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Taxonomy and systematics

On the daddy long-legs spiders of the genus *Physocyclus* (Araneae: Pholcidae) from Mexico: description of a new species from the Baja California Peninsula

Sobre las arañas patonas del género Physocyclus (Araneae: Pholcidae) de México: descripción de una especie nueva de la península de Baja California

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Abstract

A new species of daddy long-legs spiders of the genus *Physocyclus* Simon, 1893 of the *globosus* species group is described from the Baja California Peninsula desert, in the state of Baja California Sur, Mexico. The species is described based on adult males and females: *Physocyclus xerophilus* sp. nov. This is the sixth species described from Baja California Sur. The total number of species of *Physocyclus* increases to 34, including the new species described herein. Thirty-two of 34 species are distributed in Mexico, with one cosmopolitan: *Physocyclus globosus*. The states of Baja California Sur, Guerrero and Michoacán have the highest diversity of species in the country, with 8 species each.

Keywords: Arteminae; Taxonomy; Xerophytic scrub; Baja California Sur

Resumen

Se describe una especie nueva de araña patona del género *Physocyclus* Simon, 1893 del grupo de especies *globosus* del desierto de la península de Baja California, en el estado de Baja California Sur, México. *Physocyclus xerophilus* sp. nov. se describe con base en machos y hembras adultos y es la sexta especie descrita para este estado. El número total de especies del género *Physocyclus* aumenta a 34, incluyendo la especie nueva descrita aquí; 32 de 34 especies están distribuidas en México, con una cosmopolita: *Physocyclus globosus*. Baja California Sur, Guerrero y Michoacán tienen la mayor diversidad de especies en el país, con 8 especies cada uno.

Palabras clave: Arteminae; Taxonomía; Matorral xerófilo; Baja California Sur

Introduction

The spider family Pholcidae Koch, 1850 is the ninth largest in the order Araneae, with 1,743 species including the new species described herein, distributed in 94 genera (WSC, 2020). The family is subdivided into 5 subfamilies: Arteminae Simon, 1893, Modisiminae Simon, 1893, Ninetinae Simon, 1890, Pholcinae C.L. Koch, 1850 and Smeringopinae Simon, 1893 (Dimitrov et al., 2013; Eberle et al., 2018; Huber, 2011). The spider genus *Physocyclus* Simon, 1893 is classified in the subfamily Arteminae, which currently has 103 species in 9 genera.

Physocyclus is one of the most diversified and common pholcid spiders in Mexico, which currently includes 33 species (Jiménez & Palacios-Cardiel, 2013; Valdez-Mondragón 2010, 2013, 2014; WSC, 2020). The genus is distributed mainly in North and Central America, with most of the species from Mexico, including the synanthropic species *Physocyclus dugesi* Simon and *Physocyclus globosus* (Taczanowski), the latter with a cosmopolitan distribution influenced by human activities (Beatty et al., 2008; Huber & Kwapong, 2013; Valdez-Mondragón, 2010). Although some species are synanthropic, the common habitat is in dry and semi-arid climates, and most of the species have been collected in dry tropical deciduous forests and deserts, as the new species described here. In karstic zones, some species are found frequently in their sheet webs inside caves, on walls, holes in walls, amid large rocks on the ground, or among the karst formations (stalagmites, stalactites and columns) (Valdez-Mondragón, 2010, 2014).

Morphologically, their legs are long with relation to the body, which ranges from 3 to 5 mm, and show a ringed coloration on tibiae and femora. The body coloration varies between white and pale yellow, with an irregular brown dorsal pattern on the carapace, usually with 3 symmetrical spots on each side. However, the general overall shape and coloration is similar among the species, which indicating a conserved morphological pattern (Valdez-Mondragón, 2010, 2014).

Physocyclus is a monophyletic group based on morphological characters currently constituted by 2

species groups, *globosus* and *dugesi*, with 12 and 20 species respectively, including the new species (Valdez-Mondragón, 2013, 2014). The *globosus* group has a biogeographical distribution pattern in the Mesoamerican and Mexican Mountain biotic components, whereas the *dugesi* group has a biogeographical distribution in the Mesoamerican and Continental Nearctic biotic components (Valdez-Mondragón, 2013, 2014).

In this contribution we describe a new species of daddy long-legs spiders of the genus *Physocyclus* belonging to the *globosus* species group, based on adult males and females from the desert of the Baja California Peninsula in the state of Baja California Sur, Mexico.

Material and methods

The specimens used for this study are preserved in ethanol (80%), and for future molecular studies in ethanol (96%), deposited at the Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City (curator: Dr. Oscar F. Francke Ballvé). The specimens were collected under the Scientific Collector Permit FAUT-0309 from the Ministry of Environment and Natural Resources (Semarnat) granted to Dr. Alejandro Valdez Mondragón. All the specimens were measured and examined with a Zeiss Discovery Stereoscope V.8. Digital photographs were made using a Zeiss Axio Zoom V.16 microscope, and Axio Zoom Zen and Zen Pro software. All measurements are in millimeters (mm). The male palp and female epigynum were dissected and observed in ethanol (80%), and the epigynum was cleaned in potassium hydroxide (KOH, 10%) for a few minutes to remove all soft tissues around the pore plates. The map was done with QGIS v.3.10. The digital photographs and map were edited in Photoshop CS6 v.1.30x32. Morphological terminology follows Valdez-Mondragón and Francke (2015). Abbreviations: ALE, anterior lateral eyes; AME, anterior median eyes; PLE, posterior lateral eyes; PME, posterior median eyes; P, procursus; E, embolus; DAP, dorsal apophyses of procursus; SO, spermathecal operculum; ES, embolic sclerites; BU, bulb of palp; SF, stridulatory files of

cheliceare; LAC, lateral apophyses of chelicerae; VAE, ventral apophysis of epigynum; PP, pore plates; L/d, tibia I length/diameter.

Description

Family Pholcidae C. L. Koch, 1850

Genus *Physocyclus* Simon, 1893

Type species. *Physocyclus globosus* (Taczanowski, 1874)

Physocyclus xerophilus sp. nov.

Figs. 1-16

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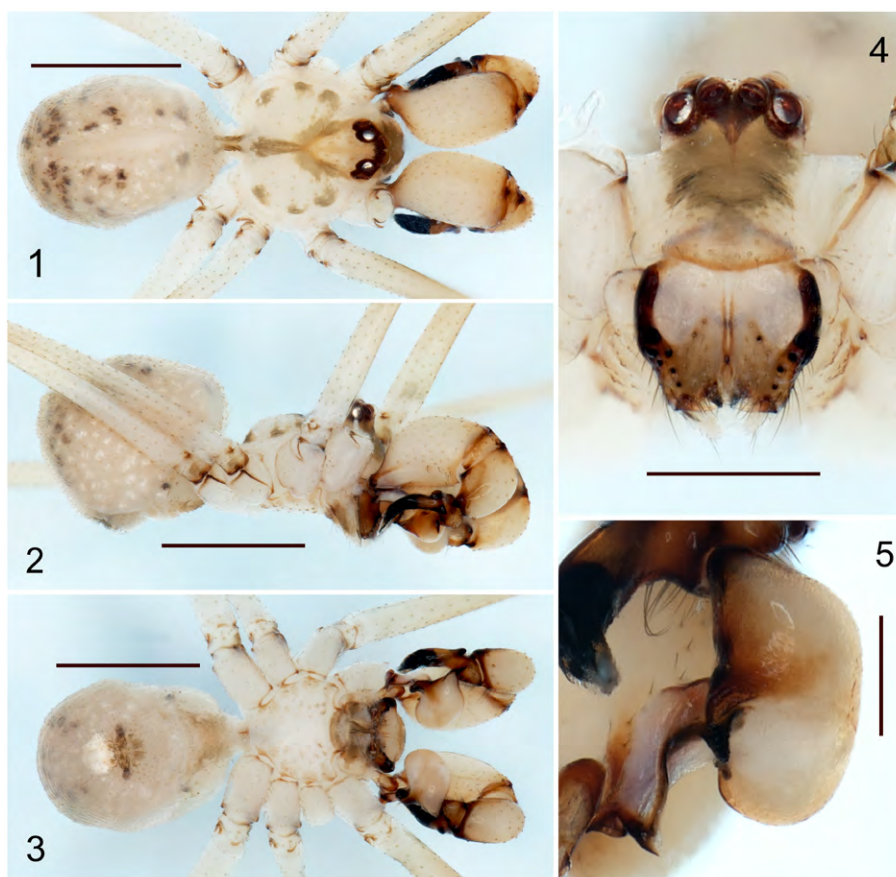
Diagnosis. Males of *Physocyclus xerophilus* sp. nov. resemble *Physocyclus globosus* in the number of sclerotized cones on the frontal part of the chelicerae (4-5 cones on each chelicerae) (Figs. 9, 10; Valdez-Mondragón, 2010: figs. 42-43). However, in the new species the lateral conical apophyses of the chelicerae are longer and sharper than *P. globosus* (Fig. 10; Valdez-Mondragón, 2010: Fig. 43). In retrolateral view, the procurus in *P. xerophilus* sp. nov. is thinner and curved, with a thin distal spine (Fig. 6); whereas in *P. globosus* the procurus is wider and conical, with a small, wide spine distally (Valdez-Mondragón, 2010: Fig. 44). The embolic sclerites (ES) in the male palp are on the bulb in *P. xerophilus* (Fig. 5), whereas the ES in *P. globosus* are located on the embolus (E) (Valdez-Mondragón, 2010: Fig. 45). In dorsal view, the embolus in *P. xerophilus* sp. nov. is wider and curved (Fig. 45), whereas the embolus in *P. globosus* is thinner and almost straight (Valdez-Mondragón, 2010: Fig. 45). Females of *P. xerophilus* sp. nov. resemble *Physocyclus lautus* Gertsch, 1971 in the shape of the epigynum (Figs. 14-16; Valdez-Mondragón, 2010: Figs. 67-69). However, in the new species the ventral apophyses of the epigynum (VAE) are shorter and in oblique position (Figs 14, 15), whereas in *P. lautus* the VAE are longer and conical (Valdez-Mondragón, 2010: Figs. 67, 69). The epigynum of *P. lautus* has paired W-shaped concavities in the middle (Valdez-Mondragón, 2010: Fig. 67), whereas in *P. xerophilus* sp. nov. those concavities are absent (Fig. 14). In dorsal view, the pore plates (PP) of the epigynum of *P. xerophilus* sp. nov. are almost circular (Fig. 16), whereas in *P. lautus* the PP are longer and oval (Valdez-Mondragón, 2010: Fig. 68). The PP in the new species have bag-shaped structures posteriorly, which are oval and smaller (arrow, Fig. 16), whereas in *P. lautus* they are longer and circular (Valdez-Mondragón, 2010: Fig. 68).

Male (holotype) (CNAN-T01365). Prosoma. Carapace light beige, with a Y-shaped light brown pattern around fovea, which extends towards the posterior part of carapace. Fovea longitudinal. Carapace with 3

irregular spots on each side (Fig. 1). Clypeus with a wide light brown mark lengthwise. Each chelicera with 4-5 sclerotized cones frontally (Fig. 4). Chelicerae with stridulatory files laterally (Figs. 4, 9, 10). Chelicerae with a lateral conical apophysis (Fig. 10). Sternum light beige, with small and inconspicuous light brown spots. Labium brown, wider than long, merged to the sternum. Endites brown prolaterally, beige retrolaterally, longer than wide (Fig. 3). Legs. All segments with beige coloration. Trochanters light brown retrolaterally with a notch distally (Figs. 2, 3). Femora and tibiae with brown rings distally. Opisthosoma. Globular, longer than wide and high, with numerous white and dark brown spots (Figs. 1-3). Spinnerets brown, with a short brown seta around (Fig. 3). Palp. Dorsal apophyses of procurus (DAP) conical (Fig. 6). Procurus (P) thin, with basal half dark brown and distal half dark, ending in a thin and long spine with a brush of pseudotrichia distally (Figs. 6-8). Femur without apophyses (Figs. 6, 8). In prolateral view, ES with oval shape located on the bulb (Figs. 5, 7, 8). E wide, slightly curved in retrolateral view, strongly curved on dorsal view (Figs. 5, 6). E with V-shaped apically (Fig. 5). Spermathecal operculum (SO) on apical part of E (Fig. 6). Measurements. Total length 2.7. Carapace 1.18 long, 1.23 wide. Clypeus 0.6 long. Diameter AME 0.08, ALE 0.12, PME 0.10, PLE 0.11. Distance ALE-PME 0.05, PME-PME 0.15. Leg I: 27.19 (7.04+0.47+7.68+10.6+1.4). Tibia II: 5.18, tibia III: 3.32, tibia IV: 5.12; tibia I L/d: 51.2.

Female (paratype) (CNAN-T01366). Similar to the male, differences: Prosoma. Dorsal pattern of carapace darker brown than male (Fig. 11). Sternum brown, with a small white region on anterior part (Fig. 13). Labium and endites brown, darker than male (Fig. 13). Clypeus darker than male. Chelicerae without sclerotized cones nor lateral apophyses. Legs. Trochanters light brown retrolaterally, darker than male. Femora and tibiae with darker brown rings distally. Epigynum. Wider than long, bell-shaped, VAE small and conical (Figs. 14, 15). PP small, oval, with bag-shaped structures below them (Fig. 16). Measurements. Total length 3.04. Carapace 1.20 long, 1.23 wide. Clypeus 0.4 long. Diameter AME 0.08, ALE 0.11, PME 0.10, PLE 0.10. Distance ALE-PME 0.05, PME-PME 0.14. Leg I: 19.49 (5.18+0.46+5.50+7.25+1.). Tibia II: 3.60, tibia III: 2.28, tibia IV: 4.00; tibia I L/d: 30.5.

Variation. Male paratype smaller than male holotype, with lighter coloration. Chelicerae of the male paratype has darker coloration on basal part. Females with small variation in size. Female collected on Santipac Beach is smaller and with darker coloration in the epigynum than the females from the type locality. Females from Cocos Beach, Misión Mulegé, and the road to San Isidro-San José



Figures 1-5. *Physocyclius xerophilus* sp. nov. Male (holotype): 1-3, Habitus, dorsal, lateral and ventral views respectively; 4, carapace and chelicerae, frontal view; 5, bulb of male palp, dorsal ventral view. Scale bars: 0.2 mm (Fig. 5), 0.5 mm (Fig. 4) and 1 mm (Figs. 1-3).

Comundú with small variation in size. Males: (N = 2), tibia I: 6.64, 7.68. Females: same locality as holotype (N = 2), tibia I: 4.50, 5.81. 800 SE of Misión Mulegé (N = 1), tibia I: 5.75. Santipac Beach (N = 1), tibia I: 4.55. Cocos Beach (N = 1), tibia I: 5.37. Comundú (N = 1), tibia I: missing.

Taxonomic summary

Type material. Mexico: Baja California Sur: 1 male holotype (CNAN-T01365) [21 July 2019; A. Valdez; P. Solís; D. Montiel; A. Cabrera Cols.], from close to “El Requesón” Beach (26.63539° N, -111.83173° W; 6 m), Mulegé Municipality. Paratypes: 1 female (CNAN-T01366); 1 male, 2 females (CNAN-T01367), same data as holotype.

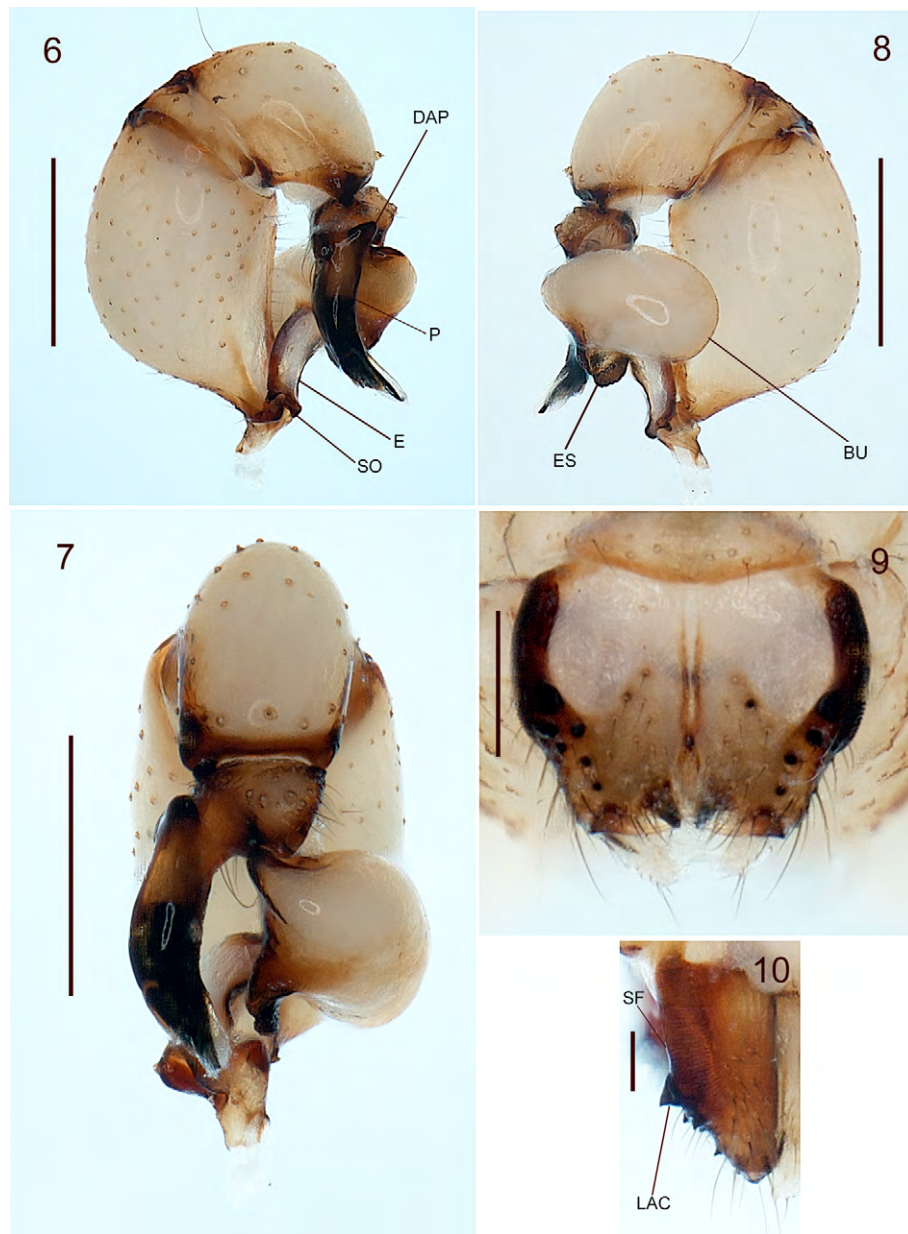
Other material examined. Mexico: Baja California Sur: 2 females (Ara-0541) [21 July 2019; A. Valdez, P. Solís, D. Montiel, A. Cabrera Cols.], 800 m SE from Misión Mulegé (lat 26.88183°, lon -111.99310°; 9 m), Mulegé Municipality. 1 female (Ara-0542) [21 July

2019; A. Valdez, P. Solís, D. Montiel, A. Cabrera Cols.], Santipac Beach, Loreto-Santa Rosalía road (26.76198° N, -111.87842° W; 2 m), Mulegé Municipality. 1 female (Ara-0543) [29 July 2019; A. Valdez, P. Solís, D. Montiel, A. Cabrera Cols.], Cocos Beach (26.74279° N, -111.90151° W; 1 m), Mulegé Municipality. 1 female (Ara-0544) [30 July 2019; A. Valdez, P. Solís, D. Montiel, A. Cabrera Cols.], Km 1 San Isidro-San José Comundú road (26.22135° N, -112.01165° W; 137 m), Comundú Municipality.

Etymology. The specific name is a noun in apposition and refers to the vegetation type where the type locality of the species is: *xerophilous* scrub or desert.

Natural history. The specimens were collected on their sheet webs among and under large boulders on the ground in the different localities. The vegetation type of the zone is dry xerophilous scrub, with cacti and scrubby vegetation (Figs. 17, 18).

Distribution. Mexico: Baja California Sur (Fig. 19).

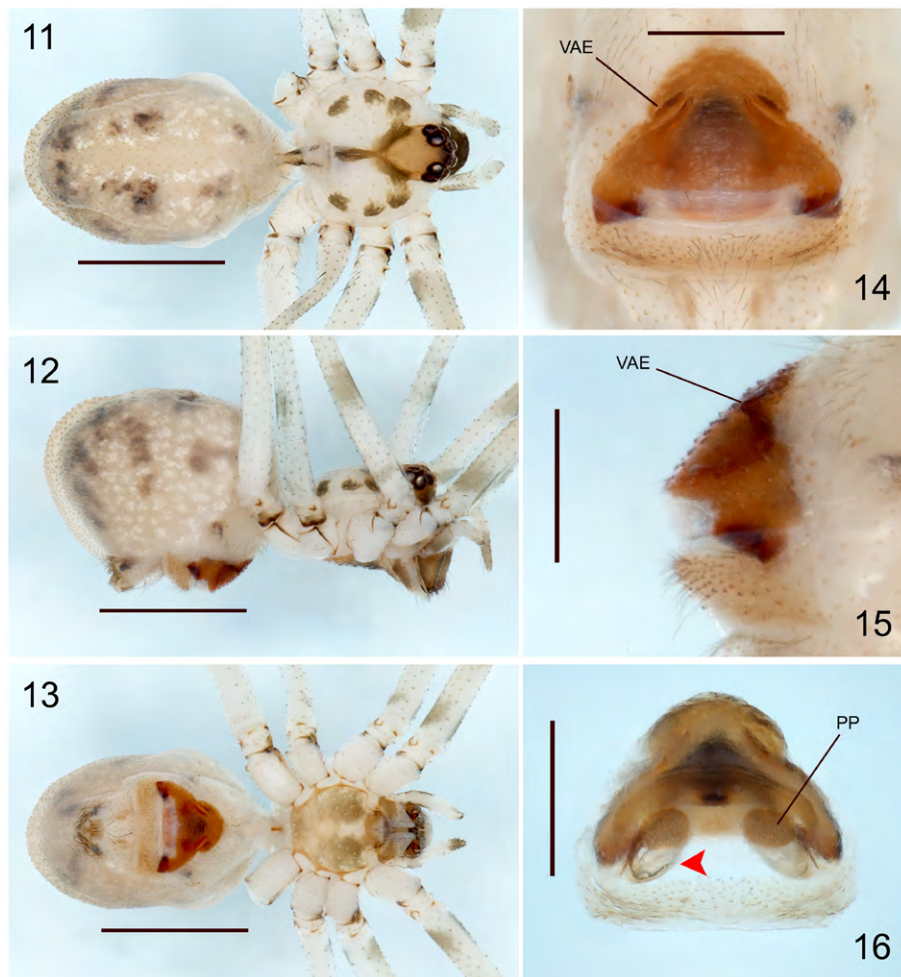


Figures 6-10. *Physocyclus xerophilus* sp. nov. Male (holotype): 6-8, Right palp, retrolateral, ventral and prolateral views respectively; 9, chelicerae, frontal view; 10, chelicerae, lateral view. Scale bars: 0.1 mm (Fig. 10), 0.2 mm (Fig. 9), 0.5 mm (Figs. 6-8). Abbreviations: DAP, dorsal apophysis of procurus; P, procurus; E, embolus; SO, spermathecal operculum; ES, embolic esclerites; BU, bulb of palp; SF, stridulatory files; LAC, lateral apophysis of chelicerae.

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Figures 11-16. *Physocyclus xerophilus* sp. nov. Female (paratype): 11-13, Habitus, dorsal, lateral and ventral views respectively; 14-16, epigynum, ventral, lateral and dorsal views respectively (arrow indicates the bag-shaped structures below the pore plates). Scale bars: 0.5 mm (Figs. 14-16), 1 mm (Figs. 11-13). Abbreviations: VAE, ventral apophysis of epigynum; PP, pore plates.



Figures 17-18. Habitat and microhabitat of *Physocyclus xerophilus* sp. nov. 17, Xerophilous scrub close to the El Requesón Beach (type locality) at Baja California Sur, Mexico; 18, rocks on the ground where the specimens of the new species can be collected (arrows indicate the specific microhabitat).

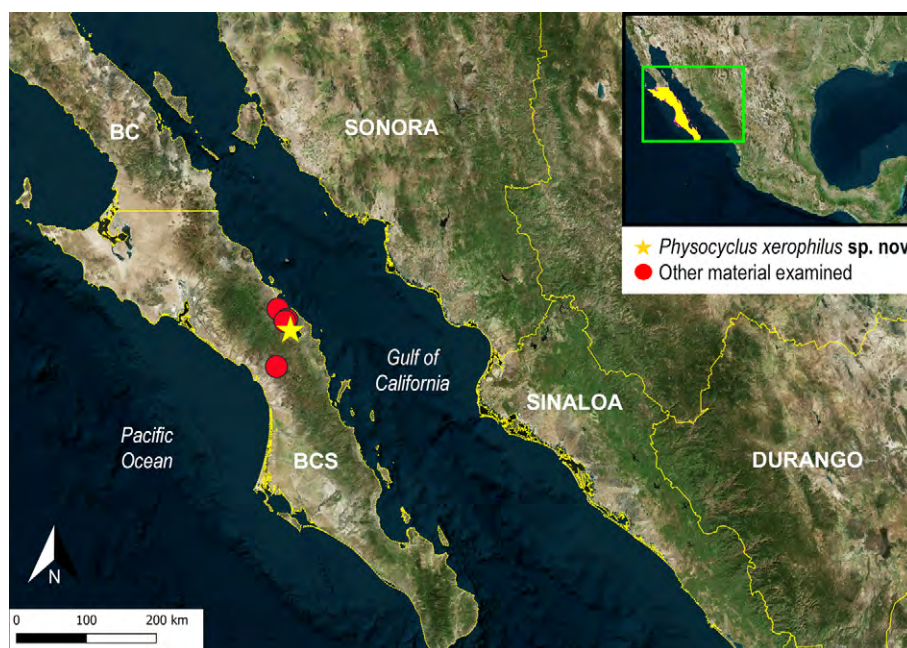


Figure 19. Known records of *Physocyclus xerophilus* sp. nov. from Baja California Sur, Mexico. Star (type locality). Abbreviation: BC, Baja California.

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