolateral view. 14. Right tarsus of leg I: prolateral view. Scale bars 1 millimeter.

Chelicera (Figs 9–10). Basicheicerite elongated and distally swollen, dorsal surface granulated. Hand globose and elongated, with a frontal granule. Fixed finger with five triangular median teeth. Movable finger with a large proximal tooth followed by six smaller teeth, the first of them low and wide, the next one small and triangular, the two following ones large and triangular, and the two distal ones low and wide.

Pedipalp (Figs 11–12). Coxa with a widened dorsoproximal process and ventral tubercles (proximal one largest). Trochanter with a small dorsal granule and two ventral tubercles. Femur and patella elongated and

unarmed. Tibia ectal with IiiIiii (1>4>6>2>3>5>7>8); mesal with IiIiI (1>4>2>3=5). Tarsus ectal with a proximal granule and IiIiii (1>3>2=5>4>6); mesal with IiIiI (3>1>5>2>4>6).

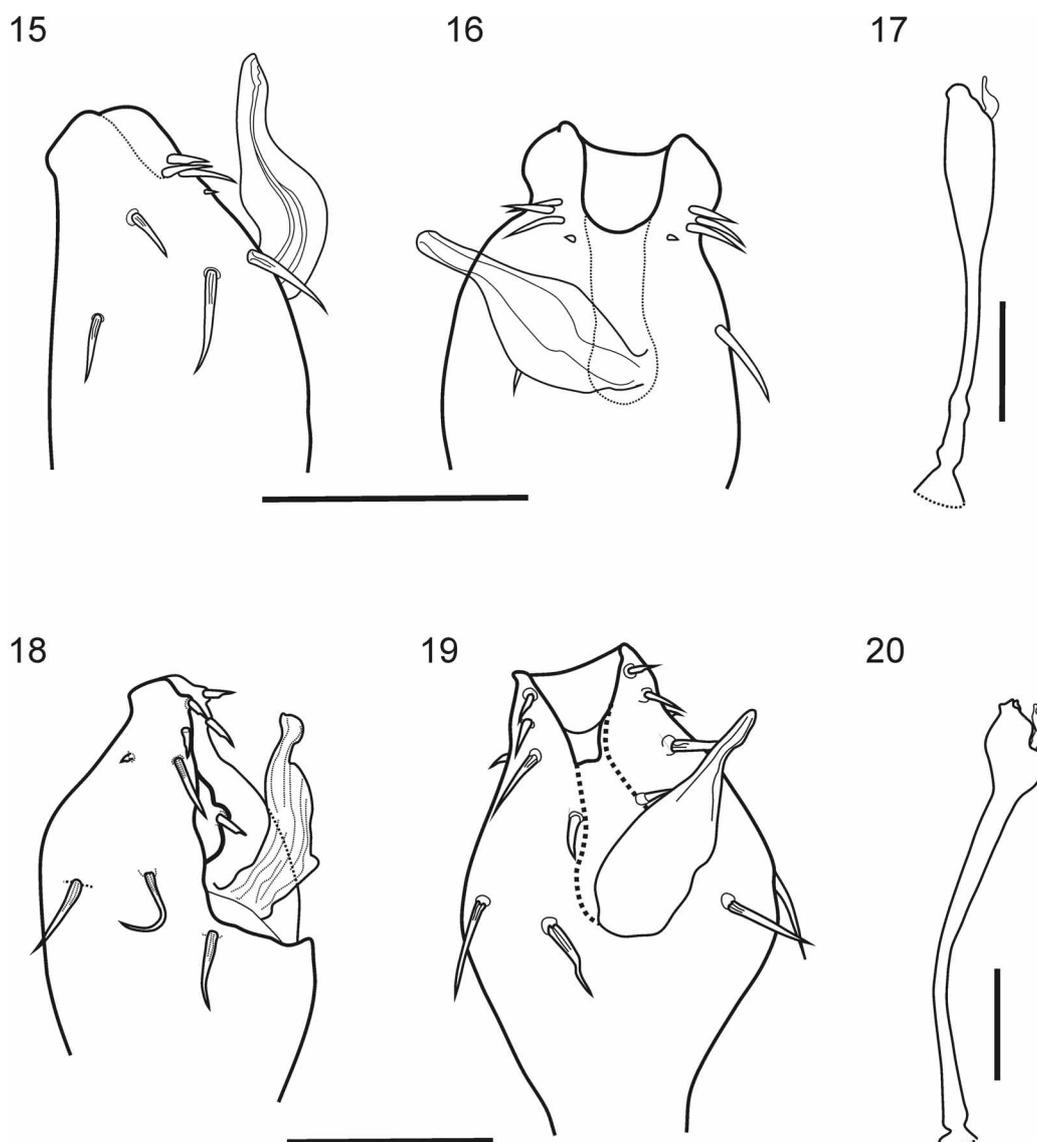
Legs (Figs 13–14). Trochanter I with 3–4 ventral granules; trochanter II with three ventral granules; trochanter IV with a ventroproximal granule and two ventrodiscal granules. Femora, patellae and tibiae I–IV unarmed. Proximal-most tarsal article of leg I swollen, others cylindrical. All tarsal articles long and without scopula. Claws subparallel and smooth. Tarsal process well-developed (Fig. 13).

Tarsal formula (from leg I to IV): 7(3)/26(3)/6/7.

Penis (Figs 18–20). Apex of truncus with three basal setae on each side, the dorsal seta clearly located below the level of the other two setae. Ventral plate with three distally aligned setae on each side, plus one small seta situated more ventrally and one seta intermediate to the basal group of setae; lateral margins slightly concave; distal margin with a wide U-shaped cleft. Glans without dorsal process.

Coloration. Dorsal scute uniformly light brown, lateral and posterior margins slightly darker. Free tergites and sternites dark brown. Chelicerae, pedipalps and legs I–II yellowish brown, with greenish brown reticulation; cheliceral fingers dark brown. Legs III–IV reddish brown.

**Female.** Unknown.



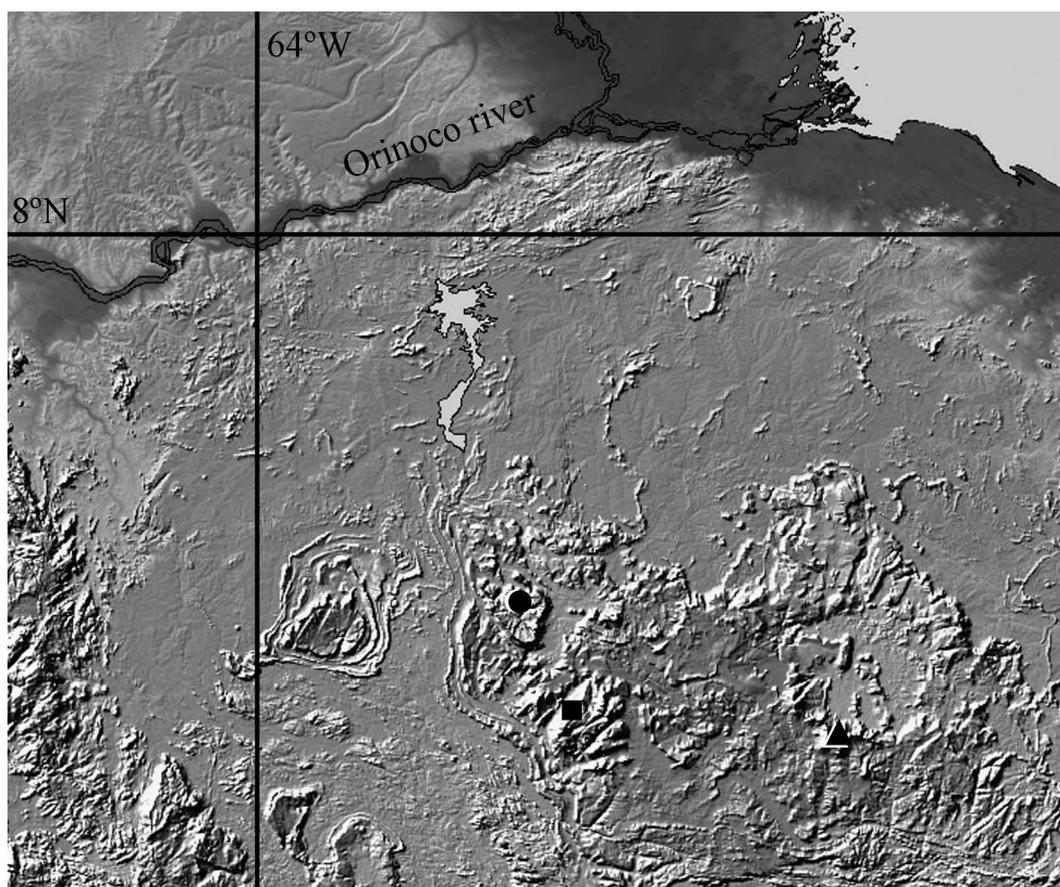
**FIGURES 15–20.** *Stenophareus aonda* sp. n., male holotype (15–17); *Stenophareus guerreroi* sp. n., male holotype (18–20). 15, 18. Distal part of penis: lateral view. 16, 19. Same: dorsal view. 17, 20. Total penis: lateral view. Scale bars 500 micrometers.

## Discussion

The genus *Stenophareus* is a member of the family Stygnidae as seen from its widely separated eyes, its rectangular dorsal scute, and its long pedipalpal coxa and long and thin pedipalpal femur. This genus was included in the subfamily Stygninae by Pinto-da-Rocha (1997). *Stenophareus* was described on the basis of a single female specimen. As most characters used to define phylogenetic relationships and delimit monophyletic groups within Opiliones are based on male genitalia, the lack of male specimens of *S. roraimus* rendered it impossible in Pinto-da-Rocha analysis (1997) to establish its systematic position and its relationships with the remaining stygnines. The genus *Stenophareus* was diagnosed in the same work using only plesiomorphic and widespread characters. Our placement of the new species in *Stenophareus* is based on morphological similarities with *S. roraimus* and on geographical proximity with that species. The new species share with *S. roraimus* a very generalized morphological pattern with four mesotergal areas and with dorsal scute ornamentation restricted to only two spines (*S. roraimus*) or tubercles (*S. aonda* **sp. n.** and *S. guerreroi* **sp. n.**) on area III. *S. aonda* **sp. n.** additionally possesses 1–2 minute granules on area II. Another similarity between *S. roraimus* and *S. guerreroi* **sp. n.** is found in the shape of the lateral margin of the dorsal scute. These two species have the dorsal scute widest between mesotergal grooves I and II. Each of the three species has been collected from a different mountain summit (Fig. 21) pertaining to the system of tepuys of the Guiana Shield. Multiple examples of various terrestrial groups (e.g., Anura: *Myersiophyla*, *Oreophrynella*; Squamata: *Adercosaurus*, *Riolama*) support the hypotheses that the Guiana Shield constitutes a real biogeographic unit (Cracraft 1985, McDiarmid & Donnelly 2005).

**TABLE 1.** *Stenophareus aonda* **sp. n.** and *S. guerreroi* **sp. n.** Measurements of dorsal scute, chelicerae and pedipalps expressed in millimeters.

Dorsal scute	<i>Stenophareus aonda</i>		<i>Stenophareus guerreroi</i>
	Male holotype MHNLS IV 230	Female paratype MHNLS IV 231	Male holotype MHNLS IV 245
DSL	3	3	3.6
PL	1.3	1.3	1.6
APW	1.9	1.7	2.2
MDW	2.2	2.2	2.6
ID	0.9	0.8	1.8
Chelicera			
Ba	1.4	1.5	1.8
Ha	1.7	1.8	2.5
MF	0.7	0.8	1.1
Pedipalp			
Co	1.2	1.2	0.8
Tr	0.8	0.8	0.8
Fe	6.7	6.8	3.3
Pa	5.7	5.6	1.9
Ti	1.7	1.8	2.0
Ta	1.8	1.9	1.4
Total	17.9	18.1	10.2



**FIGURE 21.** The Venezuelan Guiana Shield region showing the type localities of *Stenophareus aonda* sp. n. in Auyan-tepui (circle), *S. guerreroi* sp. n. in Chimantá-tepui (square) and *S. roraimus* in Roraima-tepui (triangle). Map based on shaded relief image PIA03388, Shuttle Radar Topography Mission, National Aeronautics and Space Administration (NASA).

**TABLE 2.** *Stenophareus aonda* sp. n. and *S. guerreroi* sp. n. Measurements of legs expressed in millimeters.

	<i>Stenophareus aonda</i>								<i>Stenophareus guerreroi</i>			
	Male holotype MHNLS IV 230				Female paratype MHNLS IV 231				Male holotype MHNLS IV 245			
Leg	I	II	III	IV	I	II	III	IV	I	II	III	IV
Tr	0.5	0.8	0.9	0.9	0.4	0.8	0.9	0.7	0.8	0.9	0.9	0.9
Fe	4.5	12.7	8.2	12.3	4.6	12.5	7.6	11.4	3.8	7.2	5.4	7.3
Pa	0.6	1.1	0.9	1.7	0.5	1.3	1.5	1.5	1.1	1.2	1.5	1.4
Ti	4.3	13.3	5.3	7.1	4.2	13.9	5.1	6.8	2.8	6.4	3.5	4.8
Mt	7.4	16.0	10.5	16.0	7.8	19.6	9.9	15.4	4.8	8.3	6.6	8.8
Ta	2.6	3.7	4.1	4.9	?	10.3	3.9	?	2.7	8.5	3.2	3.8
Total	19.9	47.6	29.9	42.9	?	58.4	28.9	?	16.0	32.5	21.1	27.0

No evidence for a unique derived character was found that would enable a phylogenetic evaluation of *Stenophareus* or place the new species in any of the other nominal genera. The presence of four mesotergal areas and of a tarsal process (“pseudonychium” according to other authors; see Fig. 13)—both characters presumably plesiomorphic—suggest a basal position within the Stygninae. Our comparative analysis of genital

characters indicates a sister group relationship between *Stenophareus* and *Phareus*, which is consistent with the proposed basal position of *Phareus* in Stygninae (see Pinto-da-Rocha 1997). Both genera have a wide U-cleft in the distal margin of the ventral plate of the truncus penis, a unique condition in the family and initially proposed as an autapomorphic character for *Phareus* (Pinto-da-Rocha 1997). The lack of a dorsal process on the glans is also shared by *Phareus* and *Stenophareus*, a condition homoplasiically found also in the stygnid genus *Auranus* (see Pinto-da-Rocha 1997). One could include the new species in *Phareus*, but this appears unpractical given the high morphological distinctiveness of species currently assigned to *Phareus* and the well established monophyly of this genus (Pinto-da-Rocha 1997, Villarreal & Rodríguez 2006).

*Stenophareus aonda* **sp. n.** exhibits morphological characters commonly associated with a hypogean habitat, e.g., depigmentation of tegument and eyes, and elongation of pedipalps and legs. The first two characters were observed in hemiedaphic opilionids of the family Guasiniidae (González-Sponga 1997, Pinto-da-Rocha & Kury 2002), but elongation of appendages has not been recorded for species living in leaf litter. We have no detailed information on the habitat in which the types of *S. aonda* **sp. n.** were found. Label data accompanying these specimens indicate the following: “Venezuela, estado Bolívar, Canaima National Park, Auyán-Tepui (4°55'48"N, 61°04'25"W), sistema Aonda Superior (1650 m)”. This allows us to associate the types of *S. aonda* **sp. n.** with material of *Brotochactas trezzi* (Vignoli & Kovaric), a troglomorph scorpion also collected by Trezzi on the same date (Vignoli & Kovaric 2003). This circumstantial evidence and the evident troglomorphisms of *Stenophareus aonda* **sp. n.** let us assume that this species lives in the same cave system as *B. trezzi*.

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