GAYANA Gayana (2024) vol. 88, No. 2, 297-309

ORIGINAL ARTICLE

A new species of tarantula of the genus *Euathlus* (Araneae: Theraphosidae) from Chile: distribution and possible threats to its conservation

Una nueva especie de tarántula del género *Euathlus* (Araneae: Theraphosidae) de Chile: distribución y posibles amenazas para su conservación

Andrés Taucare-Ríos[1], Sergio Ocares Plaza[2] & Fernando Pérez-Miles[3,*]

[1]Facultad de Ciencias, Universidad Arturo Prat, Casilla 121, Iquique, Chile.
[2]Los Aromos 2650, condominio Sta. María, Alto hospicio, Chile.
[3]Sección Entomología, Facultad de Ciencias, Universidad de la República, Uruguay.
*Corresponding author: myga@fcien.edu.uy

ABSTRACT

We describe and illustrate a new species of tarantula of the genus *Euathlus* Ausserer, 1875, *Euathlus walteri* sp. nov. This species represents the first record for the genus in Tarapacá region, being the northernmost limit of its known distribution in Chile. Known and potential distribution are provided. Precipitations and altitude are the most important variables for its distribution. In addition, the conservation status of the new species is discussed, and it is proposed as Endangered (EN) according to IUCN criteria.

Keywords: conservation, distribution, endemic, mygalomorph, northern Chile.

RESUMEN

Describimos e ilustramos una nueva especie de tarántula del género *Euathlus* Ausserer, 1875, *Euathlus walteri* sp. nov. Esta especie constituye el primer registro del género para la región de Tarapacá y representa el límite norte de su distribución en Chile. Se presenta la distribución geográfica conocida y potencial. Las precipitaciones pluviales y la altitud son las variables más importantes para explicar su distribución. El estatus de conservación de la especie es discutido y se propone categorizar la nueva especie como En Peligro (EN) de acuerdo con los criterios de UICN.

Palabras clave: conservación, distribución, endémica, migalomorfa, norte de Chile.

INTRODUCTION

The genus *Euathlus* Ausserer, 1875 comprises medium-sized tarantulas distributed in Argentina, Perú and Chile (World Spider Catalog 2024). These spiders live from the sea level up to higher altitudes and in last decade were studied by Perafán and Pérez-Miles (2014), Ferretti (2015), Ríos-Tamayo (2020), Quispe-Colca and Ferretti (2021). To date, the genus comprises 14 described species present in South America (World Spider Catalog, 2024). In Chile is represented by *Euathlus affinis* (Nicolet, 1849), *Euathlus antai* Perafán & Pérez-Miles 2014, *Euathlus atacama* Perafán & Pérez-Miles 2014, *Euathlus condorito* Perafán & Pérez-Miles 2014, *Euathlus manicata* (Simon, 1892), *Euathlus truculentus* L. Koch, 1875 and *Euathlus parvulus* (Pocock, 1903). All these species stand out for their limited distribution and high level of endemism (Perafán and Pérez-Miles 2014). Currently, seven species of *Euathlus* in this country were classified according to their conservation status (MMA, 2017): *E. antai*, *E. parvulus*, *E. atacama* and *E. condorito* as Critically Endangered (CR),

Euathlus affinis as Endangered (E), *E. truculentus* as Endangered (E) and *E. manicata*, as Near Threatened (NT). This group of spiders is characterized by males with a copulatory bulb with two prolateral keels and the tip curved retrolaterally, the tibial apophyses have retrolateral spines, a subapical spine on the retrolateral branch and the presence of an abdominal central dorsal patch of urticating setae represented mainly by type III and IV (Perafán & Pérez-Miles 2014; Ríos-Tamayo, 2020; Quispe-Colca and Ferretti, 2021). Females with two quadrangular spermathecal receptacles with a lateral spheroid chamber (Perafán & Pérez-Miles 2014). Field work developed in Tarapacá Region, Chile, led (Sergio Ocares Plaza) to collect some individuals that fit with the characteristics of *Euathlus*, but differ from all known species, so we hypothesize they could belong to a new species.

Knowledge about geographical distribution is essential to assess the conservation of species (Guisan & Thuiller, 2005; Anderson *et al.* 2002; Araújo *et al.* 2019). In this sense, potential distribution modelling has been widely used to predict and to understand the geographical distribution of rare and endemic species (de Queiroz *et al.* 2012; Morales *et al.* 2017). Using the occurrences and the climatic conditions where a species lives, we can determine the climatic niche of the species. These tools allow us to model the potential distribution of endemic species, generating successful conservation policies (Guisan & Thuiller, 2005; Morales *et al.* 2017; Qazi *et al.* 2022). One of the most used programs is Maxent. This program is usefulness lies in its ease of use and that it does not need too many occurrences to project the ecological niche of a species (Phillips *et al.*, 2006; Shcheglovitova & Anderson, 2013).

A decade ago, previous studies had reported specimens of *Euathlus* in the foothills and highlands of the Tarapacá region (Taucare-Ríos & Sielfeld, 2013), but they were never adequately described. New collections have recently been made in the highland area, obtaining adult individuals of *Euathlus*. These collections were carried out between September and November 2023 in the highlands of Tamarugal province. Its climate is very cold, dry and has large daily thermal amplitudes, with rainfall that decreases from north to south (600-200 mm annually), concentrated between December and March (60-90% of the annual total) (Garreaud *et al.*, 2003). In this work we describe, diagnose, and illustrate a new species of the genus *Euathlus* from Chile. In addition, know and potential distributions are provided, allowing the assessment of the conservation status of this new species.

MATERIAL AND METHODS

Taxonomy. Specimens were collected manually and stored in 80% ethanol. The studied specimens were deposited in the arachnological collection of the Museo Nacional de Historia Natural (MNHN), Santiago, Chile and Entomology, Science Faculty, Montevideo, Uruguay (FCE–MY). The female spermathecae was dissected and immersed in clove oil for study. Photographs were taken using a stereomicroscope Leica M205A with digital camera and images were processed with LAS Software except for female body which was photographed with Nikon D3200 due to her large size. Measurements were taken under stereomicroscope with ocular micrometer and are in millimeters. Total length does not include chelicerae, nor spinnerets. Palpal bulb terminology follows Bertani (2000), Fukushima *et al.* (2005) and Fonseca *et al.* (2017). Spination description follows Pérez-Miles *et al.* (2008); leg scopula is described as proposed by Pérez-Miles (1994); tibial apophysis are described following Perafán & Pérez-Miles (2014); and urticating setae following Cooke *et al.* (1972) and Bertani & Guadanucci (2013). When bilateral features are counted (e.g. cuspules, spines) right/left numbers are represented. Other terminology and description format follows Perafán & Pérez-Miles, 2014. The following abbreviations are used throughout the descriptions: ALE = anterior lateral eyes, AME = anterior median eyes, AK = accesory keel, d= dorsal, OQ = ocular quadrangle (incl. lateral eyes), p = prolateral, PI = prolateral inferior keel, PLE = posterior lateral eyes, PME = posterior median eyes, PS = prolateral superior keel, r = retrolateral, v = ventral.

Potential distribution modeling. The geographic coordinates were taken from Google Earth. The potential distribution was modelled with Maxent Version 3.3.4 (Phillips *et al.*, 2009) which produces results ranging from 0 to 1, indicating the relative suitability of a given cell (Hijmans & Graham 2006; Phillips *et al.*, 2006). We chose Maxent because it: (1) is in common use; and (2) has been found to perform well for small sample sizes in previous studies with endemic species (Pearson *et al.*, 2007; Shcheglovitova & Anderson, 2013; Vásquez-Palacios *et al.*, 2023). We use 4 records to obtain the model. Those from the type localities and previous records (Taucare-Ríos & Sielfeld, 2013). We applied the criteria of fitting the model by modifying the parameters of Shcheglovitova & Anderson (2013) for small sample sizes. We compare four different models: Linear plus quadratic (L_Q), Auto Features (AF), Quadratic (Q), and Linear (L); using three different regularization values (0.25, 1, 2) (Phillips *et al.*, 2006) to evaluate the best performance using the metric of the Area Under Curve (AUC) (Swets, 2014), according to the recommendations for datasets of less than 10 records (Anderson & Gonzalez, 2011). The values of AUC greater than 0.9 indicate very good predictive power, values between 0.8 and 0.9 indicate good predictive power and values between 0.7 and 0.8 indicate predictive power

useful, but low (Swets 1988). The resulting predictions were visualized and mapped by importing the ASCII files to ArcGis 10.7.1 grid format (Hijmans *et al.*, 2005). Understanding that it is important to validate the distribution model with few occurrences, we subsequently carried out observational sampling in different parts of northern Chile (Punta Gruesa, Alto Hospicio, La Tirana, Pica, Altos de Pica, Azapa, Putre, Chapiquiña, Tocopilla, Antofagasta, Quillagua and Calama). We recorded the places where we did not find *E. walteri* sp. nov. and those where specimens were observed based on the distribution model.

We used 20 environmental variables from WorldClim (version 1.4; Hijmans *et al.* 2005) for modeling. Average annual temperature (°C) (BIO1), Temperature oscillation during the day (°C) (BIO2), Isothermality (Bio3), Temperature stationarity (°C) (BIO4), Average maximum temperature during the hottest season (°C) (BIO5), Average minimum temperature during the coolest season (°C) (BIO6), Annual temperature oscillation (°C) (BIO7), Average temperature during the rainiest season (°C) (BIO8), Average temperature during the driest trimester (°C) (BIO9), Average temperature during the hottest trimester (°C) (BIO10), Average temperature during the coolest trimester (°C) (BIO11), Annual precipitation (mm) (BIO12), Precipitation during the rainiest season (mm) (BIO13), Precipitation during the driest trimester (mm) (BIO14), Precipitation stationarity (mm) (BIO15), Precipitation during the rainiest trimester (mm) (BIO16), Precipitation during the driest trimester (mm) (BIO17), Precipitation during the hottest trimester (mm) (BIO18), Precipitation during the coolest trimester (mm) (BIO19) and Elevation (alt 20).

RESULTS

***Euathlus walteri*, new species** (Figures 1-8. Tables 1, 2)

Holotype. FCE-My 1667, adult male from Chile, Pica, Tamarugal province, Tarapacá region, road to Quebrada Blanca 20°50'53.67"S, 68°56'18.31"W, 4,269 m a.s.l, 25/09/23, under rock, Sergio Ocares Plaza leg.

Paratypes. FCE-My 1668, adult female from Chile, Pica, Tamarugal province, Tarapacá region, road to Collahuasi, Ujina site 20°46'45.07"S, 68°58'29.65"W, 4,036 m a.s.l. 15/10/23, Sergio Ocares Plaza leg. MNHN 8414, adult female from Chile, Pica, Tamarugal province, Tarapacá region, road to Quebrada Blanca 20°48'30.41"S, 68°56'53.57"W, 4,169 m a.s.l 25/09/23, under rock, Sergio Ocares Plaza leg. MNHN 8415, adult female from Chile, Chusmiza, Huara, Tamarugal province, Tarapacá region: under rock, 19°39'12.27"S, 69° 7'52.73"W, 3,850 m a.s.l., 05/09/2013, Marcos Ferrú leg.

Etymology. This species is named in honor of Walter Sielfeld Kowald, professor and mentor of the first author, who has contributed to the training of biologists in the Tarapacá region for decades.

Diagnosis. Males (Fig. 1a) differ from most species by the presence of AK on palpal bulb, from *E. vanessae* and *E. mauryi* in the PI not serrated. (Figs. 2a-e). Additionally differ from *E. mauryi* in the absence of a protuberance between both branches and from *E. grismadoi* in the shorter embolous (Fig. 2) and the more sclerotized tibial apophysis (Fig. 3). Males are also characterized by a very conspicuous coloration: carapace and legs light brown, femora, patellae and tibiae with two dorsal parallel lighter stripes; metatarsi and tarsi very dark brown, almost black; chelicerae very lighter than body; anterior region of the abdomen reddish-brown (Fig. 1a). Females differ from all known species in the shape of the spermathecae with two wide and short seminal receptacles each with a sinusoid anterior edge, a medial lobule pronounced and a lateral sub-spheroid chamber, both in opposition to the epigastric furrow (Fig. 4).

Description of male holotype. Total length: 20.56. Carapace (Fig. 5a): length 8.6, width 8.3. Anterior eye row slightly procurved, posterior eye row recurved. Eye sizes and interdistances: AME 0.23, ALE 0.32, PME 0.20, PLE 0.30, AME-AME 0.34, AME-ALE 0.15, PME-PME 0.71, PME-PLE 0.13, ALE-PLE 0.22, OQ length 0.72, width 1.2, clypeus 0.3. Labium length 1.2, width 1.6, with 88 cuspules, maxillae right/left with 75/74 cuspules (Figs. 5b, 7a). Sternum length 4.1, width 3.5. Chelicerae with eight well-developed teeth on promargin of furrow. Tarsus I-IV densely and complete scopulated. Metatarsi I and II 100% scopulated, metatarsi III 33% scopulated and metatarsi IV 25% scopulated. Sternum length 4,1, width 3,5. Abdomen (Fig. 5c-d): length 12, width 8.5. Abdomen with type III urticating setae located in a medial dorsal patch. Urticating setae patch: length 5.2, width 7.1. Tibia I apophysis with branches convergent of almost equal lengths, PB with one basal short spine and RB with one big subapical spine (Fig. 3). Spination: Femora I: 1r; II-IV 0, Patella I-IV 0; Tibia I: 3r,2v,2d,1p; II: 2p,2r,7v, III:4p,2r,6v, IV: 3r, 7v, Metatarsi I: 3v, II: 6v, III: 6v,3r, IV: 2p, 2r, 2v. Tarsus I-IV and palp 0. Leg pattern: IV>I>II>III (Tab. I). Palpal bulb (Figs. 2a-e) with unequal prolateral keels, PS and PI well-development, PI without serrated edge, AK present, small, between PS and PI. Coloration (in life): carapace dark brown, widely covered with light brown setae from the anterior edge of ocular tubercle to the fovea, and light brown setae on the margins. Abdomen dark brown with a large patch of light-brown urticating setae heart shaped. Legs dark brown, with abundant long silver-brown setae. Femora with three parallel longitudinal stripes;

patellae and tibiae with two parallel longitudinal stripes. Femora to metatarsi with abundant whitish hairs, tarsus complete dark (Fig. 1a).

Female paratype. (FCE-My 1668, Fig. 1b). Total length: 35.2. Carapace (Fig. 6a): length 16, width 14.5. Anterior eye row slightly procurved, posterior eye row recurved. Eye sizes and interdistances: AME 0.3, ALE 0.33, PME 0.25, PLE 0.30, AME-AME 0.28, AME-ALE 0.17, PME-PME 0.71, PME-PLE 0.13, ALE-PLE 0.22, OQ length 1.7, width 2.1, clypeus 0.4. Labium length 1.5, width 2.0, with 188 cuspules, maxillae right/left with 164/165 cuspules (Figs. 6b, 7b). Sternum length 8.2, width 6.3. Chelicerae with seven teeth on promargin of furrow. Leg pattern: IV>I>II>III (Tab. II). Tarsus I-IV densely and complete scopulated. Metatarsi I and II 33% scopulated, metatarsi III 33% scopulated and metatarsi IV 25% scopulated. Abdomen (Fig. 6 c-d): length 19.2, width 16.5. Abdomen with type III and IV urticating setae located in a medial dorsal patch. Urticating setae patch: length 4.5, width 6.7. Spination: Femora I-IV 0, Patella I-IV 0; Tibia I 4v, II: 4v, III 3v, IV 2v, Metatarsi I: 2v, II: 1v, III: 3, 3v, 2r, IV: 2p, 2r, 3v. Tarsus I-IV and palp 0. Leg pattern: IV>I>II>III (Tab. II). Spermathecae with two wide and short seminal receptacles each with a more or less sinusoid anterior edge, a medial pronounced lobule and a lateral sub-spheroid chamber, both in oposition to the epigastric furrow (Fig. 4).

Figure 1. *Euathlus walteri* sp. nov., habitus, dorsal view: (a) male holotype (FCE-My 1667). (b) female paratype (FCE-My 1668), Pica, Tarapacá, road to Quebrada Blanca, northern Chile. P hotos by Andrés Taucare-Ríos. / *Euathlus walteri* sp. nov., habitus, vista dorsal: (a) holotipo macho (FCE-My 1667). (b) paratipo hembra (FCE-My 1668), Pica, Tarapacá, camino a Quebrada Blanca, norte de Chile. Fotos por Andrés Taucare-Ríos.

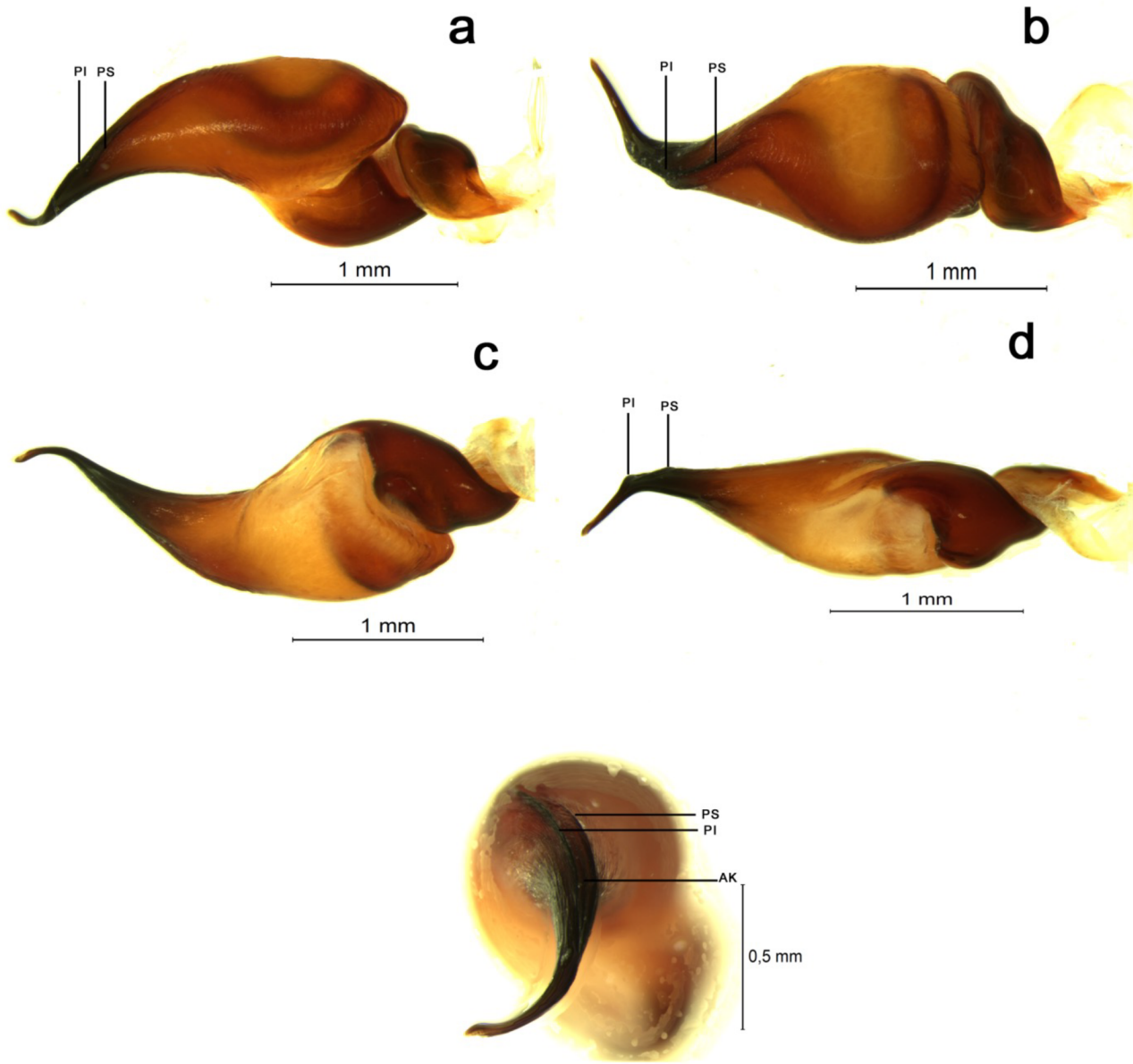

Figure 2. *Euathlus walteri* sp. nov., male holotype (FCE-My 1667), morphology of left palpal bulb. (a) Prolateral view, (b) ventral view, (c) retrolateral view, (d) dorsal view, (e) apical view. AK = accesory keel, PS = prolateral superior keel, PI = prolateral inferior keel. / *Euathlus walteri* sp. nov., holotipo macho (FCE-My 1667), morfología del bulbo izquierdo. (a) Vista prolateral, (b) vista ventral, (c) vista retrolateral, (d) vista dorsal, (e) vista apical. AK = quilla accesoria, PS = quilla prolateral superior, PI = quilla prolateral inferior.

Figure 3. Left tibial apophysis showing prolateral branch (PB) and retrolateral branch (RB), ventral view. /Apófisis tibial izquierda mostrando la rama prolateral (PB) y la rama retrolateral (RB).

Figure 4. *Euathlus walteri* sp. nov., female paratype (FCE-My 1668). Spermathecae, ventral view. / *Euathlus walteri* sp. nov., paratipo hembra (FCE-My 1668). Espermatecas, vista ventral.

Figure 5. *Euathlus walteri* sp. nov., male holotype (FCE-My 1667): (a) carapace, dorsal view; (b) cephalothorax, ventral view; (c) abdomen, dorsal view; (d) abdomen, ventral view. / *Euathlus walteri* sp. nov., holotipo macho (FCE-My 1667): (a) cefalotórax, vista dorsal; (b) cefalotórax, ventral view; (c) abdomen, vista dorsal; (d) abdomen, vista ventral.

Figure 6. *Euathlus walteri* sp. nov., female paratype (FCE-My 1668): (a) carapace and abdomen, dorsal view; (b) sternum, labium, maxillae, coxae and abdomen, ventral view. Scale bar: 1 mm. / *Euathlus walteri* sp. nov., paratipo hembra (FCE-My 1668): (a) cefalotórax y abdomen, dorsal view; (b) cefalotórax y abdomen, vista ventral. Escala: 1 mm.

Coloration (in life): Carapace dark brown widely covered with light brown setae. Legs light brown, with abundant long reddish-brown setae. Femora with three parallel longitudinal stripes (two dorsal and one retrolateral); patellae and tibiae with two parallel longitudinal stripes and one longitudinal stripe reaching the third part of the metatarsi, tarsus dark brown without markings. Abdomen dark brown, with a large patch of golden-brown urticating setae heart shaped (Fig. 1b).

Natural History. The habitat of the new species is characterized by a cold and arid environment of the dry puna. The vegetation is made up of low-lying bushes and an abundance of rocks. The dominant species in these environments are *Festuca orthophylla* Pilg. 1898 and *Parastrephia lepidophylla* (Wedd.) Cabrera. However, it is also possible to find it associated with shrubs such as *Balbisia*, *Ephedra* and *Metharme*. The female paratype was found in spring inside a tubular burrow under a stone. The male holotype was found in the same season under rock under a stone without any apparent shelter.

Known and potential distribution. *Euathlus walteri* sp. nov. is found only in localities from Tamarugal province, Tarapacá region, Chile, approximately in altitudes between 3,800 and 4,200 m a.s.l. It is not found either on the coast or in the intermediate depression, where conditions are hyper-arid with no precipitation (Fig. 8). The known distribution of this species goes from Chusmiza to Quebrada Blanca, covering an approximate distance of 350 km. In the potential distribution model (Fig. 8), the red areas represent regions with the highest occurrence probability, which coincides with the appearance of Andean tropical low scrub (*Festuca orthophylla*, *Parastrephia lepidophylla* and *P. lucida*). The model predicts an extension of its distribution southward from Ujina to Ascotan and Conchi viejo, while towards the north it predicts its distribution until Isluga. The model does not predict the presence of the species at low altitudes and coast locations. The highest habitat suitability is concentrated in 450 km^2 between Altos de Pica and Ujina gradually decreasing towards lower altitude environments. Considering all climatic variables, the model provides an excellent fit (AUC = 0.993 ± 0.003). According to the AUC criteria, the best models were the Linear (0.96), and the model of Auto Features (0.993). The environmental variables that best explain the distribution of *E. walteri* sp. nov. were Precipitation stationarity (mm) (59.3%), Precipitation during the coolest trimester (mm) (8.8%), Precipitation during the rainiest season (mm) (3.4%) and elevation (12.2%). The species will be present in places whose rainfall is between 15-50 mm. On the other hand, altitude is another important variable that determines the appearance of low-lying scrub, which constitutes the main habitat of this species.

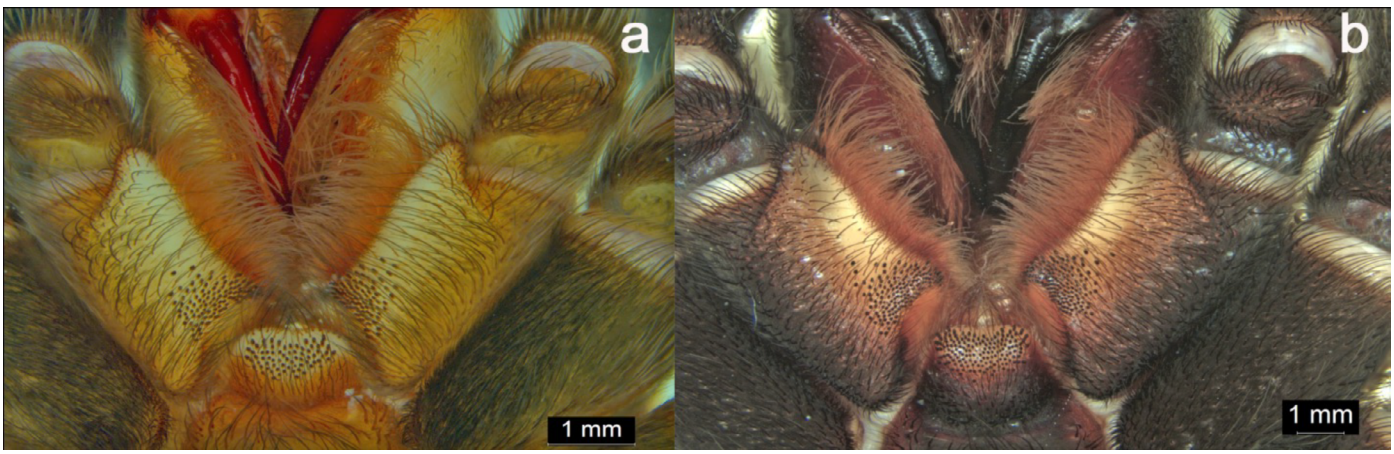

Figure 7. *Euathlus walteri* sp. nov., oral region, ventral view: a. female paratype (FCE-My 1668); b. male holotype (FCE-My 1667). / *Euathlus walteri* sp. nov., region oral, vista ventral: a. paratipo hembra (FCE-My 1668); b. holotipo macho (FCE-My 1667).

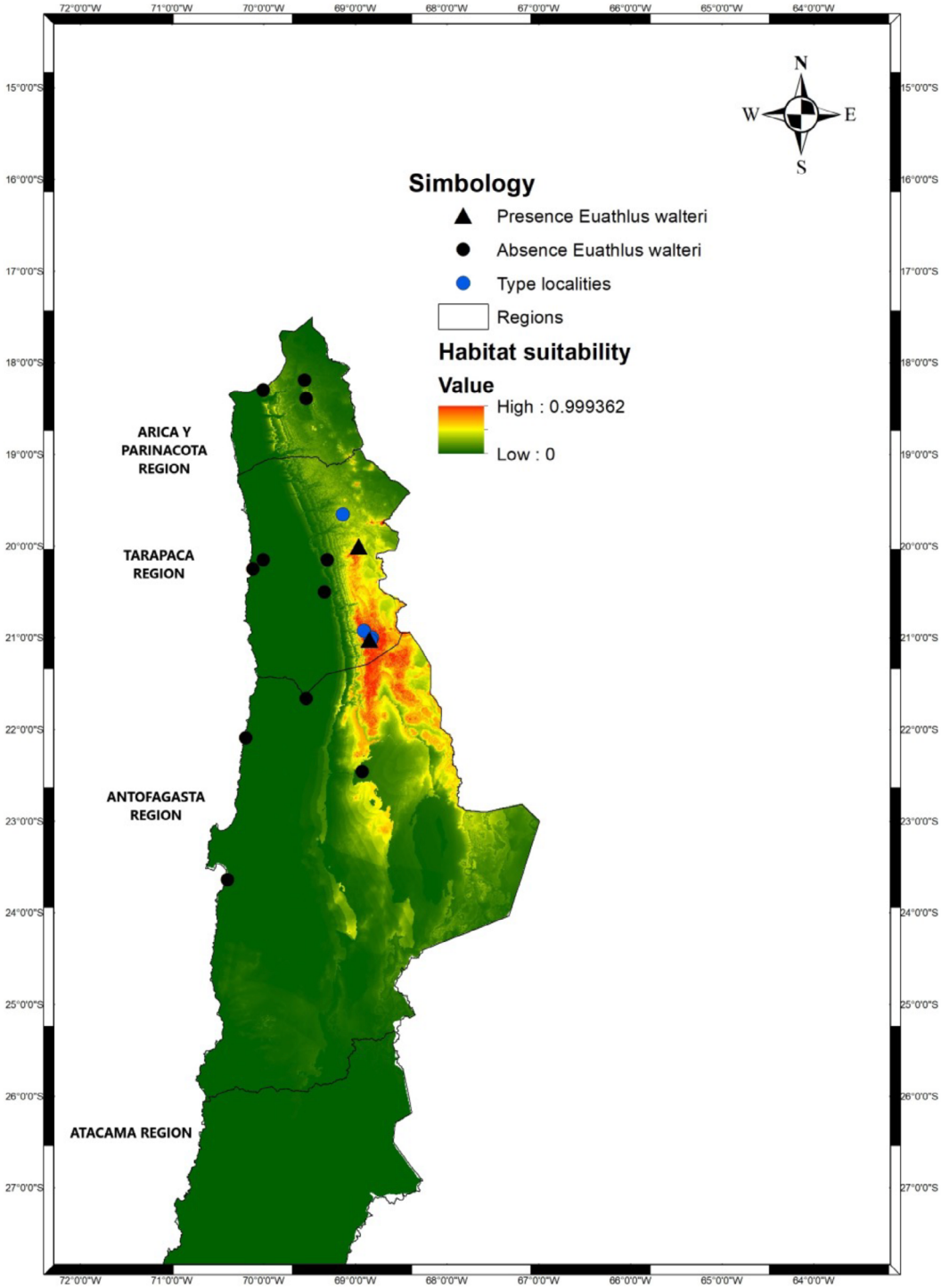

Figure 8. Potential distribution of *E. walteri* sp. nov, collect effort for presence/absence and type localities in northern of Chile. / Distribución potencial de *E. walteri* sp. nov, esfuerzo de captura para presencia/ausencia y localidades típicas en el norte de Chile.

Table 1. *Euathlus walteri* sp. nov., male holotype (FCE-My 1667). Lengths of palpal and leg segments. / *Euathlus walteri* sp. nov., holotipo macho (FCE-My 1667). Longitudes del palpo y los segmentos de las patas.

	I	II	III	IV	Palp
Fe	7.5	6.6	6	6.5	2.8
Pa	3.9	4	4	4	1.1
Ti	5.4	5	4.4	5.7	4
Mt	4.5	4.5	5.2	4.5	
Ta	3.5	4	3.8	4.5	1.5
Total	24.8	24.1	23.4	25.2	9.4

Table 2. *Euathlus walteri* sp. nov., female paratype (FCE-My 1668). Lengths of palpal and leg segments. / *Euathlus walteri* sp. nov., paratipo hembra (FCE-My 1668). Longitudes del palpo y los segmentos de las patas.

	I	II	III	IV	Palp
Fe	10.5	10	9.5	10	6
Pa	6.9	5	6.4	6.5	4
Ti	8	7	7	9	4.3
Mt	5.3	6	4	7.3	
Ta	4	5	4.5	5.5	4
Total	34.7	33	31.4	38.3	18.3

DISCUSSION

Most *Euathlus* species are endemic with restricted geographic ranges and specific ecological requirements (Perafán & Pérez-Miles, 2014; MMA, 2017; Ríos-Tamayo, 2020; Quispe-Colca & Ferretti, 2021). Some Chilean species are critically endangered or vulnerable due to its limited distribution and low abundances (MMA, 2017). Considering that theraphosids have sedentary habits, limited dispersal mechanisms and great longevity (Ferretti *et al.*, 2014), habitat disturbance could contribute to the decreasing population densities of *Euathlus* species, especially at high altitudes (Quispe-Colca & Ferretti, 2021).

The distribution of the spider *Euathlus walteri* sp. nov. are compatible with restricted distribution for endemic species (IUCN, 2019). Major part of the Andean zone of Tarapacá region where this species live is under mining activities and other industrial processes that can affect their fragile environments. The areas with intensive mining activities remove the ground, affecting the endemic vegetation led to a direct impact on the spider populations (Farrel & Kratzing, 1996; Quispe-Colca & Ferretti, 2021). Therefore, the main threat to *E. walteri* sp. nov. in northern Chile is the habitat loss and the consequent reduction of their populations. Our information suggests that this species has an area of extension less than 1,000 km^2 and is currently known from about five locations. Considering that it is an endemic species, that can be affected by fragmentation of their habitat and their dispersal mechanisms are limited, their population densities may decrease due to intervention of their habitat. Based on the IUCN (2019) categories and criteria, we suggest Endangered (EN): B1ab (iii) + 2ab (iii) as a conservation category for *E. walteri* sp. nov. Although we do not have population studies regarding this species, there is no doubt that its populations can be potentially threatened by human activity. In fact, other species of *Euathlus* with similar habitat conditions are currently in conservation category (MMA, 2017; Quispe-Colca & Ferretti, 2021). Thus, future actions are needed to preserve this species in Chile.

ACKNOWLEDGEMENTS

Sampling was authorized by the Servicio Agrícola y Ganadero, Exempt Resolution N° 4945/2023. The first author thanks Sebastián Cabello, Elena Alarcón, Luis Oroz and Gustavo Klapp for their help in collecting the specimens. FPM thanks CSIC - UDELAR (Project C-305-347) by the financial support.

REFERENCES

Anderson, R.P., González, I. 2011. Species-specific tuning increases robustness to sampling bias in models of species distributions: An implementation with Maxent. Ecological Modelling 222(15): 2796-2811.

Anderson, R.P., Peterson, A.T., Gomez-Laverde, M. 2002. Using niche-based GIS modeling to test geographic predictions of competitive exclusion and competitive release in South American pocket mice. Oikos 98: 3-16

Araújo, M.B., Anderson, R.P., Barbosa, A.M., Beale, C.M., Dormann, C.F, Early, R. 2019. Standards for distribution models in biodiversity assessments. Science Advances 5(1): eaat4858.

Bertani, R. 2000. Male palpal bulbs and homologous features in Theraphosinae (Araneae, Theraphosidae). Journal of Arachnology 28: 29-42.

Bertani, R., Guadanucci, J.P.L. 2013. Morphology, evolution and usage of urticating setae by tarantulas (Araneae: Theraphosidae). Zoologia 30(4): 403-418. https://doi.org/10.1590/S1984-46702013000400006

Cooke, J.A., Roth, V.D., Miller, F. 1972. The Urticating Hairs of Theraphosidae. American Museum Novitates 2498: 1-43.

de Queiroz, T.F., Baughman, C., Baughman, O., Gara, M., Williams, N. 2012 Species distribution modeling for conservation of rare, edaphic endemic plants in White River Valley, Nevada. Natural Areas Journal 32(2): 149-158.

Farrell, T.P., Kratzing, D.C. 1996. Environmental effects. In: Mulligan, D.R. (Ed.) Environmental Management in the Australian Minerals and Energy Industries: Principles and Practices. pp. 14-45. University of New South Wales Press, Sydney.

Ferretti, N. 2015. On three new *Euathlus* tarantulas from Argentina and cladistic analysis of the genus. Journal of Arachnology 43(3): 313-326. https://doi.org/10.1636/0161-8202-43.3.313

Fonseca-Ferreira, R., Zampaulo, R.A., Guadanucci, J.P.L. 2017. Diversity of iron cave-dwelling mygalomorph spiders from Pará, Brazil, with description of three new species (Araneae). Tropical Zoology 30: 178-199.

Fukushima, C.S., Bertani, R., da Silva Jr, P.I. 2005. Revision of Cyriocosmus Simon, 1903, with notes on the genus *Hapalopus* Ausserer, 1875 (Araneae, Theraphosidae). Zootaxa 846: 1-31.

Garreud, R., Vuille, M., Clement, A. 2003. The climate of the Altiplano: Observed current conditions and past change mechanisms. Palaeogeography, Palaeoclimatology, Palaeoecology 194: 5-22.

Guisan, A., Zimmermann, N.E. 2000. Predictive habitat distribution models in ecology. Ecological Modelling 135: 147-186.

Guisan, A., Thuiller, W. 2005. Predicting species distribution: offering more than simple habitat models. Ecology Letters 8: 993-1009.

Hijmans, R.J. Graham, C.H. 2006. The ability of climate envelope models to predict the effect of climate change on species distributions. Global Change Biology 12: 2272-2281.

IUCN. 2019. Guidelines for Using the IUCN Red List Categories and Criteria, Version 14. Prepared by the Standards and Petitions Committee. Available at https://www.iucnredlist.org/documents/RedListGuidelines.pdf Accessed: March 2, 2024.

Morales, N.S., Fernández, I.C., Baca-González, V. 2017. MaxEnt's parameter configuration and small samples: are we paying attention to recommendations? A systematic review. PeerJ 5: e3093.

MMA. 2017. Decreto Supremo N°6-2017. Aprueba y oficializa clasificación de especies según su estado de conservación, Décimo Tercer proceso. Diario oficial de la república de Chile. Publicado el 02 de junio de 2017. Ministerio del Medio Ambiente, Chile. https://clasificacionespecies.mma.gob.cl/wp-content/uploads/2019/10/DS_06_2017_DiarioOficial_Oficializa13erProcesoRCE_16marz2017.pdf Accessed: March 18, 2023.

Perafán, C., Pérez-Miles, F. 2014. The Andean tarantulas *Euathlus* Ausserer, 1875, *Paraphysa* Simon, 1892 and *Phrixotrichus* Simon, 1889 (Araneae, Theraphosidae): phylogenetic analysis, genera redefinition and new species descriptions. Journal of Natural History 48: 2389-2418. https://doi.org/10.1080/00222933.2014.902142

Pérez-Miles, F. 1994. Tarsal scopula division in Theraphosinae (Araneae, Theraphosidae): its systematic significance. Journal of Arachnology 22: 46-53.

Pérez-Miles, F., Gabriel, R., Miglio, L., Bonaldo, A., Gallon, R., Jimenez, J.J., Bertani, R. 2008. *Ami*, a new theraphosid genus from Central and South America, with the description of six new species (Araneae: Mygalomorphae). Zootaxa 1915: 54-68.

Phillips, S.J., Anderson, R.P., Schapire, R.E. 2006. Maximum entropy modeling of species geographic distributions. Ecological Modeling 190: 231-259.

Quispe-Colca, O.M., Ferretti, N.E. 2021. First record of the tarantula genus *Euathlus* (Araneae: Theraphosidae: Theraphosinae) in Peru, with the description of a

threatened new species. Iheringia, Série Zoologia 111(e2021026): 1-10. https://doi.org/10.1590/1678-4766e2021026

Ríos-Tamayo, D. 2020. Three new species of *Euathlus* Ausserer, 1875 (Araneae, Theraphosidae) from Argentina. Studies on Neotropical Fauna and Environment 55(2): 83-95. https://doi.org/10.1080/01650521.2019.1696653

Shcheglovitova, M., Anderson, R. 2013. Estimating optimal complexity for ecological niche models: A jackknife approach for species with small simple sizes. Ecological Modelling 269(2013): 9-17.

Swets, J.A. 1988. Measuring the accuracy of diagnostic systems. Science 240: 1285-1293.

Taucare-Ríos, A., Sielfeld, W. 2013. Arañas (Arachnida: Araneae) del extremo norte de Chile. Boletín del Museo Nacional de Historia Natural 62: 7-27.

Vásquez-Palacios, S., Chirivi-Joya, D.A. 2023. Ecological niche modeling in a whip spider, *Heterophrynus boterorum* (Phrynidae), from the Colombian Central Andes. Biota Colombiana 24(1): e104.

World Spider Catalog. 2024. World Spider Catalog Version 25.0. Natural History Museum Bern, Bern. https://wsc.nmbe.ch/ Accessed: March 1, 2024.

Received: 11.04.2024
Accepted: 11.07.2024

Editor: Fulgencio Lisón