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First record of *Anelosimus jucundus* (O. Pickard-Cambridge, 1896) (Araneae, Theridiidae) in the state of Ceará, Brazil

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Abstract

We present the first record for *Anelosimus jucundus* O. Pickard-Cambridge, 1896 for the state of Ceará, Brazil. We collected 22 individuals in three different ecosystems: (1) Mangrove swamps, (2) Caatinga-type desert vegetation, and (3) Montane semi-deciduous tropical forest. We corrected the misinformation of Levi's 1963 Ceará record, which was actually from the state of Pernambuco. *Anelosimus jucundus* presents a wide altitudinal distribution, which indicates that this species can tolerate a variety of climatic conditions and can colonize a variety of sites with different vegetation.

Keywords

Caatinga ecosystem, cobweb spiders, mangrove swamps, social spider.

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Introduction

The family Theridiidae, also known as cobweb spiders, constitutes one of the largest families of cosmopolitan spiders, with over 2509 species in 124 genera (World Spider Catalog 2019). Theridiid spiders are three-dimensional space-web-builders (Dias et al 2009; Cardoso et al. 2011) that exhibit extreme diversity in morphology, ecology, and behavior, which make several of their species biological research models (Agnarsson 2004).

The genus *Anelosimus* Simon, 1891, contains 74 described species with most of its species occurring in

tropical or subtropical regions (World Spider Catalog 2019). In Brazil, 13 species are currently known, with five presenting a restricted distribution in Brazil (*A. dubiosus* Keyserling, 1891; *A. jabaquara* Levi, 1956; *A. pantanal* Agnarsson, 2006; *A. rabus* Levi, 1963) (Agnarsson 2005, 2006; World Spider Catalog 2019). *Anelosimus* species differ from most theridiids in lacking a colulus, but in having a pair of colular setae. They also have a characteristic pattern of coloration of the abdomen: a dark, notched, longitudinal central band, delimited by a narrow, notched, white band, and bilateral white spots distributed outside the dorsal band (Agnarsson 2006).

Specifically, *A. jucundus* Pickard-Cambridge, 1896, has been reported in the states of São Paulo and Pernambuco (Levi 1963; Gonzaga and Santos 1999).

Anelosimus spiders are particularly important because the genus contains species varying from solitary to those that show gradients of social behavior (Avilés 1997; Agnarsson 2004). Thus, the genus plays an important role in the study of sociality and its evolution (Powers and Avilés 2003; Avilés and Bukowski 2005; Agnarsson et al. 2006). The objectives of our paper is record for the first time *A. jucundus* from the state of Ceará. This extends the geographical range of the genus *Anelosimus* to the Northeast Region of Brazil.

Methods

The study was conducted in a four localities: (1) mangrove swamps in the municipality of Trairi (03°11'09"S, 039°24'24"W; 6 m a.s.l.); (2) Caatinga-type desert vegetation in the municipality of Tururu (03°35'50"S, 039°24'06" W; 106 m a.s.l.); (3) a protected area of FLONA (National forest) of "Chapada do Araripe" in Montane semi-deciduous tropical forest in the municipality of Crato (07°16'45"S, 039°27'12"W; 961 m a.s.l.); and (4) Montane semi-deciduous tropical forest in the municipality of Mulungu (04°18'40"S, 038°58'05"W; 840 m a.s.l.) in the state of Ceará, Brazil.

Our new records are based on 22 specimens (two adult male, six adult female, and 14 juveniles) manually collected during several field expedition in the four areas in December 2016 and July 2017. The identification of the individuals was made by the expert Dr Antonio Brescovit and was based on the identification key of Agnarsson (2004, 2006). A distribution map (Fig. 1) was created using SimpleMappr (Shorthouse 2010). All specimens collected were preserved in 70% alcohol and deposited in the Arachnida collection at the Instituto Butantan, São Paulo (IBSP; curator A.D. Brescovit).

Results

New records. Brazil: Ceará • Trairi (03°11'09"S, 039°24'24"W), IBSP 221664, 2♀, Jober Fernando Sobczak, Jullyana Cristina Moura Sobczak collectors, 17 December 2016. • Tururu (03°35'50"S, 039°24'06"W), IBSP 221609, 1♀ and 14 juveniles, Emily Oliveira Fonseca, Francisco Ageu de Sousa Nóbrega collectors, 15 December 2016. • Crato (07°16'45"S, 039°27'12"W), IBSP 221605, 2♀ and 1♂, Jober Fernando Sobczak, Jullyana Cristina Moura Sobczak collectors, 05 July 2017. • Mulungu (04°18'40"S, 038°58'05" W), IBSP 221609, 2♀, Joedson Castro Pires, Márcio Lopes Faustino, 09 December 2016.

Identification. *Anelosimus jucundus* shows a relatively intermediate degree of sociality when compared with other members of the same genus. Although *A. jucundus* shows a degree of sociability, few individuals were

observed on the webs (including juvenile, female, and adult male spiders; Fig. 2A–D). According to the diagnoses by Agnarsson (2004, 2006), males of *A. jucundus* (Figs 2D, 3B) can be recognized by their tegular outgrowth on the ectal margin (a unique feature in *A. jucundus*), extending beyond the embolus base (Fig. 3D) and in having a more robust embolus fork. Females have the epiginal plates strongly ridged (Fig. 3C), and internally the sclerotized portion of the copulatory duct extends beyond the ectalmost margin of the spermatheca.

Discussion

The subsocial species *Anelosimus jucundus* has been recorded from Mexico to Argentina (Avilés 1997). In Brazil this species had only been recorded in the states of São Paulo and Pernambuco, where the record of the last state erroneously appears as "Brazil. Ceara: Serra Communitaty" (Levi 1963), while "Serra Communitaty" is in fact in Pernambuco. We correct this error here and extend the geographic range of *A. jucundus* to the Northeast Region of Brazil. *Anelosimus jucundus* was recorded from 6 to 961 m above sea level at the four sites where we fund it. Other studies have found *A. jucundus* at various altitudes in various ecosystems. For example, this species has been reported at 1500 m in Arizona, USA (Powers and Avilés 2003), at 196 m in a tropical humid forest in Ecuador (Tapia and de Vries 1980), and at 850 m in a rainforest in Panama (Nentwig and Christenson 1986). Indeed, Agnarsson (2006) mentioned that *A. jucundus*



Figure 1. Distribution records of *Anelosimus jucundus* in the Americas. Orange circles = known records; red stars = new records.

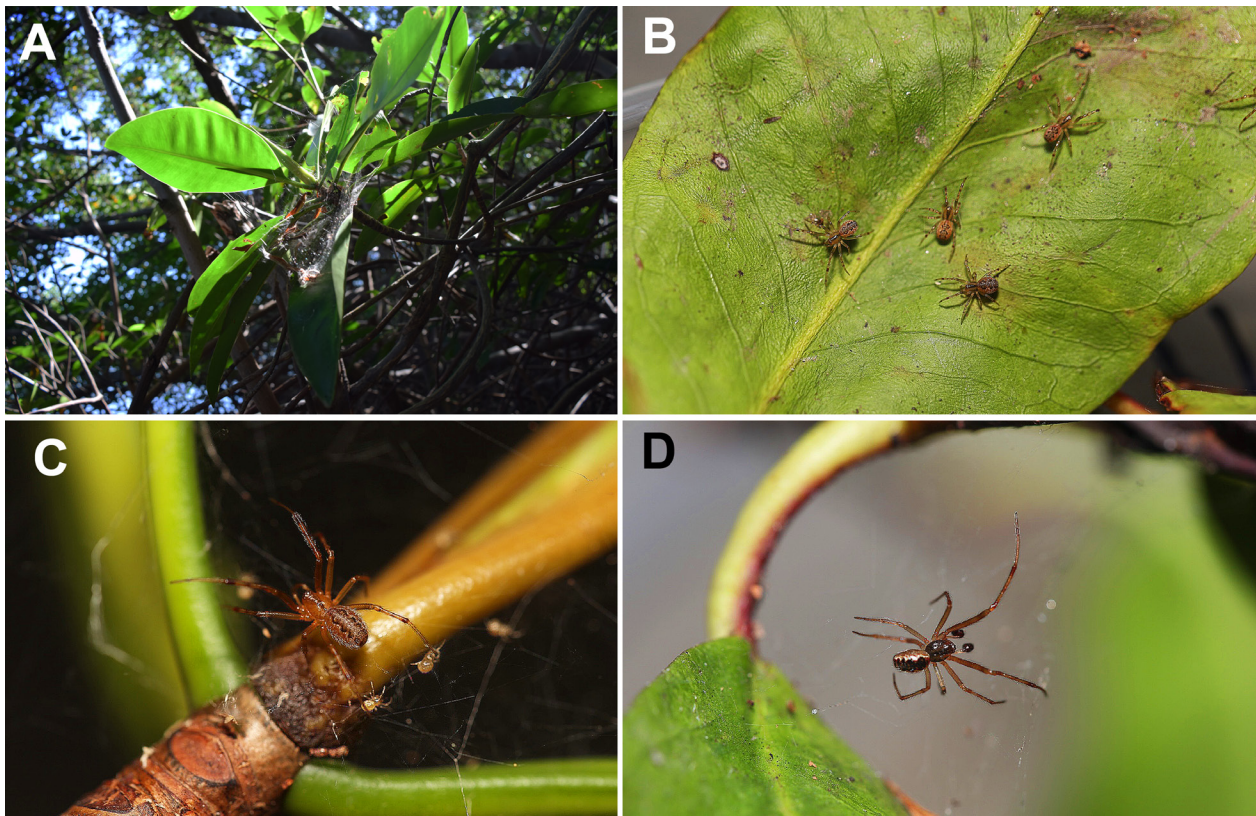


Figure 2. *Anelosimus jucundus*. **A.** Spider web of *A. jucundus*. **B.** Subadult females. **C.** Adult female with spiderling. **D.** Adult male.

has a wide altitudinal distribution from 200 to 2500 m. This suggests that *A. jucundus* tolerates a variety of climatic conditions and can colonize sites with different vegetation. However, experimental studies are necessary to know the tolerance ranges of temperature and humidity required for the survival and reproductive success of *A. jucundus*.

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Authors' Contributions

JFS, JCMSMS, EOF, FASN, JCP, and MLF collected and photographed the specimen. DP and GAVB wrote the manuscript and, made figures. All authors discussed the final results and contributed to the final version of the manuscript.

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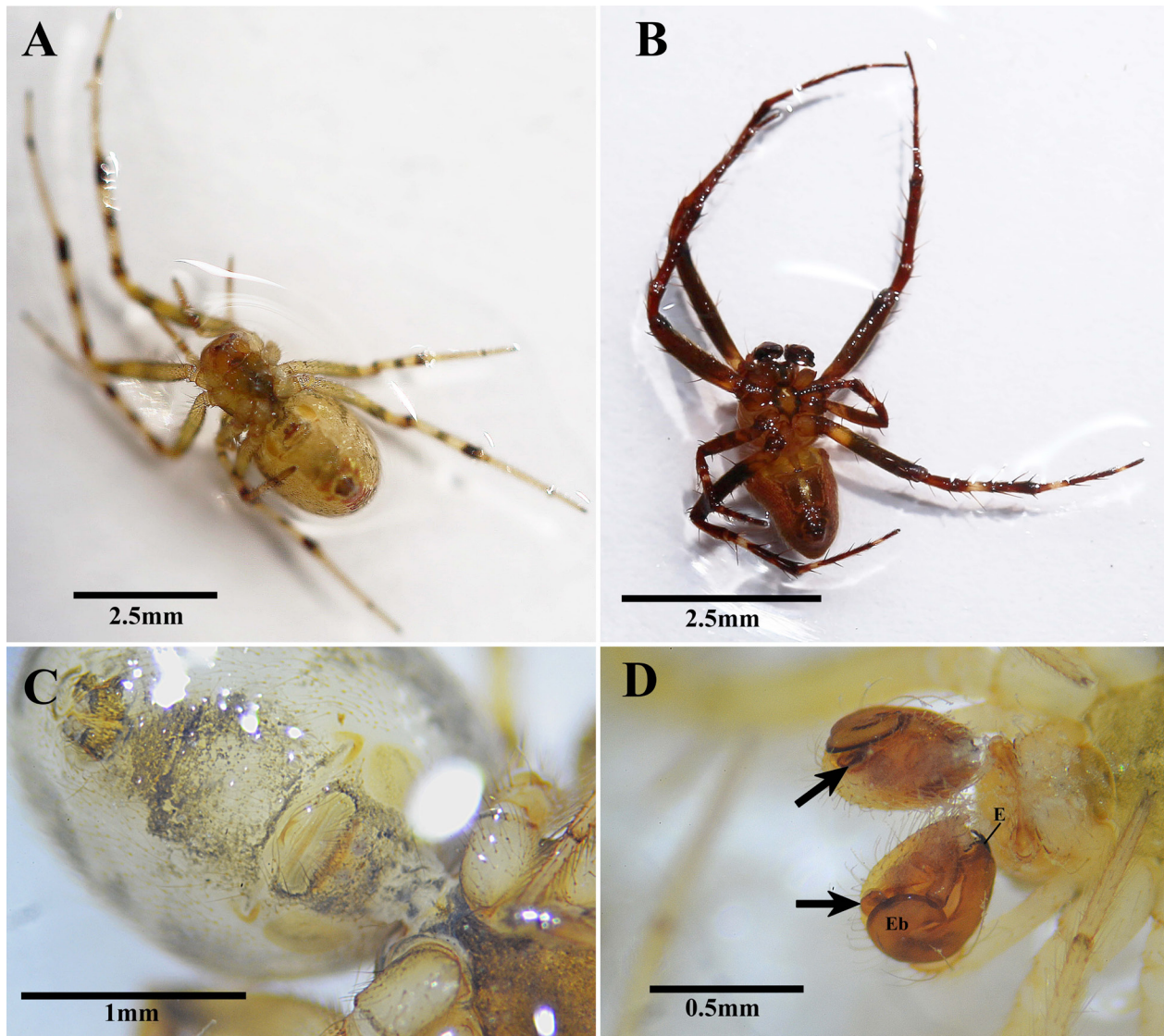


Figure 3. *Anelosimus jucundus*, genital detail. **A.** Adult Female ventral view. **B.** Adult Male ventral view. **C.** Epigynum. **D.** Male palp, note ectal outgrowth of the tegulum (black arrow), Eb = embolic division b, E = embolus.

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