



Research article

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First endemic arachnid from Isla Sala y Gómez (Motu Motiro Hiva), Chile: a new species of tube-dwelling spider (Araneae: Segestriidae)

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Abstract. The Isla Sala y Gómez or Motu Motiro Hiva is located 415 km northeast of Rapa Nui (Easter Island) and 3420 km from the coast of northern Chile. It is a small oceanic island (2.5 km²) dominated by volcanic rock with very little vegetal cover. Here, we describe the first endemic arachnid for the island, *Ariadna motumotirohiva* sp. nov. Females are similar to those of *Ariadna perkinsi* Simon, 1900 from Hawai'i and *Ariadna lebronneci* Berland, 1933 from the Marquesas in the dorsal dark abdominal pattern, but they differentiate from the latter in the anterior receptaculum, promarginal cheliceral teeth and leg IV macrosetae. A recent survey of the arachnid fauna of Rapa Nui, which included Motu Nui and the rocky shores, did not record the presence of the family Segestriidae, neither has it been found during previous surveys. However, it is not possible to discard the possibility of a local extinction on Rapa Nui and survival on Sala y Gómez. This study suggests other endemic terrestrial arthropods could be present on this very small and remote island.

Keywords. Taxonomy, Synspermiata, *Ariadna*, Pacific Islands, morphology.

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Introduction

Ariadna Audouin, 1826 is a genus in the tube-web family Segestriidae, currently comprising 107 species (World Spider Catalog 2019). Recently, Giroti & Brescovit (2018) presented a new taxonomic revision of the genus for the American continent, in which six species were recorded from Chile: *Ariadna maxima* (Nicolet, 1849), *A. abrilae*, *A. araucana*, *A. changellkuk*, *A. levii*, all described by Grismado (2008), and *A. lalen* Giroti & Brescovit, 2018. Currently, only *A. maxima* can be found on Chilean islands, most precisely on the Juan Fernández islands, a small archipelago near the Chilean coast. Similarly to other members of the Segestriidae, this genus inhabits silk tube-webs, with irradiate threads, often inside tree logs and bark, rock crevices, and human constructions (Giroti & Brescovit 2018). Some species are even found in desert areas of Namibia, where they build silk tubes burrowed in the sand (Costa *et al.* 1995; Costa & Conti 2013).

The Isla Sala y Gómez or Motu Motiro Hiva ($26^{\circ}28' \text{ S}$, $105^{\circ}21' \text{ W}$) is located 415 km northeast of Rapa Nui (Easter Island) and 3420 km from the coast of northern Chile. It is 2.5 km² in area, has a horseshoe shape and measures 700 m east-west and 400 m north-south at its widest points (Fig. 1). The highest point reaches only 30 m above sea level (Castilla & Oliva 1988). This volcanic island is part of the same underwater mountain chain as Rapa Nui. The age of its lava flows ranges between 1.31 and 1.94 million years (Clark & Dymond 1977). The island's surface is dominated by volcanic rock with very little vegetal cover, composed of two vascular plants (*Portulaca oleracea* L. and *Sesuvium portulacastrum* (L.) L.; Rehder 1980) and one fern (*Asplenium obliquum* G.Forst.; Skottsberg 1956). Most of the faunistic studies from the island refer to marine invertebrates (Rehder 1980; Castilla & Rozbaczylo 1988; Burukovsky 1990; Tabachnick 1990; Coloma *et al.* 2004) and fishes (Parin 1991; Pequeño 2004). There are also records for 14 species of sea birds, with 10 of those nesting on site (Vilina & Gazitua 1999). The first record for a terrestrial arthropod on the island corresponded to *Cryptamorphodesgardinsi* (Guérin-Ménéville, 1844) (Silvanidae, Coleoptera; see Elgueta & Lazo 2013). This species is considered cosmopolitan and it is present on Rapa Nui (Campos & Peña 1973). Recently, Hershauer *et al.*

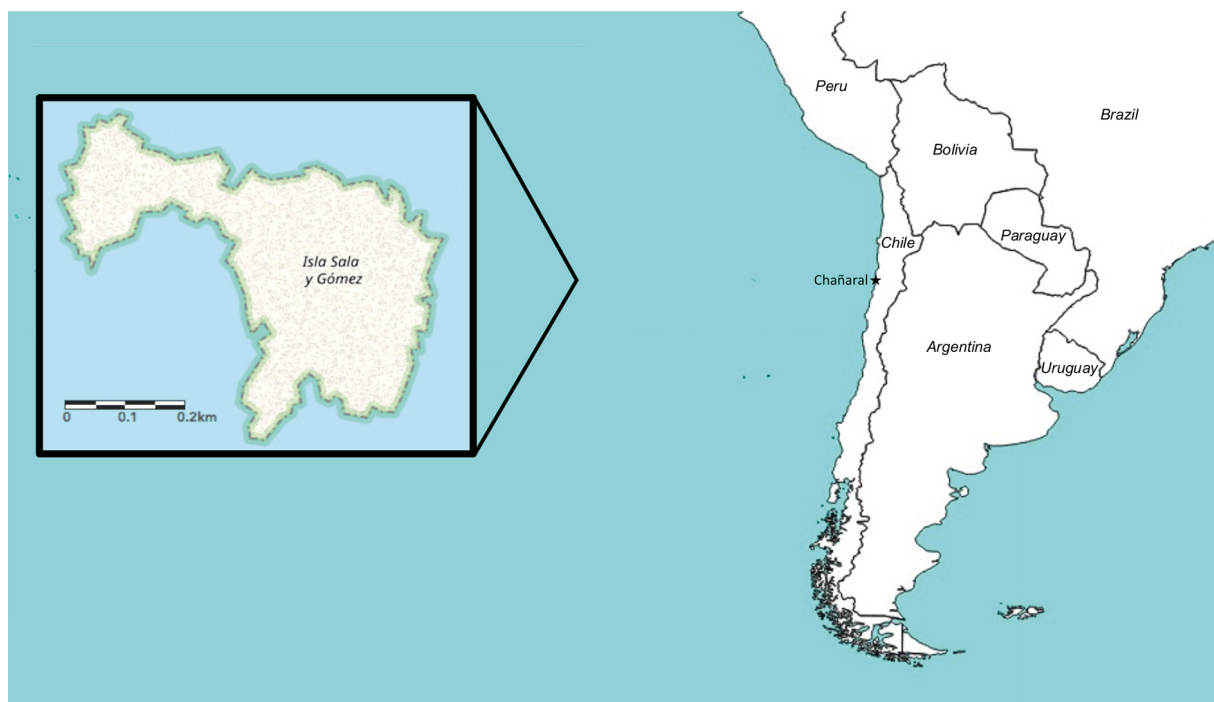


Fig. 1. Map of southern South America and Isla Sala y Gómez in detail. The islet is located approximately in front of Chañaral along the Chilean coast.

(2020) published an arthropod inventory carried out in 2016. In this species list, they report the presence of 15 terrestrial morphospecies representing 10 different orders, which include three arachnids including a Segestriidae, but without definition of species. The remoteness of Sala y Gómez, combined with the difficulties in accessing it are likely responsible for the limited number of terrestrial invertebrate records. In the present study, we describe the first endemic arachnid for the island, a new segestriid species, based on female specimens collected in 2012.

Material and methods

Examinations and descriptions of the specimens were made under a Leica MZ6 stereo microscope. Descriptions, macrosetae pattern and female internal genitalia preparation follow Giroti & Brescovit (2018). Measurements are in millimeters (mm), except those of the internal female genitalia. External morphology photographs were taken with a Leica DFC 500 digital camera attached to a Leica MZ16A stereo microscope; extended focal range photos were composed with Leica Application Suite ver. 3.8. Internal female genitalia photographs were taken with a Leica DFC 425 digital camera attached to a Leica DM 2500 microscope and stacked using Combine ZP 1.0 software. Illustrations were made using a Leica DM 4000 B microscope with camera lucida attached. Geographical coordinates are given in degrees (DMS). The map on Fig. 1 was treated with Esri (www.esri.com) and QGIS (ver. 2.18.28).

Abbreviations

ALS	= anterior lateral spinnerets	p	= prolateral
AR	= anterior receptaculum	PLS	= posterior lateral spinnerets
d	= dorsal	PR	= posterior receptaculum
DL	= dorsal lobe	r	= retrolateral
GD	= glandular ducts plate	UE	= uterus externus
IBSP	= Instituto Butantan São Paulo	v	= ventral
IF	= interpumonary fold	VL	= ventral lobe
MNHN	= Museo Nacional de Historia Natural de Chile	vp	= ventro-prolateral
		vr	= ventro-retrolateral

Results

Taxonomy

Class Arachnida Cuvier, 1812
 Order Araneae Clerck, 1757
 Family Segestriidae Simon, 1893
 Subfamily Ariadninae Wunderlich, 2004
 Genus *Ariadna* Audouin, 1826

Ariadna motumotirohiva sp. nov.

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Figs 1–3

Segestriidae sp. – Hershauer *et al.* 2020: 3, fig. 3b.

Diagnosis

Females of *Ariadna motumotirohiva* sp. nov. are similar to those of *Ariadna perkinsi* Simon, 1900 and *Ariadna lebronneci* Berland, 1933 due to the dark dorsal abdominal pattern (Fig. 2A; Giroti & Brescovit 2018: fig. 31a, e), but differ from the former by the anterior receptaculum with the dorsal lobe globous

(Fig. 3; Giroti & Brescovit, 2018: fig. 31i–j), by the presence of three promarginal teeth on the chelicerae and femur IV with dorsal macrosetae, and from the latter by four promarginal teeth (see Berland 1933: 44, figs 1–2).

Etymology

The name refers to the name given by the Rapa Nui people to the type locality, 'Motu Motiro Hiva'; noun in apposition.

Type material

Holotype

CHILE • ♀; V Región de Valparaíso, Isla Sala y Gómez; 26°28' S, 105°28' W; Nov. 2012; P. Lazo leg.; MNHN (MNHN 8366).

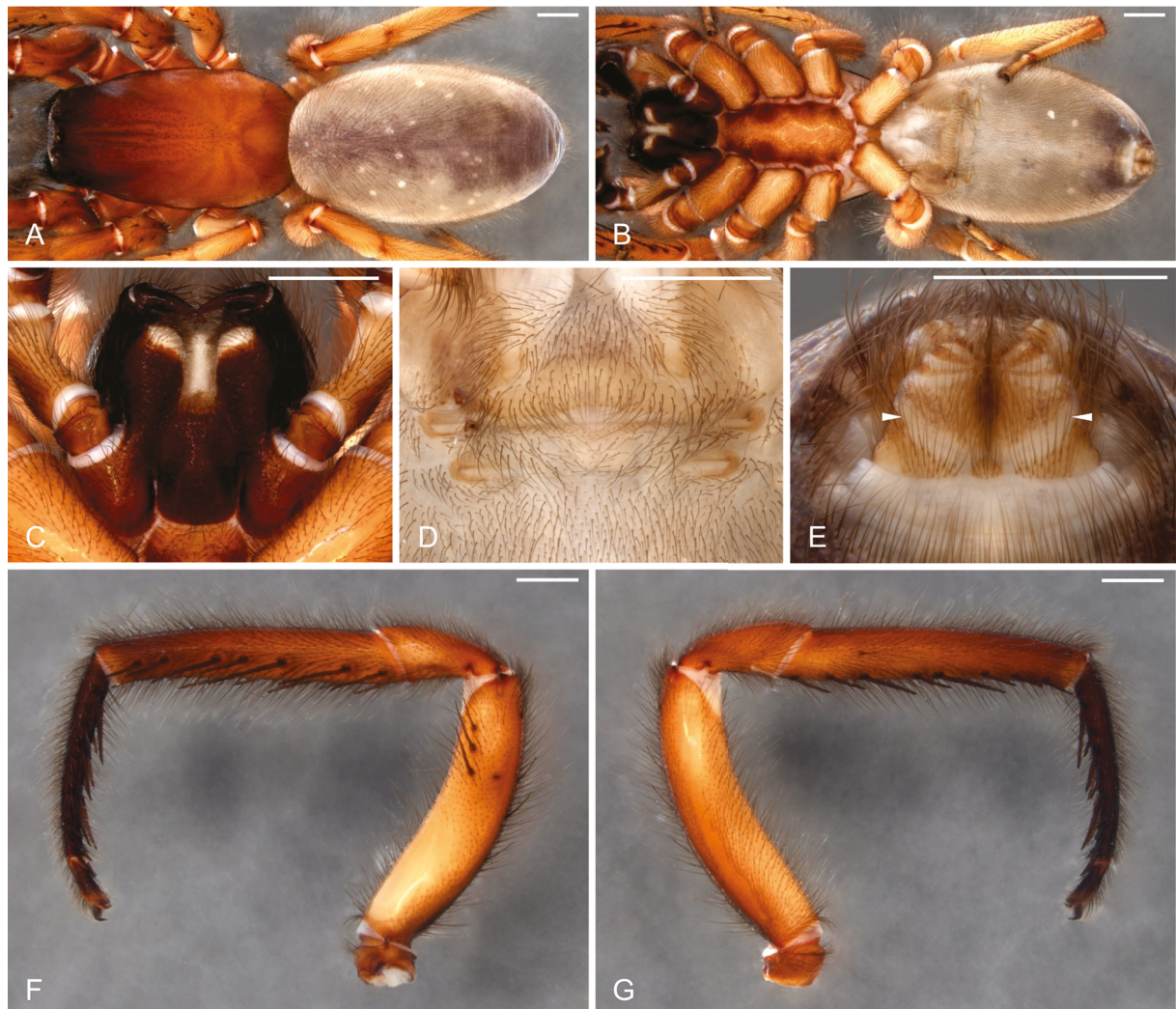


Fig. 2. *Ariadna motumotirohiva* sp. nov., ♀, holotype (MNHN 8366). **A.** Habitus, dorsal view. **B.** Habitus, ventral view. **C.** Endites, labium and labrum, ventral view. **D.** Epigastric furrow, ventral view. **E.** Spinnerets, ventral view, arrowheads showing the diagonal membranous stripes of the ALS. **F.** Right leg I, prolateral view. **G.** Right leg I, retrolateral view. Scale bars = 1 mm.

Paratype

CHILE • ♀; V Región de Valparaíso; same collection data as for holotype; IBSP (IBSP 246895).

Description**Female (holotype) (measurements in mm)**

Carapace orange with cephalic region reddish orange; eyes bounded by dark outlines (Fig. 2A). Chelicerae, endites and labium dark reddish orange (Fig. 2C). Sternum light orange with darker margins, and four pairs of dark marginal areas (Fig. 2B). Palps brownish orange, gradually darkening distally (Fig. 2B). Legs brownish orange with pairs I–II darker, and metatarsi and tarsi I–II reddish orange (Fig. 2F–G). Abdomen whitish grey, with a faint dark dorsal pattern comprising arrow-shaped marks (Fig. 2A–B). Total length 13.36; carapace 6.4 long, 3.76 wide. Carapace oblong, cephalic region narrower than thoracic region, with short setae conspicuously delimiting it. Six indirect eyes, with the posterior ones in a slightly recurved line (Fig. 2A). Chelicerae conical, wider basally, with frontal setae (Fig. 2A, C);

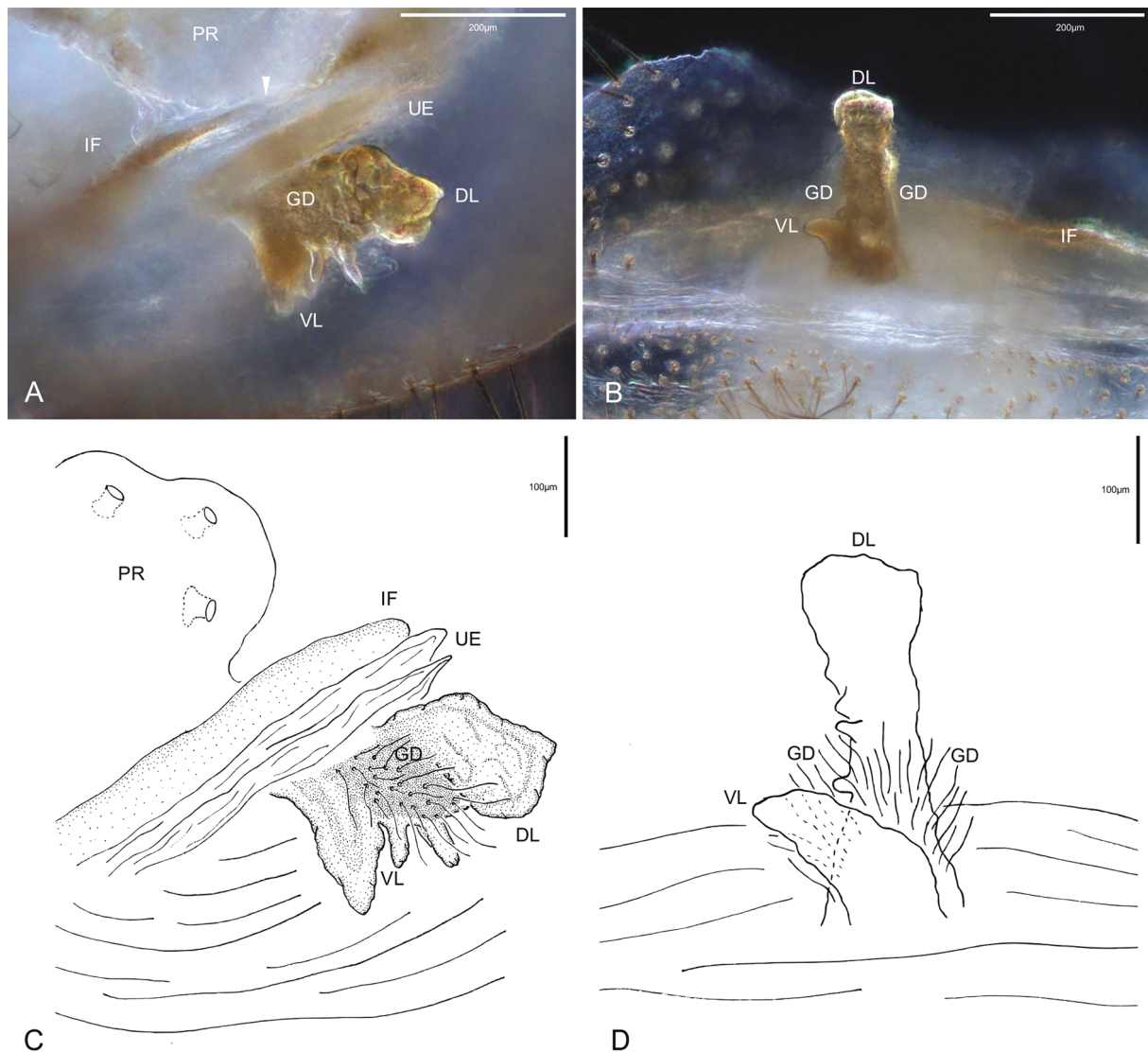


Fig. 3. *Ariadna motumotirohiva* sp. nov., ♀, paratype (IBSP 246895). **A–D.** Internal genitalia. **A, C.** Lateral view, arrowhead in A = median membranous crack. **B, D.** Detail of the anterior receptaculum, ventral view.

chelicerae with one retromarginal and three promarginal teeth. Endites spatulate, narrowed medially, rounded distally and proximally. Labium longer than wide, with a narrowed distal region. Labrum well developed, longer than the labium (Fig. 2C). Palps short and robust, with one diaxially orientated articulated claw; tarsi and tibia with prolateral setae. Legs robust, pair III directed forward (Fig. 2A–B, F–G). Leg formula: I–IV–II–III. Leg measurements: I, femur 4.48, patella 2.2, tibia 4.4, metatarsus 3.32, tarsus 0.72, total 15.12; II, 3.88, 2.08, 4.12, 3.04, 0.64, 13.76; III, 3.28, 1.76, 2.64, 2.52, 0.8, 11.0; IV, 4.32, 2.16, 3.6, 3.2, 0.8, 14.08. Macrosetae: I, femur d0-0-0-0-0/1-1-2/1-0, p0-0-0-0-1-2-1/0-1-0; tibia vp1-1-0-1/0-1-1-0-1-1-0, vr1-1-1-0-1-1-0-1-1-1-0, r0-0-1-0-0-0-0-0; metatarsus vp1-1-1-1-0/1-1-1-1-1-1-1-0/1-0/1-1, vr1-0-1-1-0-1-1-0-1-1-1-1; II, femur d0-0-1-1-1-2-0-2-0, p0-0-0-0-0-1-0-1-0; tibia p0-1-0-1/0-1/0-0-0-0-0-0, vp1-1-1-1-1/0-1-0-1/0-1-0, vr1/2-1-1-0-1-1-0-1-1/0-0/1-1-0, r0-0-0-1/0-1/0-0-0-0; metatarsus vp1-1-1-0/1-1-1-1-1-1-1, vr1-0-1-1-0-1-0-1-1-0-1; IV, femur d0-1-1-1-0-1/0-1/0-0-0-0, r0-0-0-0-0-0-0-1-0-0; metatarsus vr metatarsal comb with 3 macrosetae. Abdomen membranous, longer than wide, uniformly hairy; epigastric genital plate sclerotized; tracheal system dysderoid like, with the tracheal openings positioned near the epigastric furrow (Fig. 2A–B, D). Six spinnerets, ALS with three segments, the basal one crossed by a diagonal membranous band; PLS with distal external sclerite equally sclerotized; colulus distinct and pilose (Fig. 2E). Internal female genitalia with anterior receptaculum bilobulated, dorsal lobe conspicuously longer than the ventral one, with median and ventral projections; glandular ducts plate medianly positioned; interpulmonary fold with the dorsal margin sclerotized, and a median membranous crack; posterior receptaculum membranous, with tubular invaginations (Fig. 3).

Variation

Female (n = 2): total length 10.8–13.36; carapace 5.92–6.4 long, 3.44–3.76 wide; femur I 3.76–4.48.

Note

For comparison we used the female specimen of *A. perkinsi* described by Giroti & Brescovit (2018) (IBSP 209056) and the original description and illustrations provided by Berland (1933: 44) of *A. lebronneci*.

Distribution

Only known from the type locality (Fig. 1).

Discussion

A new species from the family Segestriidae is described based on female specimens collected on the remote Isla Sala y Gómez. The species is most similar to *Ariadna perkinsi* Simon, 1900 and *Ariadna lebronneci* Berland, 1933 due to the dorsal dark abdominal pattern; however, it differentiates from them in the anterior receptaculum and the promarginal cheliceral teeth, and leg IV macrosetae, respectively. These morphological affinities suggest an evolutionary proximity; however, explicit phylogenetic reconstructions including this species are still needed.

The colonization by the genus *Ariadna* of several remote archipelagos in the eastern Pacific (*A. perkinsi* in Hawai'i, *A. lebronneci* in the Marquesas, *A. maxima* in the Juan Fernández, *A. tarsalis* in the Galápagos, and *A. weaveri* in the Revillagigedo Islands; Grismado 2008; Giroti & Brescovit 2018; World Spider Catalog 2019), may have been mediated by rafting. The large size of these spiders when adult probably prevents mature specimens from performing ballooning (see Sheldon *et al.* 2017), although there is an exception to this claim found in Eresidae (Schneider *et al.* 2001). Currently, a single species is described for each group of islands, implying that the genus is not prone to diversifying within an island, or that there are cryptic species yet to be described.

Ariadna motumotirohiva sp. nov. is present on a single island, the closest land mass is Rapa Nui at 415 km. This distance is about 50 km greater than the separation between Kauaʻi and Maui in Hawaiʻi, or Isla Darwin and Isla San Cristóbal in the Galápagos; each island pair having populations of the respective species from the archipelago (Giroti & Brescovit 2018). However, there is the important difference of only having water between Sala y Gómez and Rapa Nui; while for the other examples, there are other islands in between, facilitating a potential stepping stone dispersal. Because of the high number of terrestrial extinctions on Rapa Nui (Wynne *et al.* 2014), the lack of knowledge and the depopulate condition of Sala y Gómez, it is difficult to argue that both islands correspond to an archipelago system, although for marine organisms this idea has been suggested (Rehder 1980). For this reason, the marine environment of Sala y Gómez might resemble the one on Rapa Nui before humans. Does the same situation apply to the terrestrial environment? It is important to consider the intrinsic particularities of Sala y Gómez, which create strong constraints for the species that inhabit it; particularly, the lack of permanent sources of fresh water, the reduced vegetation and the complete exposure to the marine environment. Therefore, the fairest comparison with Rapa Nui will correspond to the rocky shores or, even more similarly, to the two islets on the south of the island (Motu Nui and Motu Iti).

A recent survey of the arachnid fauna of Rapa Nui, which included Motu Nui and the rocky shores, did not record the presence of Segestriidae, neither was it described from previous collections (Cotoras *et al.* 2017a). However, it is not possible to discard the possibility of local extinction on Rapa Nui and survival on Sala y Gómez. The only endemic spider described for Rapa Nui, *Tetragnatha paschae* (Tetragnathidae), potentially went extinct during the first half of the 20th century (Cotoras *et al.* 2017b), implying that other unrecorded extinctions may also have occurred.

Neighboring small islets could function as relictual sites for the species originally present on the main island. This has been shown for plants in Hawaiʻi (Wood 2012) and for the Lord Howe Island stick insect (Priddel *et al.* 2003). The situation of the latter bears similarities to that of *A. motumotirohiva* sp. nov., due to the almost complete lack of vegetation on Ball's pyramid, the islet where the stick insect was re-discovered.

This study provides the first record of an endemic arachnid on Isla Sala y Gómez, suggesting that other endemic terrestrial arthropods could be present on this very small and remote island. Only paleontological studies of sediment cores from the Rapa Nui lakes could reveal whether *A. motumotirohiva* sp. nov. is a relictual species previously also present on Rapa Nui or an extreme case of local insular endemism.

Acknowledgments

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