

First record of Brongersma's toad *Barbarophryne brongersmai* (Anura, Bufonidae) in the central High Atlas Mountains, Morocco

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Abstract

First record of Brongersma's toad *Barbarophryne brongersmai* (Anura, Bufonidae) in the central High Atlas Mountains, Morocco. Brongersma's toad *Barbarophryne brongersmai* is known in the southern Moroccan Atlantic coast, in the Anti-Atlas, in the arid plain of Marrakech, and in several localities in North-western Algeria. However, its distribution in Morocco is far from clear and its range is not well known. We report a new record of *B. brongersmai* in Morocco, in the region of the central High Atlas. The habitat type in this region is different from areas where the species has been observed previously. It consists of temporary ponds, located between rock outcrops and filled by stormy rains or snow during the winter. We recommend conducting surveys to collect additional information about this toad in other Moroccan regions, such as in the Middle Atlas where suitable conditions for this species may exist.

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Key words: Brongersma's toad, Distribution update, Biogeography, Snowy area, Morocco

Resumen

Primer registro del sapo de Brongersma, *Barbarophryne brongersmai* (Anura, Bufonidae), en las montañas del Atlas Central, Marruecos. *Barbarophryne brongersmai* se distribuye en la costa atlántica del sur de Marruecos, en el Anti Atlas, en la árida llanura de Marrakech y en algunas localidades del noroeste de Argelia. La distribución y extensión de esta especie en Marruecos no son bien conocidas. Este estudio documenta un nuevo registro de *B. brongersmai* en Marruecos, precisamente en la región del Alto Atlas central. El tipo de hábitat en esta región es diferente de los hábitats donde la especie había sido observada previamente y está constituido por charcas estacionales situadas entre afloramientos rocosos que se llenan con agua procedente de tormentas o nieves invernales. Recomendamos realizar estudios para disponer de información adicional sobre la presencia de este sapo en otras regiones marroquíes como el Medio Atlas, donde pueden darse condiciones adecuadas para esta especie.

Datos publicados en Zenodo (Doi: [10.5281/zenodo.7035551](https://zenodo.org/doi/10.5281/zenodo.7035551))

Palabras clave: Sapo de Brongersma, Actualización de la distribución, Biogeografía, Zona nevada, Marruecos

Resum

Primer registre del gripau de Brongersma, *Barbarophryne brongersmai* (Anura, Bufonidae), a les muntanyes de l'Atlas Central, Marroc. *Barbarophryne brongersmai* es distribueix a la costa atlàntica del sud del Marroc, a l'Antiàtlès, a l'àrida plana de Marràqueix i en algunes localitats del nord-oest d'Algèria. La distribució i l'extensió d'aquesta espècie al Marroc no són ben conegudes. Aquest estudi documenta un nou registre de *B. brongersmai* al Marroc, precisament a la regió de l'Alt Atlas central. El tipus d'hàbitat d'aquesta regió és diferent dels hàbitats on l'espècie havia estat observada prèviament i està constituït per tolles estacionals situades entre afloraments rocosos que s'omplen amb aigua procedent de tempestes o neus hivernals. Recomanem portar a terme estudis per disposar d'informació addicional sobre la presència d'aquest gripau en altres regions marroquines com l'Atlas Mitjà, on es poden donar condicions adequades per a aquesta espècie.

Dades publicades a Zenodo (Doi: [10.5281/zenodo.7035551](https://doi.org/10.5281/zenodo.7035551))

Paraules clau: Gripau de Brongersma, Actualització de la distribució, Biogeografia, Zona nevada, Marroc

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Introduction

Brongersma's toad *Barbarophryne brongersmai* (Hoogmoed, 1972), also known as the Tiznit toad, is a small toad endemic to Morocco and Algeria. This species was described and separated from the European green toad species *Bufo boulengeri* by Hoogmoed (1972). It is currently classified as Least Concern on the International Union for Conservation of Nature's Red List (IUCN, 2021). According to available studies, the species occurs in several localities across the coastline of Morocco, from the town of Laâyoune to the town of Safi, in the Anti–Atlas from the Atlantic Ocean to the town of Figuig in the region of Jbilet in the north of Marrakech, and in the Chichaoua region in the south–west of Marrakech (Salvador et al., 2006; Doglio et al., 2009; Beukema et al., 2013; Fattah et al., 2014). The distribution of this species in Morocco is far from clear and information outside its known distribution area is lacking. The objective of this study was to confirm the presence of Brongersma's toad in the region of Azilal, in the central High Atlas Mountains of Morocco.

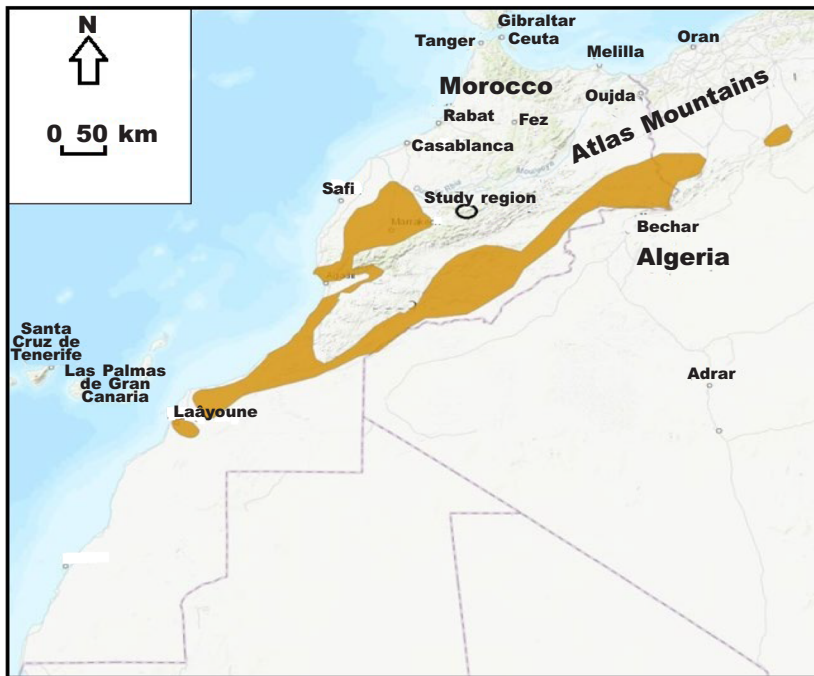


Fig. 1. Range of *Barbarophryne brongersmai* (IUCN, 2021; modified). Brown indicates the known range; the circle associated to the study region indicates new records for the species in the central High Atlas Mountains of Azilal, Morocco.

Fig. 1. Distribución de *Barbarophryne brongersmai* (IUCN, 2021; modificada). El color pardo indica la distribución conocida y el círculo asociado a la región de estudio los nuevos registros de la especie en las montañas del Alto Atlas Central, región de Azilal, Marruecos.

Material and methods

The study was conducted in the region of Azilal, in the central High Atlas Mountains, Morocco (fig. 1). The study site consists of non-wooded terrain, small agricultural land, forests and brushwood. Altitude varies from 900 m to 1,500 m a.s.l. Climate in the area varies from semi-arid to sub-humid, and is characterized by a cold and snowy winter and summer drought (Ouchbani and Romane 1995). The average annual precipitation in the town of Azilal is 578.5 mm, the annual mean maximum temperature is 22.1°C, the annual mean minimum temperatures is 9.2°C, and Emberger's pluviothermal coefficient is 62.5 (Aboulabbes, 2007). The habitat types are mainly forests of pure holm oak or holm mixed with junipers and lentisk (El Alami et al., 2013).

Observation of a Brongersma's toad in the town of Azilal was first reported by the first author in early 2018. A systemic study was then carried out to confirm the presence of the species in this region. During surveys, conducted between December 2018 and December 2019, the authors visited several sites in the region. To search for toads, the authors visited



Fig. 2. *Barbarophryne brongersmai* in the region of Azilal, central High Atlas Mountains, Morocco.

Fig. 2. *Barbarophryne brongersmai* en la regió de Azilal, muntanyes del Alto Atlas Central, Marruecos.

suitable habitats for the amphibians, especially temporary pools, lakes and ponds. During this study, the authors searched for live and dead toads. Searches were performed twice; during the day to look for clutches and tadpoles, and at night to look for adults. When an adult was identified, we captured it by net to determine its sex, and then *released it* in the *place* it was captured. Identification of the species follows Fattah et al. (2014) and Hoogmoed (1972).

Results and discussion

During the study period, we found *B. brongersmai* (fig. 2) in two breeding sites in the study region (fig. 1; see also dataset published at Zenodo: Doi: [10.5281/zenodo.7035551](https://doi.org/10.5281/zenodo.7035551)). The first site was located inside the town of Azilal (31° 95' 79.02" N, 6° 57' 67.98" W; 1,364 m



Fig. 3. The pond where *Barbarophryne brongersmai* were found; 304 regional road, Azilal, central High Atlas Mountains, Morocco. Upper picture in winter of 2019, lower picture in spring of 2019.

Fig. 3. Charca donde se registraron Barbarophryne brongersmai durante el invierno (fotografía superior) y la primavera (fotografía inferior) de 2019 en el emplazamiento de la carretera regional 304, en la región de Azilal, montañas del Alto Atlas Central, Marruecos.

a.s.l.). The second site was located next to the regional road number 304 (31° 94' 19.13" N, 6° 46' 30.21" W; 1,057 m a.s.l.), 15 km south–west of the town of Azilal (fig. 3). At the first site, four males, one female and several tadpoles were found in a temporary pond in December 2018. One male and one female were observed around a neighbourhood in February 2019. In the second site, nine males, one female and several tadpoles were observed in March 2019. Seven males and tadpoles were observed in April 2019, and five males were found in November 2019. Survey observations showed that habitat of *B. brongersmai*

in the region of Azilal is characterized by very low winter temperatures with abundance of snow and drought in summer. During winter, snow is abundant, but the pond rarely freezes completely. Figure 3 shows the temporary pond where the species was observed at the second site (304 regional road) during winter and spring of 2019.

This study documents a new record of the Brongersma's toad in Morocco, precisely in the region of Azilal, in the central High Atlas. This region is far from the previously known range of the species. It is located 82 km from the region of Marrakech to the southwest and 150 km from the region of Errachidia to the southeast (fig. 1). Since 2000, this species has been observed in several new localities in Morocco and Algeria (Herrmann and Herrmann, 2003; Guillon et al., 2004; Doglio et al., 2009; Mateo et al., 2013). The habitat type differs from those where the species has been observed previously (Gallix, 2002; Delfino et al., 2009; Fattah, 2015). The present study is the first work to highlight the presence of *B. brongersmai* in a snowy area that is part of the central High Atlas, where the species has not been found previously. The study region has an upper semi-arid Mediterranean climate, but Emberger's pluviothermal coefficient and the average annual precipitation values are very close to the characteristic values of the lower subhumid climate (Ouchbani and Romane, 1995; Aboulabbes, 2007). *B. brongersmai* inhabits semi-arid areas and breeds in temporary ponds, often located in the bed of temporary rivers (Gallix, 2002; Salvador et al., 2006; Fattah et al., 2014; Fattah, 2015). These toads gather for reproduction in the ponds once they are filled with water (Guillon et al., 2004; Fattah et al., 2014). This study showed that this species occurs in a region characterized by a cold and snowy winter and drought summer. It is very important to understand how this animal adapts to these climatic conditions, in particular during winter. We know today that this toad aestivates during summer to adapt to hot dry conditions (Delfino et al., 2009; Fattah et al., 2014; Fattah, 2015). The discovery of *B. brongersmai* in the central High Atlas Mountains of Azilal extends its range in Morocco and suggests that it may extend even further.

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