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Communal egg-laying of *Atlantolacerta andreanszkyi* (Squamata: Lacertidae) in the Moroccan High Atlas

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Reproduction is one of the most important evolutionary challenges faced by living organisms. Oviposition in reptiles is a crucial step in the reproductive process, and the choice of an appropriate egg-laying site can influence embryonic development and offspring survival (Birchard, 2004; Iraeta et al., 2006). Thermal and hydric requirements and the avoidance of potential predators are some of the factors to be considered by females when choosing suitable oviposition sites (García-Roa et al., 2015). Additionally, egg-laying success is highly dependent on local climatic conditions, availability of oviposition sites, soil characteristics, and microclimatic conditions (Galán, 2009). The laying behaviour may vary interspecifically, but also, on the population level of the same species (Shine, 1991; Perry and Dmi'el, 1994). Defined as non-accidental egg-laying in a site shared by two or more conspecifics (Espinoza and Lobo, 1996), communal egg-laying has been described for many lizards such as *Psammodromus algirus*, *Podarcis bocagei*, *Zootoca vivipara*, *Iberolacerta aurelioi*, and *Quedenfeldtia trachyblepharus* (Braña, 1996; Galán, 1996; Pleguezuelos et al., 2004; García-Roa et al., 2015; Bouazza et al., 2016). Scarcity of nesting sites and/or the communal benefit of incubating eggs from different females in the same place by improving the microhydric situation (Galán, 2009) may lead to communal nesting (Radder and Shine, 2007; Doody et al., 2009).

During fieldwork in the High Atlas at Zaouiat Bouguemez (31.7622°N, 6.2816°W; 2,724 m a.s.l.) in July of 2017, we found a communal oviposition site under a rock, measuring about 554 ± 100 mm in height, 404 ± 122 mm in width, and 283 ± 65 mm in depth. It was located on a north westerly facing with sparse spiny xerophytes on a wet and clayey substrate (Fig. 1).

The only reptile species present in the surrounding area was *Atlantolacerta andreanszkyi* (Werner, 1929) and some females of this species were sighted within less than five metres from the rock. This nesting site contained 11 fresh eggs, seven recently broken eggs, and remains of 29 eggs from a previous reproductive cycle (Fig. 2). Some eggs were found to lie exposed on the surface when the stone was raised, but others were covered by substrate. In this same place, we discovered, in October 2017, 16 young newly hatched together under the same rock (Fig. 3). To our knowledge and except the mention of a nest of 14 young individuals by one of us (D.J.H.) in the spring near Jbel Siroua a few years ago, communal laying has never been described in this small

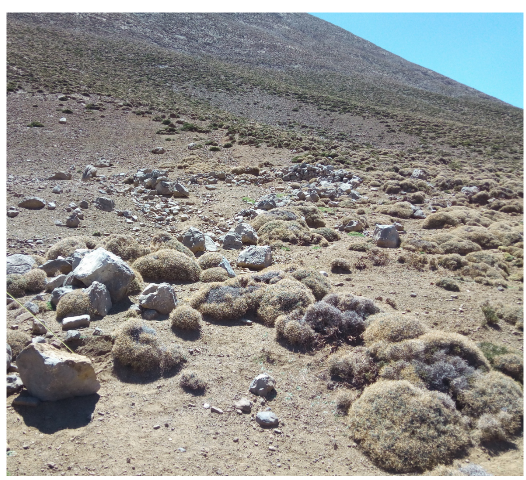

Figure 1. Representative habitat of *Atlantolacerta andreanszkyi* in the High Atlas at Zaouiat Bouguemez.

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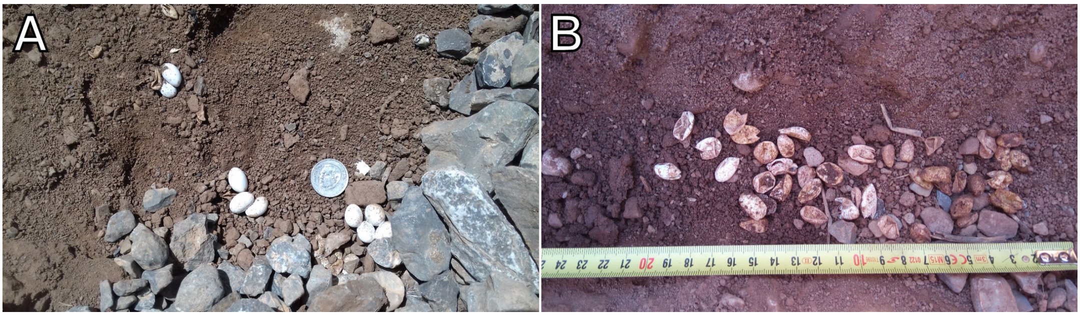

Figure 2. Common nesting sites of *Atlantolacerta andreanszkyi* in the High Atlas at Zaouiat Bouguemez.

Lacertidae endemic to Morocco. However, clutches with a size of two to three eggs were identified in a population of the same species in the field in the High Atlas at Oukaimeden and in the laboratory by gravid females kept in breeding (A. S'khifa, unpubl. data). If these average values have been interpreted as a strategy to reduce the risk of potential predation, they suggest that our discovery includes at least eight broods, thus confirming common spawning in the *Atlantolacerta* genus. The environmental conditions of the place where we found the community clutches were similar to those of Oukaimeden (31.2038° N, 7.8586°W; 2,598 m a.s.l.) where these lizards are located in alpine meadows at the level of scree in areas with spiny xerophytes. The rocks that can serve as a laying site for several females of *Atlantolacerta* are rather rare in these environments. Indeed, in Zaouiat Bouguemez, the eggs were deposited under rocks half buried in the soil (pers. obs.), creating a stable environment for incubation (Huey et al., 1989; Kearney, 2002).

Endemic in Morocco, where it is limited to the High Atlas mountain range between 2,400 and 3,800 m a.s.l. (Martínez del Mármol et al., 2019), *Atlantolacerta andreanszkyi* has an area of occurrence of less than 2,000 km^2 (Geniez, 2006), where known populations are clearly fragmented, and could be therefore vulnerable to climate change (Sinervo et al., 2010; McCain and Colwell, 2011; Monasterio et al., 2013). Listed as "Near Threatened" according to the IUCN Red List of Threatened Species (Geniez, 2006), this species does not seem to have a major threat, but it occurs in easily accessible areas, particularly by hikers. In order to better understand the life history of this endemic species of the Moroccan High Atlas, it is important to carry out more in-depth studies on the reproductive ecology of the different populations of *Atlantolacerta andreanszkyi*.

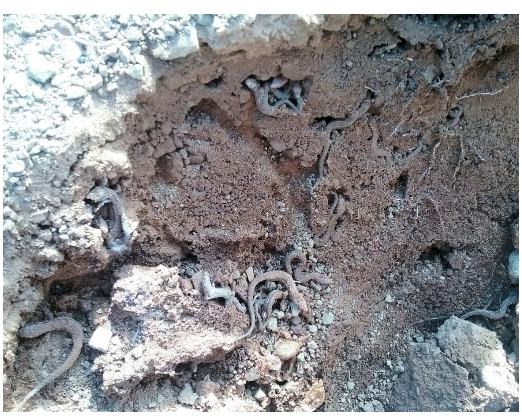

Figure 3. Nest with 16 newly hatched young *Atlantolacerta andreanszkyi* in the High Atlas at Zaouiat Bouguemez.

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