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Rediscovery, distribution extension and defensive behaviour of *Xenodon histricus* (Squamata: Serpentes) in the state of Rio Grande do Sul, Brazil

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Jan's hognose snake, *Xenodon histricus* (Jan, 1863), is a species of the family Dipsadidae Bonaparte, 1838 (Carreira 2010) that has been thought of as rare for more than 80 years (Devincenzi 1925). It belongs to the tribe Xenodontini Bonaparte, 1845, which includes the Neotropical genera *Liophis* (including *Erythrolamprus*), *Lygophis*, *Umbrivaga*, and *Xenodon* (including *Waglerophis* and *Lystrophis*). The genus *Lystrophis* has recently been synonymized with *Xenodon*, following a review of the phylogeny and classification of Neotropical xenodontines (Zaher et al. 2009). The genus *Xenodon* contains six species that are distributed in southern Bolivia, Paraguay, northern and central Argentina, mid-western, southeastern and southern Brazil, and Uruguay (Peters & Orejas-Miranda 1970, Hoge et al. 1975, Scrocchi & Cruz 1993). *Xenodon histricus* is distinguished from other species of its genus by the absence of a prefrontal scale and its dorsal pattern of incomplete bands and a narrow cross marking on a red background (Cei 1993).

The geographic distribution of this species includes northeastern Argentina, southeastern Paraguay, Uruguay, and part of the Brazilian territory comprising the region between the states of Mato Grosso do Sul and Rio Grande do Sul, except Santa Catarina state (Hoge et al. 1975, Achaval 2001). In Uruguay, this snake is associated with rocky habitats of natural grasslands, and the scarcity of records probably is due to its fossorial habits (Achaval & Olmos 2007, Prigioni et al. 2011). Brazilian records of *X. histricus* appear be associated with natural grasslands, but the few records that have been available until now make inferences about habitat requirements (as well as the biology and behaviour) of this species difficult (Giraudo 2004). The last specimen collected in the Brazilian state of Rio Grande do Sul dates back to 1958 (Di-Bernardo et al. 2003), and most specimens were collected before 1950 (Orejas-Miranda 1966, Viñas & Olmedo 1988). There are photographic records that suggest *Xenodon histricus* lives only in two regions of Uruguay: the departments of Maldonado and Treinta y Tres, in Quebrada de los Cuervos (Achaval & Olmos 2007, Prigioni et al. 2011).

Here, we describe the rediscovery of *X. histricus* in the state of Rio Grande do Sul 46 years after the last record and provide new records (Fig. 1). In addition, we provide the first photographic record of a live *X. histricus* from a Brazilian population (Fig. 2); additionally we report on the defensive behaviour exhibited by one specimen during handling. Both individuals of *X. histricus* were collected in native grassland in the Pampa biome. The first individual was an adult female (SVL (snout–vent length) = 288 mm, TL (Tail length) = 42 mm, TTL (total length) = 330 mm, weight = 20.3 g) collected on 20 January 2004, at the Fazenda Santo Antônio do Buricaci (29°36'16.90" S, 54°55'48.11" W, 183 m), in the municipality of São Francisco de Assis. The specimen had been killed by rural residents in "mixed fields of Andropogoneae and Asteraceae " (sensu Hasenack et al. 2010), and kept frozen until it was delivered to us. Scale counts taken from this specimen (following Dowling 1951): ventrals and subcaudals (140 and 37, respectively), dorsals (17–19–15), subcaudals (37), supralabials right/left (6/7), with 6th and 7th supralabials partial-

ly fused, infralabials (9/8), preoculars (1), postoculars (2), and no subocular.

The second individual, an adult male (SVL = 282 mm, TL = 51 mm, TTL = 333 mm, weight = 18 g) was collected on 17 March 2013 in a pitfall trap with drift fences set up in a transition zone between two grassy ecosystems, grassy field and shrubby field (sensu Hasenack et al. 2010), at the Fazenda da Família Severo (30°34'15.42" S, 54°29'3.70" W, 184 m), in the municipality of São Gabriel (Fig. 3). Scale counts: ventrals and subcaudals (133 and 29, respectively), dorsals (19–19–17), subcaudals (29), supralabials (7/7), infralabials (9/9), preoculars (1), postoculars (2), and no subocular. The specimens are now stored in the Herpetological Collection of the Universidade Federal de Santa Maria (ZUFSM 2465 and 3071).

From the second individual, we recorded at least four expressions of defensive behaviour (sensu Gans 1988) during handling (Fig. 2): 1) forming a ball (coils of the body are arranged into an irregular, approximately spherical mass); 2) hiding the head (the head is hidden under one or more parts of the body); 3) dorsoventral body compression (the body is flatted dorsoventrally), and 4) tail display (refers to all behaviour in which the tail is elevated or otherwise made more prominent, but not used as a weapon, inverted into a tight spiral). Three of the four behavioural expressions exhibited by *Xenodon histricus* are considered common in phylogenetically related species, such as *Xenodon dorbignyi* (Tozetti et al. 2009). The latter species is diurnal and associated with open habitats such as grasslands, which is a preferred foraging ground of visually oriented predators (Oliveira et al. 2004) and promotes the subsequent development of defensive behaviours such as body flattening and tail display in these snakes (Tozetti et al. 2009). *Xenodon histricus* also exhibits a colour pattern resembling that of the highly venomous genus *Micrurus*, consisting of a crosslateral banded pattern that includes red, light and blackish bands. The tail display and colour pattern (mimicry to *Micrurus*) may reduce the risk of predation (Sazima & Abe 1991, Marques 2002, Buasso et al. 2006). On the other hand, the mimetic "coral" pattern may provoke an increased killing of these "false corals" by people (Giraudo et al. 2012).

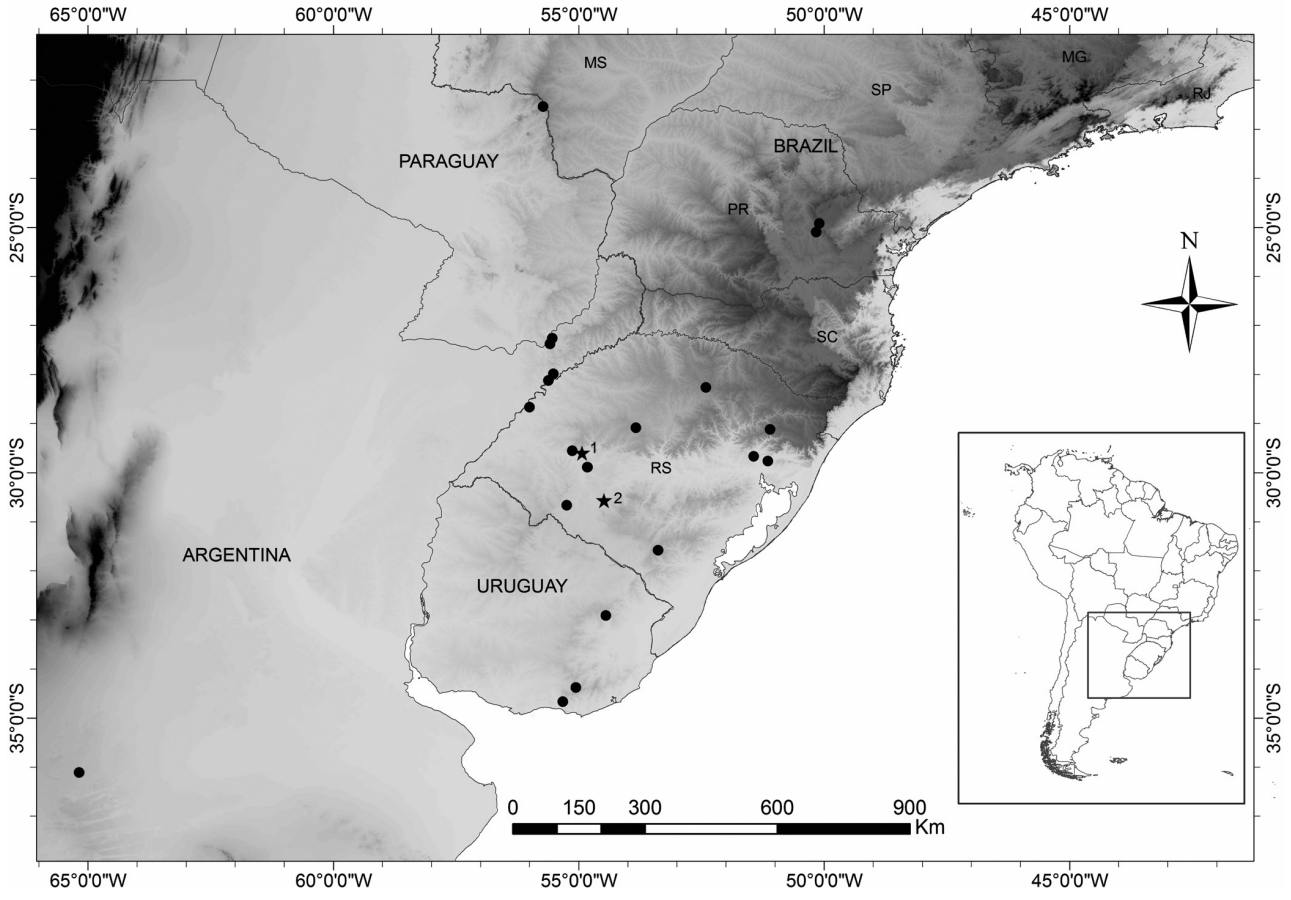

Figure 1. Map of the known distribution of *Xenodon histricus* (based on specimens deposited in collections, circles), including the new records in the São Francisco de Assis (1) and São Gabriel (2) municipalities (stars). The abbreviations MG, MS, PR, RJ, RS, SC, and SP, refer to the Brazilian states of Minas Gerais, Mato Grosso do Sul, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo, respectively.

The few records of *X. histricus* suggest that this species is rarely encountered along its geographic distribution. Its occurrence is likely restricted to pristine environments, since individuals were not found for at least 46 years in Rio Grande do Sul, even in areas where systematic collections have been made in the last decade. In Rio Grande do Sul, *X. histricus* is listed as vulnerable (VU), according to the red list of threatened fauna in the state, probably due to the degradation of habitat (Di-Bernardo et al. 2003). In Uruguay and Argentina, *X. histricus* is categorised as a data-deficient species (Canavero et al. 2010, Giraudo et al. 2012). On a global scale, this species is regarded as 'least concern' (Carreira 2010). We stress the urgency of studies on *X. histricus* and its habitats, in particular because natural grasslands are poorly represented in Brazilian conservation units (MMA 2007, Overbeck et al. 2009, Vélez et al. 2009) and currently threatened by the rapid expansion of soybean farming and forestry (*Acacia*, *Eucalyptus*, and *Pinus*) (Mma 2007, Overbeck et al. 2009, Santos & Trevisan 2009, Bond & Parr 2010, Ferreira et al. 2012, Silva 2012). Thus, we suggest studies focusing on the species geographic distribution, including niche modelling, regional inventories to localize remnant populations and identify habitat requirements to better understand its biology.

Figure 3. Native grassland where an individual of *Xenodon histricus* was captured, municipality of São Gabriel municipality, Rio Grande do Sul state, Brazil.

Figure 2. Examples of defensive displays exhibited by *Xenodon histricus* during handling: forming a ball and dorsoventral body compression (A), hiding the head and tail display (B).

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