AMERICAN MUSEUM NOVITATES

Number 4050, 14 pp. February 27, 2026

# *Phrynus abstrusus*, a New Troglophilous Whip Spider (Amblypygi: Phrynidae) from Southern Texas

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ABSTRACT

The arachnid order Amblypygi Thorell, 1883, currently comprises 299 described species in 18 genera and five families, a surprisingly low diversity compared to other globally distributed arachnid orders. The genus *Phrynus* Lamarck, 1801, the most speciose genus of the Neotropical family Phrynidae Blanchard, 1852, is one of several amblypygid genera that contain much undescribed diversity. For example, its type species, *Phrynus operculatus* Pocock, 1902, allegedly distributed from southern Texas to Guatemala, appears to represent a complex of more range-restricted cryptic species. Existing records suggest a disjunction in the distribution of *P. operculatus*, with the Texan population separated from Mexican populations by considerable distance and a potential barrier of unsuitable desert habitat. The recent collection and examination of new material from the Big Bend area of southern Texas revealed that the Texan population is not conspecific with typical *P. operculatus* material from Mexico and Central America. It differs from the latter in being almost entirely depigmented and is the third troglomorphic species of *Phrynus*. The morphology and habitat of this unusual troglophilous species, named *Phrynus abstrusus*, sp. nov., are described herein.

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 ISSN 0003-0082

## INTRODUCTION

The order Amblypygi Thorell, 1883, also known as whip spiders (Weygoldt, 2000), is an ancient lineage of tetrapulmonate arachnids, which have remained remarkably conserved in body plan and life history since evolving almost 315 million years ago (Garwood et al., 2017). There are currently 299 described species of Amblypygi, in 18 genera and five families (Prendini, 2025), a surprisingly low diversity compared with other globally distributed arachnid orders (Harvey, 2003, 2007). Much progress has been made in the classification of whip spiders in the 130 years since the first comprehensive treatments of their systematics were presented (Kraepelin, 1895, 1899). In common with several amblypygid families (Prendini et al., 2005), the Neotropical family Phrynidae Blanchard, 1852, contains much undescribed diversity, especially in the genera *Paraphrynus* Moreno, 1940, and *Phrynus* Lamarck, 1801 (Seiter et al., 2020; Cazzaniga and Prendini, 2024).

*Phrynus* is the most speciose genus of Phrynidae, with 41 described species (Prendini, 2025). Its type species, *Phrynus operculatus* Pocock, 1902, allegedly distributed from southern Texas to its type locality in Guatemala, is one of many widespread species that probably represent complexes of more range-restricted cryptic species (Quintero, 1981; Chirivi Joya, 2021). Existing records suggest a disjunction in the distribution of this species, with the Texan population separated from Mexican populations by considerable distance and a potential barrier of unsuitable desert habitat (Quintero, 1981; Harvey, 2007). The recent collection and examination of new material from the Big Bend area of southern Texas (figs. 1–3) revealed that the Texan population is not conspecific with typical *P. operculatus* material from Mexico and Central America. It differs from the latter in being almost entirely depigmented (figs. 3B, 4) and is the third troglomorphic species of *Phrynus*. The morphology and habitat of this unusual troglophilous species, named *Phrynus abstrusus*, sp. nov., are described herein.

## MATERIAL AND METHODS

Fieldwork: Specimens were collected between 9 p.m. and 3 a.m. during the new moon in the first week of August, 2023, from crevices and a small cavern in road cuts, i.e., vertical cliff faces created by road excavations (figs. 2, 3A). Material, preserved in 70% ethanol for morphological examination and 95% ethanol for DNA isolation, was deposited in the collections of the American Museum of Natural History (AMNH), New York, and the Ambrose Monell Cryocollection for Molecular and Microbial Research (AMCC) at the AMNH.

Microscopy and Imaging: Specimens were imaged using a Microptics™ ML-1000 digital photomicrography system. Morphological examination of specimens was conducted using a Nikon SMZ 1500 stereoscope.

Morphology: Diagnostic characters and morphology follow Seiter et al. (2020) and Cazzaniga and Prendini (2024). Spine terminology was based on primary spination; i.e., spines which were consistently observed. The following abbreviations are used: sp = basitarsus; F1–F6 = femur, dorsal spines 1–6; FI–FVI = femur, ventral spines 1–6; T1–T8 = tibia, dorsal spines 1–8; TI-TVI = tibia, ventral spines 1–6; sp1–sp3 = basitarsus, dorsal spines 1–3; spI, spII, spIII = basitarsus, ventral spines I, II, and III.

Mapping: The distribution map was generated using ArcGIS (https://www.arcgis.com) from records on iNaturalist (https://www.inaturalist.org) and collection localities georeferenced with a portable Garmin 64s GPS Navigation System during fieldwork. Coordinates of collection localities for the new species are given at the accuracy of degrees and minutes only to prevent collection for private or commercial purposes.

## COMPARATIVE MATERIAL EXAMINED

*Phrynus noeli* Armas and Pérez González, 1994: **CUBA: Pinar del Río:** *Municipio de Viñales*: Viñales, Cueva Santo Tomas,

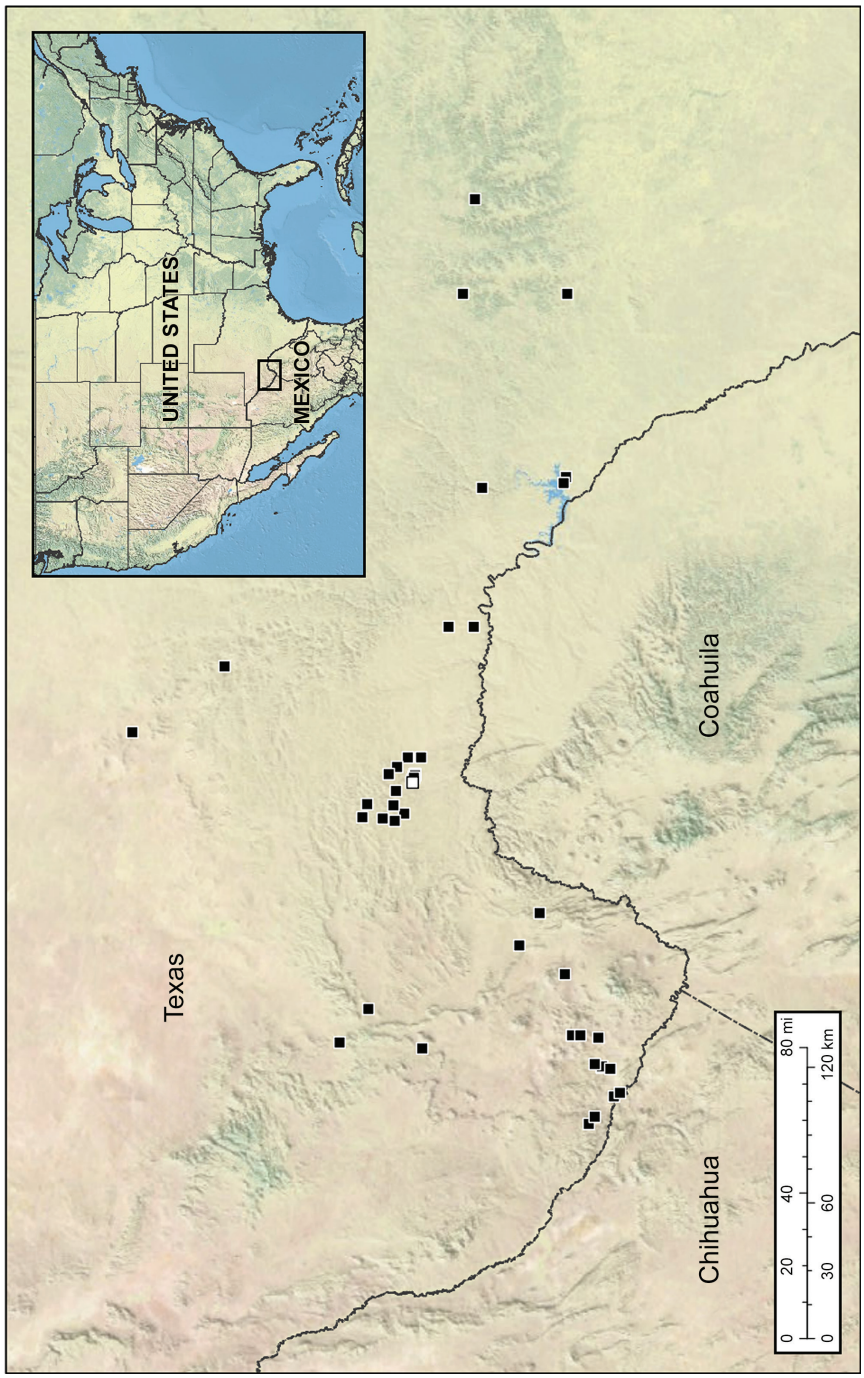


FIGURE 1. Map of southern Texas and northern Mexico, plotting known distribution of *Phrynus abstrusus*, sp. nov. (black squares), with type locality denoted by white square.


FIGURE 2. *Phrynus abstrusus*, sp. nov., habitat near Terlingua, Texas, **A.** road cut and **B.** limestone crevices.


FIGURE 3. *Phrynus abstrusus*, sp. nov. **A.** Microhabitat, cavern near Terlingua, Texas. **B.** Paratype ♂ (AMNH), Sanderson, Texas, habitus in life.

22°32′50.5″N 83°50′33.2″W, 167 m, 8.ii.2013, M. Seiter, 1 juv. (AMNH).

*Phrynus operculatus* (Pocock, 1902): **MEXICO: Oaxaca:** *Municipio de Tehuantepec*: Tehuantepec [16°19′N 95°14′W], 23–27.x.1939, C.M. Bogert and H.E. Volkes, 1 ♂, 1 juv. ♀ (AMNH). **Sinaloa:** *Municipio de Culiacán*: Culiacán [24°40′N 107°26′W], 5 mi. SW, 26.xi.1939, C.M. Bogert and H.E. Volkes, 1 ♂, 2 ♀ (AMNH) **Nayarit:** San Blas [21°33′N 105°17′W], 4–5.ix.1947, C. Goodnight and B. Malkin, 3 ♂, 5 ♀ (AMNH).

## SYSTEMATICS

### Family Phrynidae Thorell, 1883

### Genus *Phrynus* Lamarck, 1801

### ***Phrynus abstrusus***, sp. nov.

Figures 1–9

Type Material: Holotype ♀ (AMNH), **U.S.A.: Texas:** *Terrell Co.*: Sanderson Canyon, 0.4 mi. NW turnoff to 5 Mile Road on US 90 to Dryden, 30°04′N 102°21′W, ca. 810 m, 1.viii.2024, N. Cazzaniga, from rock crevice. Paratypes: **U.S.A.: Texas:** *Brewster Co.*: Terlingua Ranch Gate 8 Road, 0.2–0.4 mi. N of turnoff on TX 118, 29°26′N 103°30′W, ca. 1008–1034 m, 3.viii.2024, N. Cazzaniga, W. Phillips and L. Prendini, from rock crevices, 1 juv. ♂, 1 juv. ♀ (AMCC [LP 20764]). *Terrell Co.*: 5 Mile Road, 0.3–0.6 mi. ESE turnoff on US 90 to Dryden, 30°04′N 102°20′W, ca. 802–807 m, 6.viii.2024, N. Cazzaniga, W. Phillips and L. Prendini, from rock crevices, 1 juv. ♂, 1 juv. ♀ (AMNH); Harrell Road, 0.9 mi. ESE turnoff on US-90 to Dryden, 30°03′N 102°18′W, ca. 784 m, 6.viii.2024, N. Cazzaniga, W. Phillips and L. Prendini, from rock crevice, 1 juv. ♂ (AMCC [LP 20775]), 1 juv. ♀ (AMNH); Harrell Road, 0.2–0.6 mi. ESE turnoff on US 90 to Dryden, 30°04′N 102°19′W, ca. 777–802 m, 6.viii.2024, N. Cazzaniga, W. Phillips and L. Prendini, from rock crevice, 1 juv. ♂ (AMNH); Villa Delamina Road turnoff, ca. 8 mi. NE of Lajitas on Hwy FM170, [29°19′N 103°39′W], ca. 932 m, 4.viii.2024, N. Cazzaniga, W. Phillips and L. Prendini, from rock crevices, 1 ♂, 2 ♀ (AMNH), 1 juv. ♀ (AMCC [LP 20721]).

Diagnosis: *Phrynus abstrusus*, sp. nov., differs from most other *Phrynus* species in its general absence of pigmentation. The cuticle of adults and immatures is translucent, the carapace and appendages uniform orange-brown and the opisthosomal tergites cream in color (figs. 3B, 4). The depigmentation is sufficiently developed that the dorsal aorta and gonopods may be observed through the cuticle of the opisthosoma, as in some troglobitic species.

*Phrynus noeli* Armas, 1994, and *Phrynus perii* Guzmán, Chirivi Joya and Francke, 2015, most closely resemble the new species, in being similarly depigmented. However, the new species can be distinguished by the absence of an additional ventral spine on the pedipalp basitarsus (spIII) (fig. 8), as well as an additional branching spine on sp3, both present in *P. noeli*. The new species differs further insofar as the sclerotized claws of the female gonopods flank the basal lobes (fig. 9B), unlike *P. noeli*, in which the claws are tucked along the distal margins thereof, and the tarsus of the first leg comprises 63 segments in the new species compared with 60 in *P. noeli*. The new species can be distinguished from *P. perii* by its fully developed and pigmented median ocelli (fig. 5A); the median ocelli of *P. perii* are reduced and depigmented (Guzmán et al., 2015).

The new species can be further separated from *P. operculatus*, with which it was previously confused, by the following characters. Femoral spine FIII is almost the same length as spine FII in the new species, but only half its length in *P. operculatus*. The third ventral basitarsal spine (spIII) is greatly reduced in the new species (fig. 8), being almost indistinguishable from the secondary spines, whereas this spine is equivalent in length or longer than spI in *P. operculatus*. Addi-


FIGURE 4. *Phrynus abstrusus*, sp. nov., paratype ♂ (AMNH), Sanderson, Texas, habitus, **A.** dorsal and **B.** ventral aspects. Scale bar = 10 mm.


FIGURE 5. *Phrynus abstrusus*, sp. nov., paratype ♀ (AMNH), Sanderson, Texas, prosoma. **A.** Carapace, dorsal aspect. **B.** Tritosternum, ventral aspect. Scale bars = 2 mm.

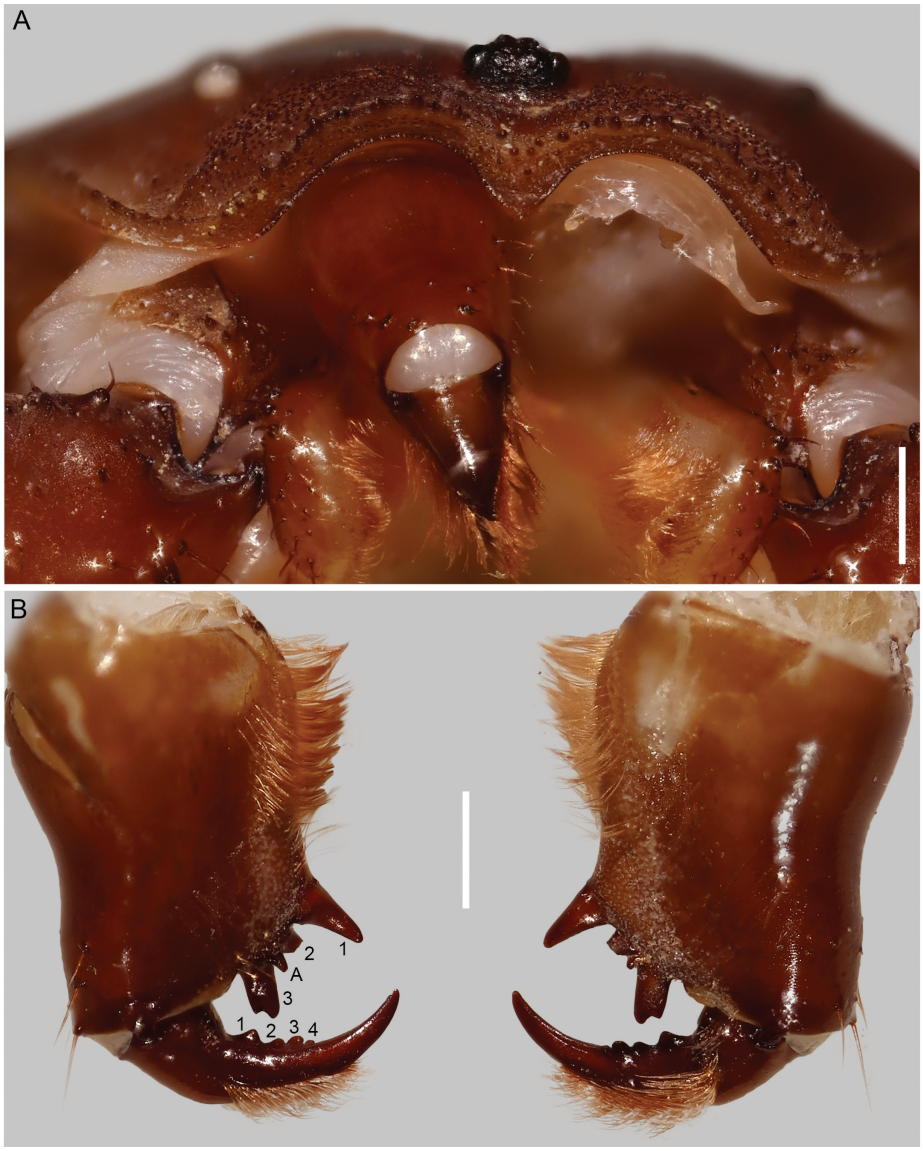


FIGURE 6. *Phrynus abstrusus*, sp. nov., holotype ♀ (AMNH), Sanderson, Texas, prosoma. **A.** Carapace, frontal process, and coxae, dorsal aspect. **B.** Sinistral chelicera, retrolateral aspect (left), illustrating one tooth (A) on prolateral margin and three teeth (1, 2, 3) on retrolateral margin, and prolateral aspect (right), dense setae near prolateral denticle row, at cheliceral base, removed. Scale bars = 0.5 mm.

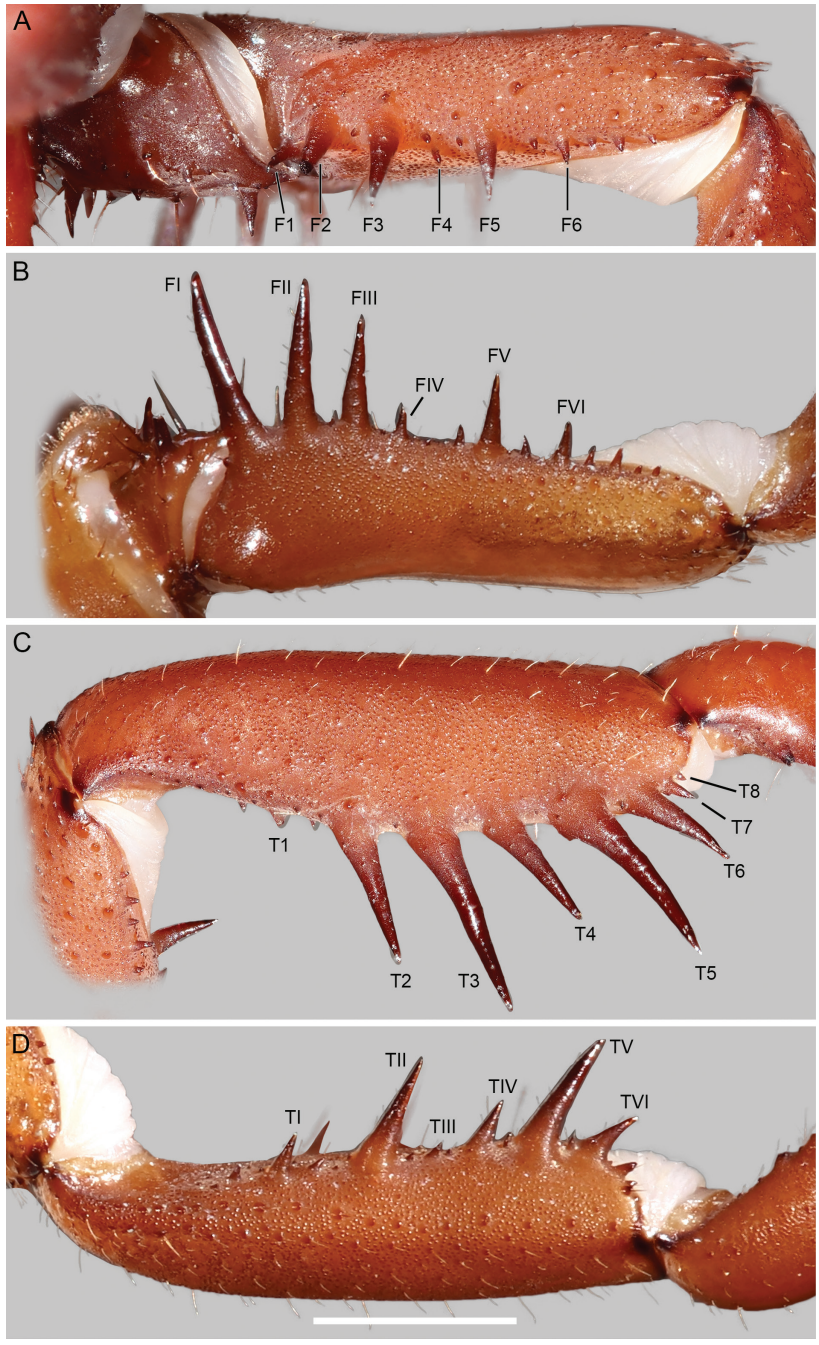


FIGURE 7. *Phrynus abstrusus*, sp. nov., holotype ♀ (AMNH), Sanderson, Texas. **A, B.** Pedipalp trochanter and femur, **A.** dorsal and **B.** ventral aspects. **C, D.** Pedipalp tibia, **C.** dorsal and **D.** ventral aspects. See text for spine annotations. Scale bar = 2 mm.

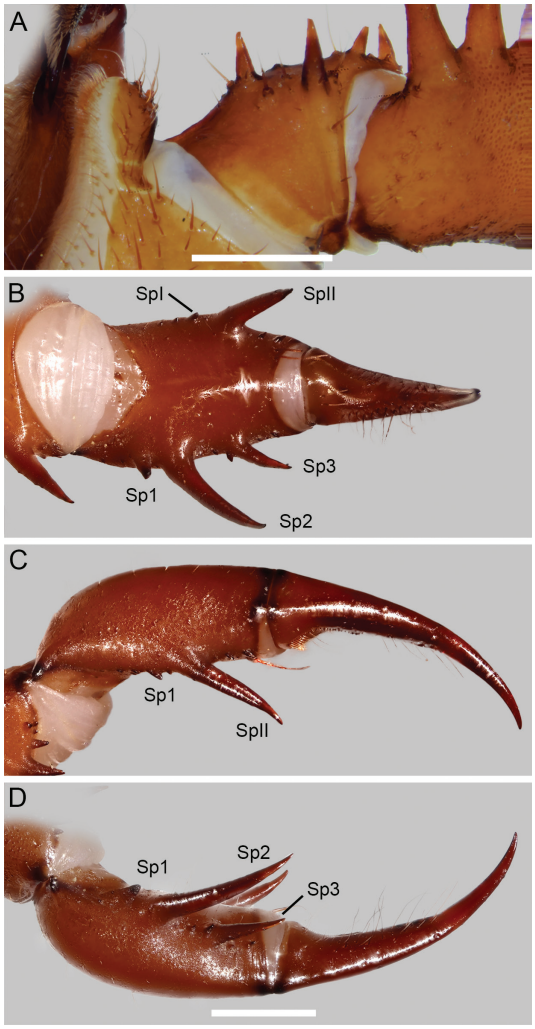


FIGURE 8. *Phrynus abstrusus*, sp. nov., holotype ♀ (AMNH), Sanderson, Texas. **A.** Pedipalp trochanter, ventral aspect. **B–D.** Pedipalp basitarsus and pretarsus, **B.** prolateral, **C.** dorsal, and **D.** ventral aspects. See text for spine annotations. Scale bars = 2 mm.

tionally, the tarsus of the first leg comprises 63 segments in the new species, compared with 62 in *P. operculatus*. Finally, the female gonopods of the new species are distinctive in the close proximity of the basal lobes, which are barely separated, unlike the gonopods of *P. operculatus*, in which a distinct gap is evident between the lobes.

Etymology: Latin adjective meaning secluded, concealed, or hidden, referring to the reclusive, crevice-dwelling nature of the new species.

Description: The following description is based on the type material.

*Color*: Depigmented, translucent (figs. 3B, 4). Carapace, pedipalps, chelicerae, and legs pale brown. Opisthosomal sternites and tergites tan to olive, intersegmental membranes slightly paler. Gnathocoxa ventral surface, cuticle similar in color to rest of pedipalp.

*Carapace*: Frontal process visible in anterior aspect only. Carapace dorsal surface finely granular with few tubercules, almost asetose (figs. 5A, 6A). Median ocelli and lateral ocular triads well developed, darkly pigmented.

*Chelicerae*: Cheliceral base, dorsal surface sparsely setose with few obsolete tubercles; prolateral surface densely setose, becoming asetose prodorsally; prolateral margin with one tooth, cuspid (fig. 6B); retrolateral margin with three teeth, first (dorsalmost) tooth bicuspid, second and third cuspid. Cheliceral claw, dorsal surface with four cuspid teeth, first (distalmost) tooth half the size of others; prolateral surface densely setose, becoming asetose distally.

*Sternum*: Sternal plates moderately sclerotized, three primary plates more markedly sclerotized. Anteriormost plate (tritosternum) elongated and sparsely setose, with four setae at base, one medially, and two apically. Gnathocoxa ventral surface with several rows of macrosetae.

*Pedipalps*: Surfaces lightly tuberculate. Trochanter with four prominent spines of similar lengths. Femur (F) with six primary dorsal spines and six primary ventral spines (fig. 7A, B); F3 largest (F3 > F2 > F5 > F1 > F6 > F4), with F1 and F2 sharing same base; FI largest (FI > FII > FIII > FV > FVI > FIV). Tibia (T) with eight primary dorsal spines and six primary ventral spines (fig. 7C, D); T3 largest (T3 > T5 > T2 > T4 > T6 > T7 > T1 > T8); TV largest (TV > TII > TVI > TIV > TI > TIII). Basitarsus (sp) with three primary dorsal spines, two primary ventral spines, and several obsolete spines (assumed to be greatly reduced spIII and other formerly retained spines); sp2 largest (sp2 > sp3 > sp1);

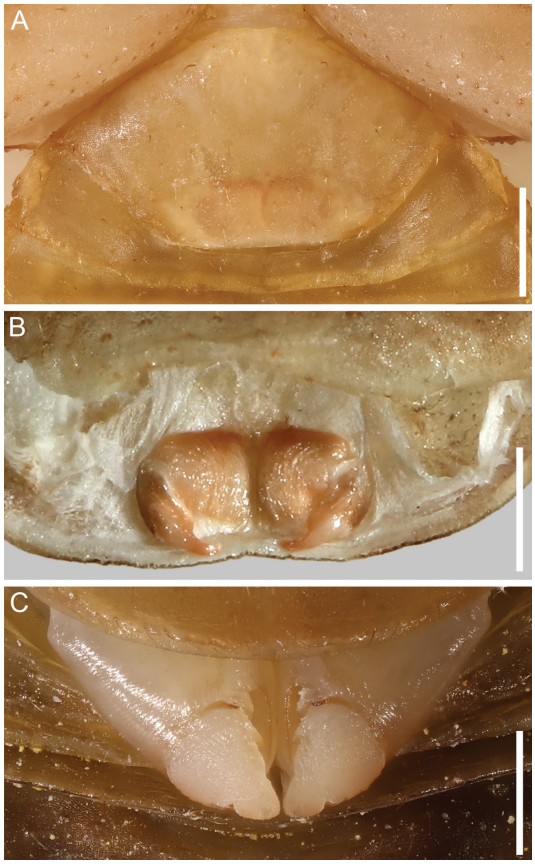


FIGURE 9. *Phrynus abstrusus*, sp. nov., **A.** paratype ♀ (AMNH), **B.** holotype ♀ (AMNH), and **C.** paratype ♂ (AMNH), Sanderson, Texas. **A.** Genital operculum, ventral aspect, illustrating gonopods visible through cuticle. **B.** Female gonopods. **C.** Male gonopods. Scale bars = 1 mm (**A**), 0.5 mm (**B, C**).

spII largest (spII > spI); prolateral surface with two larger, thickened setae (fig. 8). Tarsus aspinose, with prominent cleaning organ. Pretarsus and tarsus fused.

*Legs*: Antenniform legs each comprising 29 and 63 tibial and tarsal segments, respectively. Legs II–IV femora finely tuberculate. Leg IV basitibia trisegmented.

*Gonopods*: Female gonopods visible through translucent cuticle (fig. 9A), comprising pair of sclerotized, hooklike appendages, curving inwards; basal lobes weakly sclerotized, with anterior margins more heavily sclerotized (fig. 9B); margins of lobes slightly curved and almost in contact. Male gonopods lobed, blunt distally and covered proximally by plate of genital operculum (fig. 9C).

Distribution: Recorded from multiple localities in eleven counties (Brewster, Crockett, Edwards, Kinney, Pecos, Presidio, Real, Terrell, Upton, Uvalde, and Val Verde) of Texas (fig. 1). Unverified observations from internet databases suggest that the species may also occur south of the Río Grande in the states of Durango, Chihuahua, Coahuila, and Nuevo León, northern Mexico, where similar habitats exist. Further sampling in these states is needed to verify if the records are accurate, and if so, whether the whip spiders occurring there are conspecific with *P. abstrusus*, sp. nov.

Ecology: The type material was collected from rock crevices and a small cavern in vertical limestone roadcuts comprising bedrock that was exposed from below ground when road excavations bisected rocky ridges (figs. 2, 3A). Some specimens were captured from crevices extending deep into the vertical rock face. Individuals were seldom observed in the open, only within close proximity to crevices or caverns, even on nights following light rainfall, when most of the specimens were collected.

The vegetation of the semiarid limestone hills inhabited by the new species is characterized by typical Chihuahuan Desert xerophytes like yuccas, e.g., *Yucca constricta* Buckley, *Yucca reverchonii* Trel., and *Yucca thompsonii* Trel.; agaves, e.g., *Agave havardiana* Trel. and *Agave lecheguilla* Torr.; cacti, e.g., *Cylindropuntia* sp., *Echinocactus* sp., *Echinocereus* sp., and *Opuntia* sp.; creosote bush, *Larrea tridentata* (DC) Coville; and ocotillo, *Fouquieria splendens* Englem. As it is unlikely that these depigmented and weakly sclerotized whip spiders could withstand the high surface temperatures and desiccation they would experience during the summer if living under stones or other surface debris like other xeric species of *Phrynus*, e.g., *P. operculatus* in Mexico, it is assumed that they survive in subterranean caverns and passages, many of which

may be interconnected underground, and only emerge to surface crevices to catch prey under suitable conditions (e.g., after rainfall). Based on its habitat and habitus, the new species is therefore considered to be troglophilous (Trajano and Carvalho, 2017).

## DISCUSSION

The description of the new species raises the number of *Phrynus* species to 42 (Prendini, 2025). *Phrynus abstrusus*, sp. nov., is the fifth species of Phrynidae recorded in the United States, as well as the northernmost species of *Phrynus*. Its distinctive morphology, especially the depigmentation of its cuticle, together with the above-mentioned observations of its habitat, suggest that it is troglophilous, though not obligately hypogean like the troglobite, *P. perii*, which in addition to the depigmented cuticle, has reduced and depigmented median ocelli (Guzmán et al., 2015). *Phrynus abstrusus*, sp. nov., represents the second troglophilous species of *Phrynus*. *Phrynus noeli*, which also displays depigmentation but not ocular reduction, has been documented inside and outside caves and is therefore not an obligate troglobite (Armas and Pérez González, 1994; Armas, 2006).

Troglophiles are notoriously susceptible to disturbance and exploitation hence they are of particular concern for conservation (Culver and Pipan, 2009). Human habitat modification, e.g., road excavations that expose underground passages and caverns, may have allowed the new species to be more commonly encountered than would otherwise be the case and may place it at greater risk of desiccation caused by human-induced climate change, as well as overharvesting by private and commercial collectors.

## ACKNOWLEDGMENTS

The authors thank Alan Jeon for providing ecological information and sensitive locality data about the new species; the U.S. National Parks Service for permit BIBE-2024-SCI-0016 and the Texas Parks Service for permits 047-24 and SPR-0724-090 to collect arachnids; William Phillips for assistance in the field; Pio A. Colmenares for laboratory assistance and constructive suggestions; Steve Thurston for assistance with preparing the plates for this contribution; Javier Blasco-Aróstegui, Jairo A. Moreno-González, Michael Seiter, and an anonymous reviewer for constructive comments on previous drafts of the manuscript.

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