

Documenting the introduction of the Moorish gecko *Tarentola mauritanica* (Linnaeus, 1758) (Squamata: Phyllodactylidae) on the Levant and Port-Cros Islands (Hyères Archipelago, Var department, France)

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The archipelago of the Hyères islands consists mainly of four French Mediterranean islands: Porquerolles, Port-Cros, Bagaud and the Levant (Fig 1). The Moorish gecko, *Tarentola mauritanica* (Linnaeus, 1758), is mentioned as absent from these islands (Lantz, 1932; Knoepffler, 1960; Cheylan, 1983; Geniez and Cheylan, 2012), except for Porquerolles where the species was discovered in 2001 (Cluchier and Cheylan, 2004; Astruc and Cheylan, 2008). The native herpetofauna of the islands includes the European leaf-toed gecko *Euleptes europaea* (Gené, 1839). The Turkish gecko *Hemidactylus turcicus* (Linnaeus, 1758) colonised more recently the western Mediterranean and is not considered here as a native species of its islands (Carranza and

Arnold, 2006; Moravec et al. 2011; Rato et al., 2011; Šmíd et al., 2013; Silva-Rocha et al., 2019).

The Moorish gecko *Tarentola mauritanica* was unknown from the Levant Island until one adult individual was opportunistically sighted in the village of Héliopolis on 4 November 2017 during the settlement of a protocol for the assessment of the conservation status of the Tyrrhenian Painted Frog *Discoglossus sardus* Tschudi in Otth 1837 (Deso et al., 2018). To our knowledge, this is the first record of *T. mauritanica* on the island (Geniez and Cheylan, 2012). Following this observation, we examined a dozen photographs made by amateur naturalists and wildlife enthusiasts since 2007, which were posted on a website run by one of the authors (FC <http://www.iledulevanthodie.fr/>). Among

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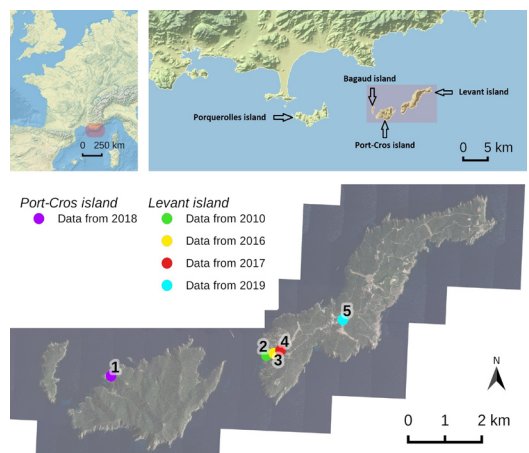


Figure 1. Locations at which Moorish Gecko *Tarentola mauritanica* was found on the Levant and Port-Cros islands.

the many photographs of reptile species, two of them depicted the Moorish gecko. One of the pictures shows a juvenile photographed on the Heliopolis beach on 21 October 2010 and the other one, an adult, on the 29 May 2016 (Fig. 2). Both photographs were taken by FC.

These pictures from the Levant island confirm the presence of *T. mauritanica* since at least 2010. Furthermore, two juveniles were photographed on 29 January 2019 in the military zone of the island, 2 km further east of the first records made in the civil part of the island, which supports the hypotheses of either a possible successful mating or the result of an introduced pregnant female in the island. Their presence is observed in the anthropogenic densest urbanised area (Joss Defarges, pers. comm.). This is not surprising, since *T. mauritanica* is known to be frequently associated with anthropogenic environments, such as houses and stone walls, especially near artificial lights that attract insect prey (Arnold and Ovenden, 2002). Hence, this close relationship with humans, sometimes leads to accidental anthropogenic introductions of these geckos into new areas.

Since the arrival of the Moorish gecko on the island of Porquerolles, the National Park of Port-Cros has ordered the monitoring of the colonisation pattern of the species on this island (Astruc *et al.*, 2014) and has set up surveillance of a potential arrival on the Island of Port-Cros (Medail *et al.*, 2013). In the fall of 2018, the Moorish gecko was reported for the first time with certainty on the island of Port-Cros (DG pers. obs., Table 1).

The biogeographic pattern of the European colonisation of the Moorish gecko is complex and could result from a combination of recent human-mediated colonisation and more ancient natural colonisations from North Africa through the Strait of Gibraltar (Harris *et al.*, 2004a, b; Perera and Harris, 2008; Rato *et al.*, 2010, 2012). Moreover, the phylogeographic study from Rato *et al.* (2010) suggests that the current genetic diversity of the European populations of the Moorish gecko seem to be the result of both recent colonisations and selection. Most occurrences reported on European islands are suspected to result from human activity (Jesus *et al.*, 2008; Barreiros *et al.*, 2010; Mačát *et al.*, 2014; Rato, 2015; Mizerakis and Strachinis, 2017; Strachinis and Pafilis, 2018). Since the species has never been previously recorded in the Levant Island (Geniez and Cheylan, 2012), its presence there is probably the result of a recent accidental human-mediated introduction. The presence of *T. mauritanica* on these islands could

represent a threat to non-native gecko species such as *H. turcicus*, and the native species, *E. europaea* (Astruc *et al.*, 2014). At least on the Iberian Peninsula and Balearic Islands (Martínez-Rica, 1974) and in the Croatian part of the Eastern Adriatic (Lisičić *et al.*, 2012), studies on sympatric populations of *T. mauritanica* and *H. turcicus* have shown that the presence of the former induces a spatial shift on the latter, enabling their co-existence and exploration of distinct micro-habitats. However, there is still no strong evidence regarding the existence



Figure 2. Adult Moorish Gecko *Tarentola mauritanica*, Levant Island, 29/05/2016.

Table 1. Geographic coordinates of locations at which Moorish Gecko *Tarentola mauritanica* was found on the Levant and Port-Cros islands.

Island	Locality number	Latitude °N	Longitude °E	Observer	Year
Port-Cros	1	43.0101	6.3827	D. Geoffroy	2018
Levant	2	43.0156	6.4346	F. Capoulade	2010
Levant	3	43.0156	6.4367	F. Capoulade	2016
Levant	4	43.0161	6.4394	G. Deso	2017
Levant	5	43.0241	6.4584	J. Desfarges	2019

of negative effects of one species over the other (competitive exclusion).

Our observations suggest that the monitoring of *T. mauritanica* should be implemented on both Levant and Port-Cros islands to better understand its distribution, and the possible impact it can have on native and allochthonous gecko species.

Acknowledgements. We thank Joss Defarges for sending us his data in the military zone. We warmly thank Jean-Pierre Vacher for his help with translation and his quality proofreading that has improved the manuscript. We thank Nicolas Dubos for reviewing the manuscript. We also thank Wouter Beukema for providing a quality proofreading of the manuscript.

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