ENTOMOLOGICAL Communications

Entomological Communications, 8, 2026: ec08009
doi: 10.37486/2675-1305.ec08009
e-ISSN: 2675-1305
Open Access Full Text Article

Scientific Note

First record of the spider *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae) for Northeast Brazil, with notes on natural history

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Edited by: Nikolas G. Cipola

Received: November 20, 2025. Accepted: January 04, 2026. Published: April 06, 2026.

Abstract. This study presents the first record of the spider *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae) in the state of Ceará, extending the species distribution to the Northeast region of Brazil. The research was conducted in a semideciduous montane forest at Sítio São Luíz, in the municipality of Pacoti, located within the Serra de Baturité Environmental Protection Area (APA). The region is characterized by a high-altitude environment that supports the maintenance of isolated humid forests, forming vegetation enclaves surrounded by the semi-arid Caatinga and serving as important biodiversity refugia. During field expeditions conducted in August 2024 and February 2025, male and female specimens of the species were collected, and behavioral observations provided information on its natural history. The *I. limbata* female constructs three-dimensional silk retreats on the inferior surface of perforated leaves, using the opening as an ambush point to capture prey on the superior surface. During the reproductive period, the spider seeks out intact leaves and constructs a completely sealed retreat in which the female remains with the eggs until they hatch. The construction of these reinforced, isolated shelters suggests a protective strategy against predators, parasitoids, and microclimatic variations, evidencing parental care behavior. The presence of *I. limbata* in the Northeast, previously recorded only in dense forest areas such as the Amazon, may reflect climatic events that occurred during the Pleistocene, while also reinforcing the importance of these areas for understanding the distribution of the genus *Isigonia* Simon, 1897 and revealing new occurrences.

Keywords: New occurrence, Distribution, Foraging, Atlantic forest.

The family Anyphaenidae Bertkau, 1878, is divided into two subfamily, Anyphaeninae and Amaurobioidinae, currently comprises 59 genera and 654 described species, with a worldwide distribution most species are recorded in the Neotropical region (Ramirez 2003; World Spider Catalog 2025). The group has undergone recent revisions that refined the taxonomy of genera in this region, providing an updated overview of its diversity (Oliveira & Brescovit 2015; Oliveira & Brescovit 2021; 2025; Oliveira et al. 2023). Also popularly known as ghost spiders due to the agility with which they move, they are nocturnal spiders that actively hunt in the vegetation, which is why they are frequently found on leaves (Brescovit 1997; Labarque et al. 2015). These spiders also commonly use leaves rolled up with silk threads as a retreat and exhibit important parental care, protecting their eggs from predators and parasitoids until they hatch (Zanatta 2016; 2022; Villanueva-Bonilla 2025).

The genus *Isigonia* Simon, 1897 belongs to the subfamily Anyphaeninae, and is characterized by the presence of a chillum, femur I as thick as the others, metatarsi I and II with two pairs of spines, and a palp with an inconspicuous subtegular projection (Brescovit 1991; 1997). Individuals of the genus generally possess easily observable external characteristics, presenting an off-white sternum, an abdomen with a gray dorsal part and a white ventral part, reddish-brown legs I and II, and orangish legs III and IV (for more details, see Brescovit 1991).

The genus is composed, up until now, of only 3 species: *Isigonia limbata* Simon, 1897; *Isigonia reducta* (Chickering, 1940); and *Isigonia camacan* Brescovit, 1991 (Araneae, Anyphaenidae). All species occur exclusively in South America, with distributed across Panama, Venezuela, Peru, and Brazil (World Spider Catalog 2025). In Brazil, two of the three described species are found: *I. camacan* and *I. limbata*. The latter, in particular, has previously been recorded only in the states of Amazonas and Pará (Brescovit 1993; Höfer & Brescovit 2001; Bonaldo et al. 2009; Dias & Bonaldo 2012). In addition to its limited geographic distribution, little is known about the natural history of this species.

The objective of this study is to report the first occurrence of *I. limbata* in the state of Ceará, thereby extending the distribution of the species to Northeast Brazil. Furthermore, it aims to present observations on the prey capture and egg protection behavior by the female of the species.

The study was conducted in a tropical area of semi-deciduous montane forest at Sítio São Luíz, located in the municipality of Pacoti, state of Ceará, Brazil (4°14'03.0"S; 38°53'26.0"W, 732 m elevation). The location is part of the Serra de Baturité Environmental Protection Area (APA). This site features a unique environment which the altitude provides favorable climatic conditions for the formation of a humid forest enclave surrounded by the semi-arid Caatinga region. These characteristics result in a hot tropical climate, with an average annual temperature of 20°C and humid conditions, with an average annual precipitation of 1483.2 mm (FUNCEME 2025).

Initially, eight specimens of *Isigonia limbata* were located and collected in the municipality of Pacoti in August 2024 during a scientific expedition to the region (all adult females, Fig. 2A). We later returned to the site in search of males and collected five additional specimens. The spiders were observed with respect to the structure of their retreat webs, the leaf architecture used for ambush prey capture, and the web structure for egg protection (Fig. 2B–D). They were then photographed using a Canon 6D digital camera with an EF 100mm f/2.8L Macro IS USM lens and subsequently collected and taken to the Laboratory of Ecology and Evolution at the University of International Integration of Afro-Brazilian Lusophony (UNILAB), where they were fixed in 70% alcohol and sent for identification and deposition in the arachnid collection of the Butantan Institute, São Paulo (IBSP, curator A.D. Brescovit).

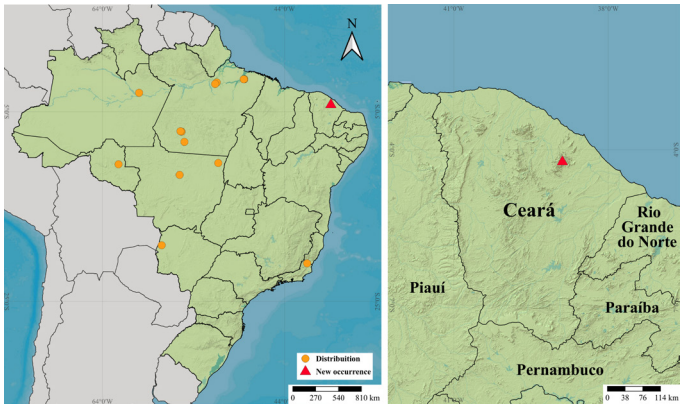

Figure 1. Distribution of *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae). **A**. Distribution of *I. limbata* in Brazil based on studies by Brescovit 1993; Höfer 2001 and Bonaldo et al. 2009; 2012 (yellow circles) and the new record (red triangle). **B.** Details of the new record for the state of Ceará, Brazil.

New records. Brazil: Ceará - Pacoti (04°14.048'S; 38°53.452'W), Araújo F.S. leg, 10.VIII.2024, 8 female (IBSP 348254, IBSP 348253, IBSP 348252, IBSP 348251, IBSP 348250, IBSP 348249), Araújo F.S. leg, 22.II.2025, 5 male (IBSP 348244, IBSP 348245, IBSP 348246, IBSP 348247, IBSP 348248).

The female *Isigonia limbata* constructs a dense, three-dimensional silk retreat, firmly anchored to the inferior surface of the leaf (Fig. 2B). This silk shelter has a domed structure, resembling a small tent or cupola, with multiple thick, taut anchor points extending from the retreat's edges to the leaf blade, provide support and structural stability (Fig. 2B). The leaves utilized for the shelter construction feature an orifice that serves as a doorway to both leaf surfaces, with the webs built over this opening (Fig. 3A-D). This clever design allows the spider to conceal itself while simultaneously monitoring the adaxial (upper) surface of the leaf (Fig. 2C). Thus, the spider remains hidden in its retreat and uses the orifice as an ambush point to capture potential prey landing on the leaf surface (Fig. 2C; Fig. 3A-D).

During the reproductive period, the female *I. limbata* alters the design of its retreat, constructing it on intact, unperforated leaves. She remains with the eggs until they hatch. Under these conditions, the retreat is constructed in a domed shape, resembling a protective capsule. It features thicker lateral silk reinforcements that fully seal the edges, preventing direct contact with the adaxial (upper) surface of the leaf and thereby forming an isolated compartment (Fig. 2B). The eggs are deposited inside the retreat, over which a separate, delicate layer of silk is constructed (Fig. 2D).

This study represents the first record of the spider *I. limbata* for the Northeast region of Brazil, expanding the known distribution of the species in the country, which was previously only recorded for the North, South, and Central-West regions of Brazil (Brescovit 1993; Höfer & Brescovit 2001; Bonaldo et al. 2009; Dias & Bonaldo 2012). This new record reinforces the biogeographical importance of the humid forest enclaves of the Serra de Baturité, which serve as biodiversity refugia within the semi-arid environment of the Caatinga, harboring species with Amazonian and Atlantic affinities (Benício et al. 2023). Such environments have proven to be crucial for the conservation of little-known taxa and for understanding the distribution patterns of Neotropical spiders.

The behavioral observations conducted in the field revealed patterns similar to those known for other Anyphaenidae species, which construct silk retreats on leaves that serve both as refuge and as base for ambushing prey (Brescovit 1997; Labarque et al. 2015). However, the use of perforated leaves for constructing retreats and hunting suggests an adaptive strategy for exploiting the microhabitat, allowing the spider to remain concealed on the abaxial surface while maintaining visual and physical access to the adaxial surface, where hunting occurs. This behavior demonstrates an efficient integration of camouflage and predation, enhancing foraging success and reducing the risk of predation.

The observed modification in the retreat structure and maternal presence during the reproductive period indicate a parental care behavior characteristic of other Anyphaenidae, such as *Aysha piassaguera* Brescovit, 1992 and *Eldar galadrielae* Oliveira & Brescovit, 2025, which protects their offspring against various natural enemies, including predators and parasitoid wasps, reducing the likelihood of attack and ensuring egg survival until hatching (Zanatta 2016; 2022; Villanueva-Bonilla 2025). Furthermore, the construction of completely sealed retreats on the underside of leaves may provide a more stable microenvironment against fluctuations in temperature and humidity, as reported in other studies on retreat architecture in spiders that adjust

Figure 2. *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae). **A.** Female of *I. limbata*. **B.** The shelter/retreat of *I. limbata* on the abaxial side of the leaf. **C.** Spider positioned beneath the entrance of the opening where it carries out its ambush **D.** Web with eggs of *I. limbata*.

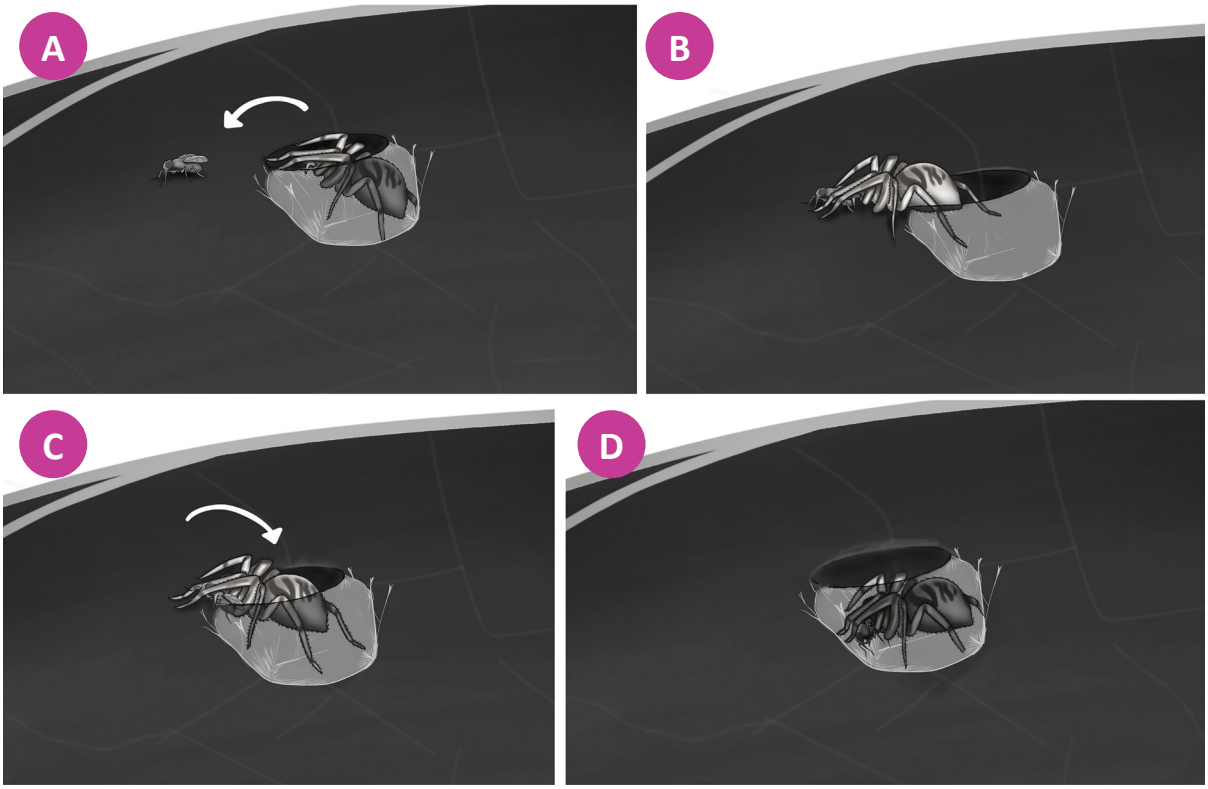

Figura 3. Foraging of *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae). **A.** A female *I. limbata* positioned inside its silk retreat, preparing to strike as a fly (prey) lands on the leaf above the opening. **B.** The spider in action, capturing the fly through the hole in the leaf. **C, D.** Sequence showing the spider returning to the retreat with the captured prey, where it will consume it safely.

Table 1. Distribution of *Isigonia limbata* Simon, 1897 (Araneae, Anyphaenidae) in Brazil according to the literature.

State	Record/ location	Year/sampling	Year/publication	Identifier	Reference	Collection
MS	Corumbá (Fazenda Manjolinho)	1942	1993	Brescovit	Brescovit 1993	MZSP 12357
MT	Serra do Tapirapé	1960	1993	Brescovit	Brescovit 1993	AMNH
PA	Belém	1970	1993	Brescovit	Brescovit 1993	MACN 8950
PA	Belém	1971	1993	Brescovit	Brescovit 1993	MACN 8949
MT	Sinop	1976	1993	Brescovit	Brescovit 1993	AMNH
RO	Ouro Preto do Oeste	1986	1993	Brescovit	Brescovit 1993	MNRJ
ES	Apiacá	1986	1993	Brescovit	Brescovit 1993	RLCB 2124
AM	Morro dos Seis Lagos	1990	1993	Brescovit	Brescovit 1993	MCN 21564
AM	Reserva Florestal Adolfo Ducke	1991	1993	Brescovit	Brescovit 1993	INPA
AM	Reserva Florestal Adolfo Ducke	1991-1992	2001	Höfer & Brescovit	Höfer & Brescovit 2001	INPA, SMNK
PA	Floresta Nacional de Caxiuanã	2005-2006	2009	Bonaldo et al.	Bonaldo et al. 2009	MPEG
AM	Coari	2006	2012	Dias & Bonaldo	Dias & Bonaldo 2012	MPEG

shelter structure in response to thermal variation (Steves et al. 2021; Zhong et al. 2025). This behavior may represent an adaptive response to the specific environmental conditions of humid high-altitude enclaves, where humidity and temperature vary throughout the day and across seasons (Souza et al. 2006). However, further investigations are necessary to validate these relationships and to better understand how parental care and retreat adjustment influence offspring survival in *I. limbata*.

The occurrence of *I. limbata* in the high-altitude humid forests of Ceará, previously known mainly from dense forest areas such as the Amazon, may reflect historical processes associated with climatic oscillations during the Pleistocene (Haffer 1969; Bartoleti et al. 2018; Silva et al. 2020). This discovery expands our knowledge of the geographical distribution of the genus *Isigonia* and underscore the need for further inventories and ecological studies in these areas, also known as exceptional landscapes, which may reveal new species and previously occurrences in the region.

Acknowledgments

We would like to thank the owners of Sítio São Luiz for supporting our research in the region, Dr. Antonio Domingos Brescovit for identifying the specimens used in this study, and the undergraduate research members of the Ecology and Natural Resources Research Group for joining our field expeditions and always assisting with the collections. Thanks to Dr. Luiz Fernando Moura de Oliveira for his help, suggestions, and valuable revisions of the manuscript.

Funding Information

This study was financed, in part, by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES-INCT-HYMPAR/SUDESTE 88887.478137/2020-00), Programa Institucional de Bolsas de Iniciação Científica (PIBIC-UNILAB PVN2091-2024), Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico (FUNCAP: Proc. PS1-0186-00411.01.00/21, FC3-0198-00094.01.00/22, UNI-00210-00485.01.00/23, BP6-0241-00187.01.00/25, NUP: 31052.001989/2025-53 J.F.S). Conselho Nacional de Desenvolvimento

Científico e Tecnológico (CNPq Universal 403884/2025-0).

Authors' Contributions

FSA: Investigation, Conceptualization, Formal Analysis, Methodology, Figures, Writing, Review and Editing. RSM: Investigation, Formal Analysis, Methodology, Tables, Writing, Review and Editing. SMS: Investigation, Formal Analysis, Methodology, Tables, Writing, Review and Editing. LCP: Formal Analysis, Writing, Review and Editing. JPGS: Formal Analysis, Writing, Review and Editing. JFS: Investigation, Formal Analysis, Review and Editinng.

Conflict of Interest Statement

The authors declare no conflict of interest.

Ethical Approval

This study did not involve human participants or vertebrate animals, as it was based exclusively on records and collection of invertebrates (spiders). Therefore, approval by an Animal Ethics Committee was not required. Specimens were collected under authorization issued by the Chico Mendes Institute for Biodiversity Conservation (ICMBio/SISBIO), License No. 97828-1.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Generative AI Statement

The authors confirm that no generative artificial intelligence tools were used in the writing, analysis, or preparation of this manuscript.

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