 https://doi.org/10.22201/fc.25942158e.2022.2.407

AN UPDATED REVIEW OF THE GEOGRAPHICAL DISTRIBUTION OF *LIOLAEMUS XANTHOVIRIDIS* (SQUAMATA: LIOLAEMIDAE)

REVISION ACTIALIZADA DE LA DISTRIBUCIÓN GEOGRÁFICA DE *LIOLAEMUS XANTHOVIRIDIS* (SQUAMATA: LIOLAEMIDAE)

Paula C. Escudero[1*], María A. González Marín[1], Mariana Morando[1] & Luciano J. Avila[1]
[1]*Instituto Patagónico para el Estudio de los Ecosistemas Continentales (IPEEC-CONICET). Grupo de Herpetología Patagónica (GHP-LASIBIBE). Puerto Madryn, Bld. Alte. Brown 2915, (U9120ACD), Puerto Madryn, Argentina.*
**Correspondence: paulaescudero2@gmail.com*

Received: 2022-01-18. **Accepted:** 2022-05-06. **Published:** 2022-05-20.
Editor: Antonieta Labra, Chile.

Resumen.– *Liolaemus* es una de las mayores radiaciones de lagartos con más de 289 especies descritas. Dentro del grupo *L. fitzingerii*, encontramos la especie *L. xanthoviridis*, la cual se distribuye en un área alrededor de la meseta de Montemayor en la costa atlántica oriental de la provincia de Chubut, Argentina. Sin embargo, el rango de distribución se hipotetiza que es mayor al registrado hasta el momento. Aquí presentamos una revisión general y actualizada de la distribución de esta especie, a lo largo de toda la Provincia de Chubut.

Palabras claves.– Lagartija de Rawson, rango de distribución, Patagonia.

Abstract.– *Liolaemus* is one of the largest radiations of lizards with more than 289 species described. Within the *L. fitzingerii* group, we find the species L. xanthoviridis, which is distributed in an area around the Montemayor Plateau in the eastern Atlantic coast of Chubut Province, Argentina. However, the actual area of distribution of this species is hypothesized to be larger than recorded so far. Here, we present an updated and general review of the distribution of the species, throughout the Province of Chubut.

Key words.– Rawson Lizard, distributional range, Patagonia.

Liolaemus is one of the largest radiation of neotropical lizards with more than 289 species described (Uetz et al., 2021) along a variety of habitats found mainly along Andean and Patagonian arid lands. The *Liolaemus fitzingerii* lizard clade occurs along Patagonian and southern Monte habitats between Colorado and Santa Cruz river basins, along Neuquén, Rio Negro, Chubut and Santa Cruz provinces, Argentina (Avila et al., 2006; Abdala, 2007; Minoli et al., 2014, 2015), and includes two species complexes: *fitzingerii* and *melanops* complex (Avila et al., 2006). Within the fitzingerii complex five species have been described: *L. fitzingerii, L. xanthoviridis, L. chehuachekenk, L. shehuen* and *L. camarones*, but despite its size and commonness, only anecdotic data about natural history of these species were published and for most species their distribution ranges are little known.

Liolaemus xanthoviridis, Cei and Scolaro 1980, is distributed in an area of approximately 50 x 200 km located around the Montemayor Plateau (Rawson, Gaiman and Florentino Ameghino Departaments) in the eastern Atlantic coast of Chubut Province, Argentina. However, few localities are known and some populations are difficult to clearly identify with morphology because hibridization is widespread between species of the *Liolaemus fitzingerii* clade (Grummer et al., 2021). This species lives mainly around clusters of spiny trees or bushes on a substrate of loose or sandy soils in some coastal areas but they are found in the hardpan Patagonian shrub-steppe habitat in inland locations. They are sexually dimorphic in size with males larger, and more robust, than females (mean snout vent length (SVL) 82.34 ± 7.75 mm vs 78.39 ± 6.48 mm). In both sexes, individuals show a noticeable polymorphism in the dorsal coloration (yellow-green to orange, Fig. 1; Escudero, 2016; Escudero et al., 2020) and in distribution of the ventral melanism (Escudero, 2016; Escudero et al., 2016). Here we do a review of the distribution range of the species.

We examined lizards from the LJAMM-CNP collection and the identity of all specimens cataloged as *Liolaemus xanthoviridis* was verified using characteristics of coloration

Figura 1. Variación fenotípica en *Liolaemus xanthoviridis*. (A) Clasificación de la coloración dorsal de izquierda a derecha: y = amarillo; gy = amarillo verdoso; oy = naranja amarillento; br = marrón con líneas rojizas. (B) Polimorfismo del melanismo ventral.

Figure 1. Phenotypic variation in *Liolaemus xanthoviridis*. (A) Classification of the dorsal coloration from left to right: y = yellow; gy = greenish yellow; oy = yellowish orange; br = brown with reddish lines. (B) Polymorphism of the ventral melanism.

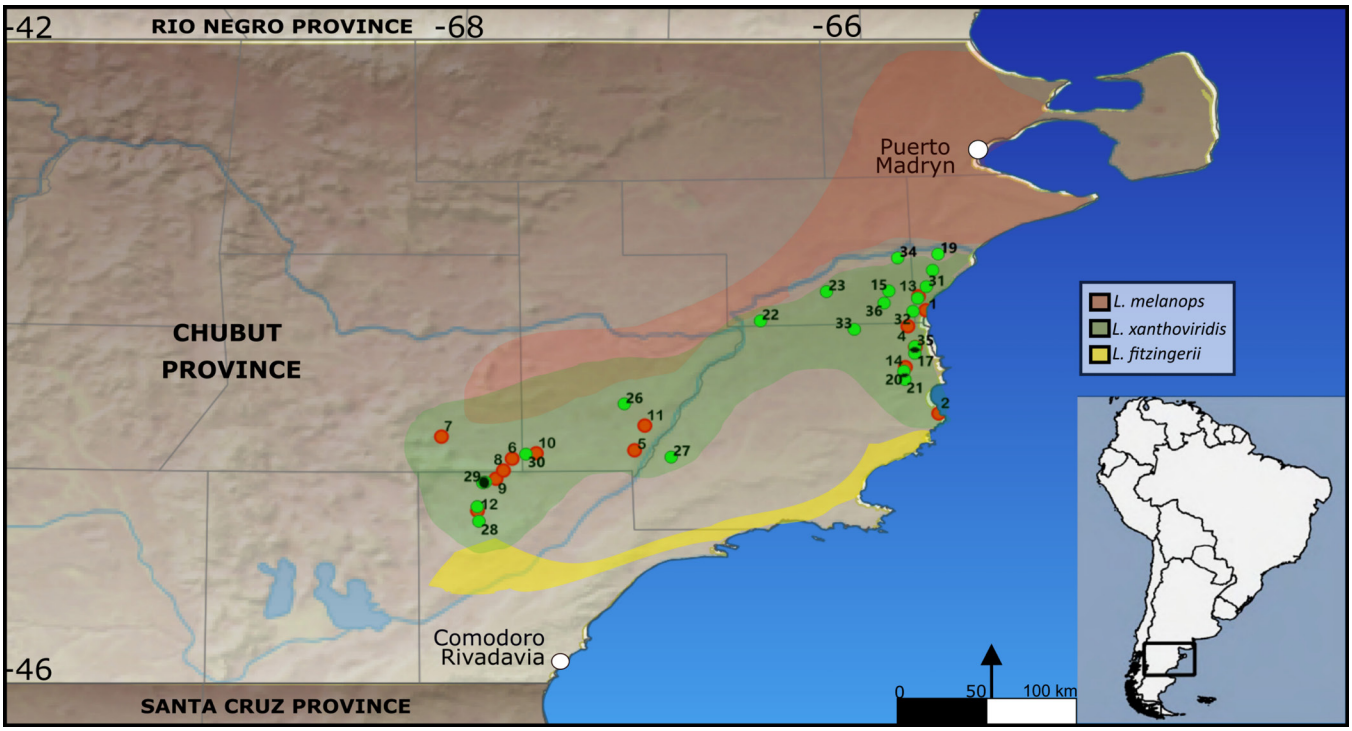

Figura 2. Distribución geográfica de *Liolaemus xanthoviridis* en la Patagonia central y ubicación dentro de Argentina (recuadro). Puntos rojos: registros bibliográficos para la especie en la provincia de Chubut, Puntos verdes: nuevas localidades. Los colores en el mapa reflejan aproximadamente los límites de la población según lo determinado por los datos de SNP de todo el genoma en Grummer (2017) que corresponden en gran medida a las especies *Liolaemus melanops* (rojo), *L. xanthoviridis* (verde) y *L. fitzingerii* (amarillo).

Figure 2. Geographic distribution for *Liolaemus xanthoviridis* in central Patagonia, and location within Argentina (inset). Red dots: bibliographic records for the species in Chubut province, Green dots: new localities. Colors on the map reflect approximate population boundaries as determined by genome-wide SNP data in Grummer (2017) that largely correspond to the species *Liolaemus melanops* (red), *L. xanthoviridis* (green), and *L. fitzingerii* (yellow).

and morphological data (only lizards that matches with original descriptions), as well as include results from previous molecular studies (Grummer et al., 2018). In addition, data from two more collections were included, San Diego State University (SDS) and Kansas University (KU) and bibliographic citations about the specimens deposited in the Fundación Miguel Lillo (FML) collection. Subsequently, with the software QGIS, we elaborated a map representing the distribution of *L. xanthoviridis* in the Chubut Province with all the specimens' localities (Table 1, Fig. 2). In total, 36 different localities were recorded where the species was found, covering 6 departments both east (coastal zone) and west of the Montemayor Plateau, with populations almost over 500 meters above sea level.

The type locality of the species is 18 km SW from Dos Pozos (Chubut Province, Cei & Scolaro 1980). The northernmost place where the species was recorded is on National Route 1 about 7 km from the city of Trelew (site code n° 19, Table 1) while the southernmost place was Provincial Route 27, 79 km NW junction with National Route 3, collected on the 30 December 2015, by J. Grumer, C.H.F Pérez, T.I. Avila & L.J. Avila (site code n° 28, Table 1), extending the known distribution about 30 air-line km SW from the nearest vouchered record (Minoli & Avila, 2011). Localities 22 and 23 fill the gap between coastal and inland populations. Grummer et al. (2021), using data from nuclear and mitochondrial genomes, identified a "sandwich" hybrid zone in which, individuals equivalent to the described species *L. xanthoviridis* (by both morphological and genome-wide single nucleotide polymorphism (SNP) data, Grummer, 2017), hybridize with two distinct populations: one north, *L. melanops* and one south, *L. fitzingerii* (Figure 2).

Theses contact zones, would mark the distribution boundaries of *L. xanthoviridis* towards north and south. Therefore, *L. xanthoviris* extends over an area of approximately 240 x 290 km located around the Montemayor plateau (bounded to the north by the Chubut River), a much greater range than was previously known. It is also important to note that *L. xanthoviridis* does not share its geographic range with any other *Liolaemus* species. It was only found in sympatry with *Leiosaurus belli*.

Tabla 1. Localidades de individuos recolectados de *Liolaemus xanthoviridis,* incluidos números de comprobantes y datos geográficos. Los códigos de sitio corresponden a números en el mapa (Fig. 2), los códigos de sitio sombreados (15-36) corresponden a las nuevas ubicaciones reportadas para la especie.

Table 1. Localities of collected individuals of *Liolaemus xanthoviridis,* including voucher numbers and geographic data. Site codes correspond to numbers on the map (Fig. 2), shaded site codes (15-36) correspond to the new locations reported for the species.

Province/ site code	Collection*	Departament	Locality	Geographic coordinates		Altitude (m)
Chubut						
1	LJAMM-CNP	Rawson	Bahía Isla Escondida	43º40'55"S	65º20'23"W	23
2	LJAMM-CNP	Florentino Ameghino	Provincial Road 1, 1 Km S Dos Pozos	43º54'37"S	65º24'10"W	25
3	LJAMM-CNP	Florentino Ameghino	Cabo Raso	44º19'23"S	65º15'46"W	24
4	LJAMM-CNP	Rawson	Provincial Road 1, 12 Km S Estancia Dos Naciones	43º46'53,4"S	65º26'49,3"W	24
5	LJAMM-CNP	Mártires	Provincial Road 29, 45 Km W Garayalde	44º33'06,9"S	67º04'45,1"W	372
6	LJAMM-CNP	Paso de Indios	Bosque Petrificado, Provincial Road Crossing 29 y 27, 106 Km W Garayalde	44º36'15,1"S	67º48'37,4"W	354
7	LJAMM-CNP	Paso de Indios	Provincial Road 27, 42.8 km S El Sombrero and junction Provincial Road 53	44º28'02,2"S	68º13'56,8"W	395
8	LJAMM-CNP	Paso de Indios	Provincial Road 27, 67.9 km N junction Provincial Road 25, between plateau Cuadrada and Sierra Cuadrada, 7.9 km S junction Provincial Road 29	44º40'38,7"S	67º51'44,2'W	477
9	LJAMM-CNP	Escalante	Provincial Road 27, 60 km N junction Provincial Road 25	44º43'43,4"S	67º54'24,0'W	349
10	LJAMM-CNP	Mártires	Provincial Road 29, 15.5 km E junction Provincial Road 27, way to Garayalde	44º34'13,4"S	67º39'58,4"W	282
11	LJAMM-CNP	Mártires	Provincial Road 48 (of Las Plumas to Garayalde), 86.7 km S Las Plumas, first hill to Valle del Río Chico, near Estancia La Madreselva	44º23'54,3"S	67º01'04,8"W	343
12	LJAMM-CNP	Escalante	Provincial Road 27, 33.1 km N junction Provincial Road 25, 55.1 km NW Puente Nollman over Río Chico	44°56'03.6"S	68°01'35.8"W	381
13	LJAMM-CNP	Rawson	Provincial Road 1 old, 38.7 km S junction Provincial Road 25	43º35'43,8"S	65º22'59,9"W	220
14	LJAMM-CNP	Florentino Ameghino	Provincial Road 1, 18 km S Estafeta Postal Dos Pozos	44º02'07,4"S	65º27'43,5"W	247
15	LJAMM-CNP	Gaiman	Provincial Road 9, 29.2 km S juntion in adjacent road Río Chubut, 6.2 km S entrada estancia Las Acacias, 11.8 km N junction Provincial Road 3	43º33'44,4"S	65º33'38,5"W	239

Tabla 1 (cont.). Localidades de individuos recolectados de *Liolaemus xanthoviridis*, incluidos números de comprobantes y datos geográficos. Los códigos de sitio corresponden a números en el mapa (Figura 2), los códigos de sitio sombreados (15-36) corresponden a las nuevas ubicaciones reportadas para la especie.

Table 1 (cont.). Localities of collected individuals of *Liolaemus xanthoviridis*, including voucher numbers and geographic data. Site codes correspond to numbers on the map (Figure 2), shaded site codes (15-36) correspond to the new locations reported for the species.

Province/ site code	Collection*	Departament	Locality	Geographic coordinates		Altitude (m)
16	LJAMM-CNP	Gaiman	Provincial Road 9, 1 km S junction National Road 3	43º38'14,7"S	65º35'21,1"W	259
17	LJAMM-CNP	Ameghino	Provincial Road 1, 11 km S Dos Pozos, 2 km S entrance Estancia La Perla and Punta Tombo	43º56'57,7"S	65º24'21,2"W	275
18	LJAMM-CNP	Rawson	Provincial Road 1, 7.5 km N junction access Bahía Isla Escondida	43º36'27,7"S	65º23'19,2"W	229
19	LJAMM-CNP	Rawson	Provincial Road 1, 7 km S Trelew	43º20'34,4"S	65º16'30,7"W	116
20	LJAMM-CNP	Florentino Ameghino	Provincial Road 1, 2 km S junction Provincial Road 32, Estancia Santa Magdalena	44º02'39,5"S	65º28"14,9W	285
21	LJAMM-CNP	Florentino Ameghino	Provincial Road 1, 10.7 km S junction Provincial Road 32, Estancia Santa Magdalena	44º06'45,4"S	65º27'51,3"W	184
22	LJAMM-CNP	Gaiman	Provincial Road 31, 61.1 km NW junction National Road 3	43º44'54"S	66º19'37,6"W	264
23	LJAMM-CNP	Gaiman	Provincial Road 10, 22 km S 28 de Julio, 4 km S Estancia San Roque	43º33'58,9"S	65º55'58,1"W	173
24	LJAMM-CNP	Escalante	Provincial Road 27, 42.2 km S junction Provincial Road 29	44º54'07,2"S	68º01'06,0"W	354
25	LJAMM-CNP	Escalante	Provincial Road 27, 2 km N junction way to Estancia El Rincón de Tomas	44º44'50,1"S	67º58'13,9"W	348
26	LJAMM-CNP	Mártires	Provincial Road 48, 5 km S Estancia La Madreselva, 65.2 km S Las Plumas, way to Garayalde	44º15'48,6"S	67º08'25,3"W	315
27	LJAMM-CNP	Florentino Ameghino	Provincial Road 48, 87 km S junction National Road 25, 97 km S Las Plumas, 27 km S Estancia La Madreselva	44º35'38,18"S	66º51'37,7"W	351
28	LJAMM-CNP	Escalante	Provincial Road 27, 79 km NW juction National Road 3	44º59'33,9"S	68º00'31,4"W	460
29	LJAMM-CNP	Escalante	Provincial Road 27, 103.9 km NW junction National Road 3, between entry roads to Estancia El Mallin and El Molle	44º45'12,2"S	67º59'07,6"W	333

Tabla 1 (cont.). Localidades de individuos recolectados de *Liolaemus xanthoviridis*, incluidos números de comprobantes y datos geográficos. Los códigos de sitio corresponden a números en el mapa (Figura 2), los códigos de sitio sombreados (15-36) corresponden a las nuevas ubicaciones reportadas para la especie.

Table 1 (cont.). Localities of collected individuals of *Liolaemus xanthoviridis*, including voucher numbers and geographic data. Site codes correspond to numbers on the map (Figure 2), shaded site codes (15-36) correspond to the new locations reported for the species.

Province/ site code	Collection*	Departament	Locality	Geographic coordinates		Altitude (m)
30	LJAMM-CNP	Mártires	Provincial Road 29, 9.7 km E junction Provincial Road 27, near Estancia El Carlitos	44º34'34,3"S	67º43'40,6"W	311
31	SDSU	Rawson	Estancia Medina, 29 km S Río Chubut	43°32'06.7"S	65°20'10.2"W	211
32	KU	Florentino Ameghino	3.5 km N Dos Pozos	43°41'03.5"S	65°24'56.6"W	224
33	FML	Florentino Ameghino	Provincial Road 3, Km 1533, 71 km S Rawson	43°47'58.1"S	65°45'59.8"W	274
34	FML	Gaiman	Parque Paleontologico, Provincial Road 9, south of Gaiman	43°21'23.7"S	65°30'19.1"W	71
35	FML	Florentino Ameghino	4.5 km S Dos Pozos	43°54'25.4"S	65°24'16.4"W	174
36	FML	Rawson	Estancia Laguna de los Indios, Provincial Road 1	43°54'37.4"S	65°24'10.2"W	191

Acknowledgements.– We thank to Blum R., Medina C., Olave M., Minoli I. and Natali L. for field assistance. Funds for field and laboratory work were provided by several grants from CONICET (PIP), ANPCyT-FONCYT (PICT), NSF, and CONICET PUE 2016-0044 and FONCYT-PICT 2017-4583.

LITERATURA CITADA

Abdala, C.S. 2007. Phylogeny of the boulengeri group (Iguania: Liolaemidae: *Liolaemus*) based on morphological and molecular characters. Zootaxa 1538:1-84.

Avila, L.J., M. Morando & Jr.J.W. Sites. 2006. Congeneric phylogeography: hypothesizing species limits and evolutionary processes in Patagonian lizards of the *Liolaemus boulengeri* group (Squamata : Liolaemini). Biological Journal of the Linnean Society 89:241-275.

Cei, J.M. & J.A. Scolaro. 1980. Two new subspecies of the *Liolaemus fitzingeri* complex from Argentina. Journal of Herpetology 14:37-43.

Escudero, P.C. 2016. Polimorfismo de coloración, melanismo y estrategias reproductivas en una población de lagartijas Patagónicas del grupo *Liolaemus fitzingerii*. Ph.D. thesis. Universidad Nacional de Córdoba. Argentina.

Escudero, P.C., I. Minoli, M.A. González Marín, M. Morando & L.J. Avila. 2016. Melanism and ontogeny: a case study in lizards of the *Liolaemus fitzingerii* group (Squamata: Liolaemini). Canadian Journal of Zoology 94:199-206.

Escudero, P.C., M.A. González Marín, M. Morando & L.J. Avila. 2020. Use of space and its relationship with sex, body size, and color polymorphism in *Liolaemus xanthoviridis* (Iguania: Liolaemini) in Patagonia. Journal of Herpetology 54:57-66.

Grummer, J.A. 2017. Evolutionary history of the Patagonian *Liolaemus fitzingerii* species group of lizards. Ph.D. thesis. University of Washington. United States.

Grummer, J., M. Morando, L.J. Avila, J. Sites, Jr. & A. Leache. 2018. Phylogenomic evidence for a recent and rapid radiation of lizards

in the Patagonian *Liolaemus fitzingerii* species group. Molecular Phylogenetics and Evolution 125:243-254.

Grummer, J.A., L.J. Avila, M.M. Morando & A.D. Leaché. 2021. Four species linked by three hybrid zones: two instances of repeated hybridization in one species group (genus *Liolaemus*). Frontiers in Ecology and Evolution 9:624109.

Minoli, I. & L.J. Avila. 2011. Geographic distribution: *Liolaemus xanthoviridis*. Herpetological Review 42:241-242.

Minoli, I., M. Morando & L.J. Avila. 2014. Integrative taxonomy in the *Liolaemus fitzingerii* complex (Squamata: Liolaemini) based on morphological analyses and niche modeling. Zootaxa 3856:501-528.

Minoli, I., M. Morando & L.J. Avila.2015. Reptiles of Chubut province, Argentina: richness, diversity, conservation status and geographic distribution maps. ZooKeys 498:103-126.

Uetz, P., Freed, P, Aguilar, R. & Hošek, J. (eds.) (2021) The Reptile Database, http://www.reptile-database.org.