

The status of the introduced Mourning Gecko (*Lepidodactylus lugubris*) in Guadeloupe (French Antilles) and the high probability of introduction of other species with the same pattern of distribution

Olivier Lorvelec^{1,2,*}, Nicolas Barré², and Aaron M Bauer³

¹ESE (Écologie et Santé des Écosystèmes), INRA, Agrocampus Ouest, Campus de Beaulieu, 35042 Rennes, Bretagne, France.

²AEVA (Association pour l'Étude et la protection des Vertébrés et végétaux des petites Antilles), C. Pavis, Hauteurs Lézarde, 97170 Petit Bourg, Guadeloupe, France.

³Villanova University, Department of Biology, 800 Lancaster Avenue, Villanova, Pennsylvania 19085, USA.

*Corresponding author (olivier.lorvelec@inra.fr)

Date of publication: 27 January 2017.

Citation: Lorvelec O, Barré N, Bauer AM (2017) The status of the introduced Mourning Gecko (*Lepidodactylus lugubris*) in Guadeloupe (French Antilles) and the high probability of introduction of other species with the same pattern of distribution. *Caribbean Herpetology*, 57,1–6.

Abstract

The Mourning Gecko, *Lepidodactylus lugubris*, is an invasive parthenogenetic species first recorded on Guadeloupe in November 2010. Today it is widely distributed on the island, at least in the south of Grande-Terre and the northeast of Basse-Terre. It occurs in and around human habitations, often together with another invasive gecko, *Hemidactylus mabouia*. Other species of invasive geckos native to the Eastern Hemisphere have similar life histories and therefore are expected to become established in Guadeloupe in the future. The impact of these introduced species on the native biodiversity of the island is not yet clear.

Keywords: Caribbean, Guadeloupe, introduced species, *Lepidodactylus lugubris*, Gekkonidae.

The Mourning Gecko, *Lepidodactylus lugubris* (Duméril & Bibron, 1836), was first recorded in Grande-Terre, Guadeloupe, on 4 November 2010 (Lorvelec *et al.* 2011). This constituted the second mention for this widely distributed tropical species on one of the islands of the Caribbean. The first introduction was documented in 1976 on Big Corn Island, a continental island off of Nicaragua (Henderson *et al.* 1976). Since 2011, we have identified seven new locations in Guadeloupe, including four not reported previously (Figs. 1, 2, 3 & 4) for this exotic species. These confirm the naturalization of this gecko, not only in Grande-Terre (six locations) but also in Basse-Terre (two locations), the two main islands of the Guadeloupean Archipelago (Fig. 5). Here we point out the status of *L. lugubris* in Guadeloupe and draw attention to other exotic species with the same pattern of distribution that may be unintentionally introduced in the future.

The eight locations where this species has been found in Guadeloupe (Fig. 5) are listed in chronological order. (1) Lorvelec *et al.* (2011) reported the observation, by Anthony Levesque, of an individual on several occasions beginning on 4 November 2010, and the collection of two individuals on 6 and 9 January 2011, in a house in Grande-Terre (Dugazon, les Abymes, 16.24667, -61.51972, 37 m). (2) Parmentier *et al.* (2013) reported the observations of adults and juveniles four times between 28 July 2011 and 30 September 2013, inside and outside a house in Basse-Terre (Lachaise, Sainte-Rose, 16.31739, -61.69778, 62 m). (3) Gomès & Ibéné (2013) reported the collection of a dead specimen on 24 December 2011, in a gymnasium in Grande-Terre (Chanzy, Pointe-à-Pitre, 16.24229, -61.53780, 8 m). (4) Philippe Burnel (personal communication, 11 October 2016) observed one individual on 15 July 2012 (Fig. 1), in a hotel in Grande-Terre (les résidences du Manganao, Saint-François, 16.24545, -61.29411, 4 m). (5) Gomès & Ibéné (2013) reported the observation of two individuals on 13 May 2013, on the walls of a house in Grande-Terre (pointe de la Verdure, le Gosier, 16.20556, -61.49922, 12 m). (6) One of us (Nicolas



Figure 1. New record of *Lepidodactylus lugubris* in Grande-Terre, Guadeloupe (15 July 2012, hotel, les résidences du Manganao, Saint-François, photo by Philippe Burnel).



Figure 2. New record of *Lepidodactylus lugubris* in Basse-Terre, Guadeloupe (10 October 2016, garden, chemin de Bel Air Desrozières, Petit-Bourg, photo by Nicolas Barré).



Figure 3. New record of *Lepidodactylus lugubris* in Grande-Terre, Guadeloupe (12 November 2016, house, le Helleux, Sainte-Anne, photo by Jean-Claude Vuillaume).



Figure 4. New record of *Lepidodactylus lugubris* in Grande-Terre, Guadeloupe (22 December 2016, house, Bois Bragelone, Saint-François, photo by Laurent Malglaive).

Barré) observed one individual on 10 October 2016 (Fig. 2) in his garden, and another smaller specimen in his house on 13 November 2016 in Basse-Terre (chemin de Bel Air Desrozières, Petit-Bourg, 16.21689, -61.63153, 80 m). Observation of the first specimen, which was exposed on an orchid leaf, occurred in the morning under clear weather conditions. (7) Jean-Claude Vuillaume (personal communication, 13 November 2016) observed about ten individuals on 12 November 2016 (Fig. 3), on the walls of a house in Grande-Terre (le Helleux, Sainte-Anne, 16.24727, -61.33382, 20 m). (8) Laurent Malglaive (personal communication, 23 December 2016) observed two individuals on 22 December 2016 (Fig. 4), in his house in Grande-Terre (Bois Bragelone, Saint-François, 16.26713, -61.29165, 38 m).

All of the sites currently recorded are in or around human habitations, which is in agreement with the type of habitat usually occupied by *L. lugubris* in its wide area of distribution (e.g., Bauer & Sadlier 2000). In five locations (1, 2, 4, 6, and 8), *L. lugubris* was living in syntopy with *Hemidactylus mabouia*, a gecko of African origin (e.g., Carranza & Arnold 2006), formerly introduced in the Antilles and now widespread in Guadeloupe (e.g., Breuil 2002). Syntopy is also likely in the three other localities. No direct interaction has been reported yet between the two species; however, agonistic or predatory behavior by *Hemidactylus* may occur to the detriment of the notably smaller *L. lugubris*.

Both specimens collected in locality 1 and the one collected in locality 3 were deposited by one of us (Olivier Lorvelec) at the Muséum National d'Histoire Naturelle in Paris (MNHN 2011.0001-2 collected by Anthony Lesvesque, and MNHN 2012.0291 collected by Régis Gomès, respectively). All three belong to clone A, identifiable by dorsal coloration and the most widely distributed clone in this diploid parthenogenetic species (Ineich 1987, 1988). Based on the pattern of dark dorsal spots, the published photographs suggest that individuals from other localities in Guadeloupe also belong to clone A. This does not necessarily mean that there was a single introduction in Guadeloupe, because of the high frequency of populations of clone A in the range of the species. It is impossible to know where, when, and how the species was introduced in Guadeloupe.

Opportunities for introduction, given its distribution and some life history traits, are numerous (see below), and the fact that the species is in the exotic pet trade further increases possibilities of introduction. The date of the first observation (November 2010) can not be correlated with an introduction date, and the large

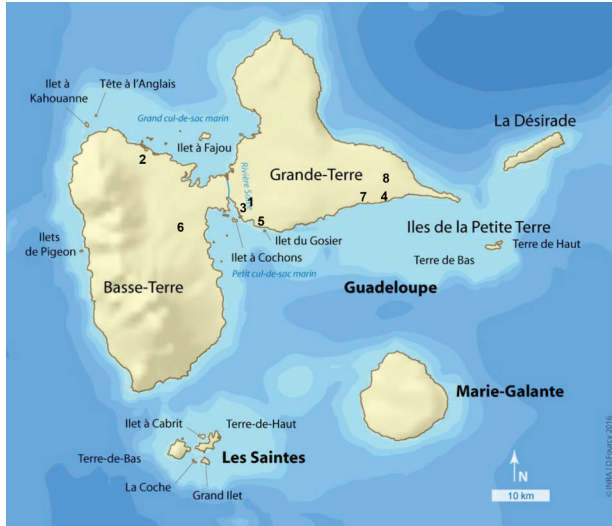


Figure 4. Map of known localities of *Lepidodactylus lugubris* in Guadeloupe as of January 2017, arranged in chronological order of discovery from 1 to 8 (see details in the text).

distance between localities (about 55 kilometers by road between localities 2 and 4) probably reflects presence of communication routes and multiple possibilities of accidental secondary introductions for this synanthropic species, rather than colonization by steps. Accumulation of observations, particularly those in October, November, and December 2016 obtained opportunistically, suggests that the species is already well distributed between localities 2 and 4 and probably elsewhere in Grande-Terre and Basse-Terre. To clarify the current distribution, surveys should be conducted in the center, north, and west of Grande-Terre, as well as in the south and west of Basse-Terre. Surveys should also be made on other islands and islets of the Guadeloupean Archipelago (the main ones being marked on the map in Fig. 5).

As has been emphasized by specialists of the Australasian herpetofauna (e.g., Brown 1957; Zug 2013),

Lepidodactylus lugubris is part of a group of eleven species of squamates which have wide distributions across many tropical Pacific islands. Specifically, this group includes seven geckoes of the family Gekkonidae (*Gehyra insulensis*, *Gehyra oceanica*, *Hemidactylus frenatus*, *Hemidactylus garnotii*, *Hemiphyllodactylus typus*, *Lepidodactylus lugubris*, and *Nactus pelagicus*), three skinks of the family Eugongylidae (*Cryptoblepharus poecilopleurus*, *Emoia cyanura*, and *Emoia impar*), and one skink of the family Sphenomorphidae (*Lipinia noctua*). Several of these species have an even wider distribution: South Asia and Pacific Ocean for *H. garnotii*; South Asia, Indian Ocean and Pacific Ocean for *H. typus* and *L. lugubris*, and almost pantropical in the case of *H. frenatus*. It should also be noted that *G. insulensis* was recently separated from *Gehyra mutilata*, the latter species now corresponding to a lineage distributed in South Asia, the Philippines, and Indian Ocean (Rocha *et al.* 2009).

Some life history traits give these species an exceptional ability to colonize, which explains their distribution pattern. Four of them have a clonal reproduction by parthenogenesis (*H. garnotii*, *H. typus*, *L. lugubris*, and *N. pelagicus*) allowing propagation by a single individual. All are synanthropic, which facilitates accidental introductions. In addition, several characteristics (morphological, physiological, ecological and behavioral), which may facilitate their dissemination, have been documented (e.g., Ineich & Blanc 1987). Such a case is the resistance of eggs to salt water exposure and/or desiccation in gekkonids (e.g., Brown & Alcalá 1957; Brown & Duffy 1992; Bauer & Sadlier 2000; Andrews 2012).

In a major part of their geographic range (see details above), these species are neither demonstrably native nor introduced, and correspond with the definition of a cryptogenic species (Carlton 1996). However, in parts of their distribution, particularly in peripheral areas, these species clearly represent accidental introductions (e.g., Lever 2003; Kraus 2009). In addition to *L. lugubris*, three of them have been introduced and are already widely distributed in tropical or subtropical regions of mainland America (*G. insulensis* or *G. mutilata*, *H. frenatus*, and *H. garnotii*). It is difficult to know which species of *Gehyra* has (or have) been introduced in mainland America (*G. insulensis* or *G. mutilata*). In addition to genetics, knowledge of the origins of introduced individuals could provide answers. According to Smith & Taylor (1950), the presence of *Peropus mutilatus* (former name of *G. mutilata*) in Mexico is likely due to an introduction from the Philippines. Furthermore, according to Ineich & Blanc (1987), the opening of the Panama Canal in 1914 may have contributed to introductions of some species in mainland America. Both species of *Hemidactylus* are now present in the islands of the Caribbean. Consultation of the latest species lists published for these islands (Powell *et al.* 2011, 2013; Henderson & Breuil 2012), indicates the presence

of *H. frenatus* in the Greater Antilles (Cuba and Hispaniola) and of *H. garnotii* in the Bahamas (New Providence Island and Man-o-War Cay). Besides Big Corn Island, Grande-Terre, and Basse-Terre, *L. lugubris* has recently been reported in the Bahamas (North Bimini, Krysko & MacKenzie-Krysko 2016).

The gradual expansion of the three other geckoes within the Neotropical region suggests they could be introduced and become established rapidly in Guadeloupe, like *L. lugubris*, if this has not already occurred. For a non-specialist, *Hemidactylus frenatus* and, to a lesser extent, *H. garnotii*, can be confused with *H. mabouia*, a common introduced species in Guadeloupe. Such confusion could delay identification. In Guadeloupe, it is difficult to forecast how these exotic species would interact with and affect the conservation of native species. However, we know that in other regions, the introduction of *H. frenatus* has had extremely negative consequences for biodiversity. In the Mascarene Islands, *H. frenatus* has caused the near extinction of several endemic species of geckoes of the genus *Nactus* (Arnold 2000; Cole *et al.* 2005). Even if there are no geckos comparable to *Nactus* in Guadeloupe, it will still be necessary to rapidly document the consequences if *H. frenatus* is introduced.

To be comprehensive, there are also other species of *Hemidactylus*, not native to the tropical Pacific islands, at least the African *H. angulatus* sensu lato (including *H. haitianus*) and the Mediterranean *H. turcicus*, which have been introduced into the Caribbean. They could also settle in Guadeloupe.

Acknowledgements

We thank Damien Fourcy (Écologie et Santé des Écosystèmes, INRA, Rennes) who produced the map of the Guadeloupean Archipelago, Philippe Burnel, Jean-Claude Vuillaume, and Laurent Malglaive, who shared their observations and photos, and Thierry Frétey (Association RACINE, Saint-Maugan) for commenting on an earlier version of the manuscript. We thank two anonymous reviewers for critically reading the manuscript.

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