

Importation of ornamental plants facilitates establishment of the Common House Gecko, *Hemidactylus frenatus* Duméril & Bibron, in the Lesser Antilles

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The Asian *Hemidactylus frenatus* is globally among the most widespread non-native species (Rödger *et al.* 2008; Torres-Carvajal 2015; Wetering & Vetter 2018) and has recently been reported from multiple novel localities, including within the Greater Caribbean region (Sánchez 2018; Behm *et al.* 2019). *Hemidactylus frenatus* is well-known as an aggressive, invasive gecko that widely interacts with native geckos throughout its non-native range, mainly documented outside the Caribbean (e.g., Hoskin 2011). Namely, reports have repeatedly described how *H. frenatus* (1) competitively displaces native species (e.g., Cole *et al.* 2005), although some accounts show native species persisting (Cisterne *et al.* 2019; Garner *et al.* 2020), and (2) are known to consume small reptilian species (see species account on GISD [2020] for an overview). Although geckos in the genus *Hemidactylus* can occasionally serve as prey for native species in the Caribbean (Reynolds *et al.* 2020), the detrimental effects of *H. frenatus* on native species highlight the need to monitor its spread closely and rapidly circulate information on novel establishments among local and regional partners. Evidently, there is an increased need for studies into the interactions between non-native and native geckos in the Greater Caribbean region (Perella & Behm 2020).

Since the passing of Hurricane Maria (a Safir-Simpson Category 5 Atlantic storm) over Dominica in September 2017, repeated surveying efforts have

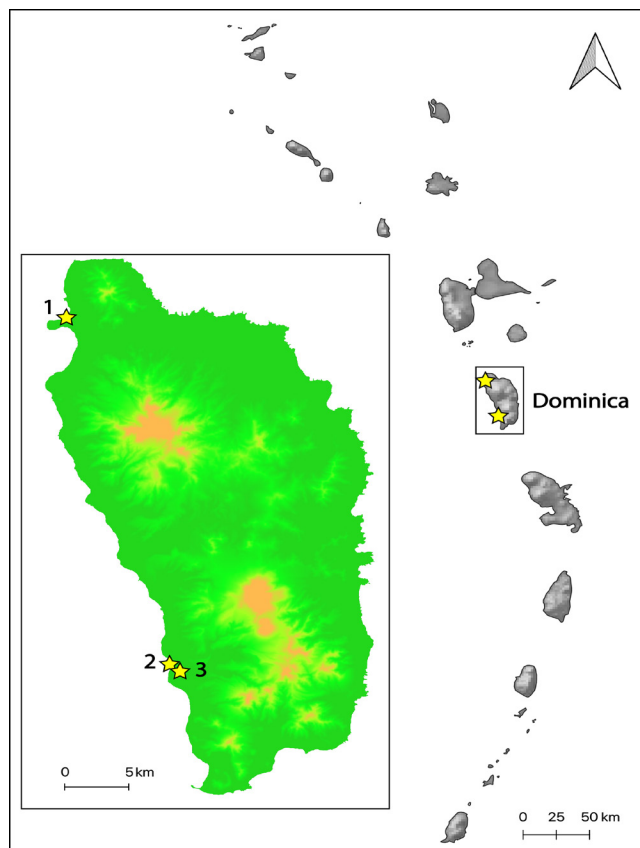


Figure 1. Map of the Commonwealth of Dominica indicating locations (stars) where *Hemidactylus frenatus* has been observed; 1) Resort north of Portsmouth, 2) Woodbridge Bay Port, 3) Roseau.

aimed to assess its impact on native species and the occurrence of non-native species. These efforts have already indicated anthropogenic-facilitated incursion of two well-known invasive amphibians and reptiles (van den Burg *et al.* 2020a). Surveys encompassed >70 areas along the island's coast where most non-native species are known to occur, as well as in the interior, with only a few in the central interior and south-eastern coast.

On 10 October 2019 at 21:47 h, the first *H. frenatus* was observed and captured on Dominica, at a recently-constructed resort near the northern town of Portsmouth (15.5913, -61.4643; Figs. 1, 2). In total, seven adult individuals were observed over a 3-hour nocturnal period at two sites (268 m apart); one on the main fencing of the hotel grounds, and, six on temporary construction houses on the opposite side of the road. This area was used as storage for imported construction materials and ornamental plants. Individuals were observed hunting on insect prey around artificial light at night. A single female *H. frenatus* was captured and held captive in a holding container for taxonomic identification purposes, where it laid two eggs.

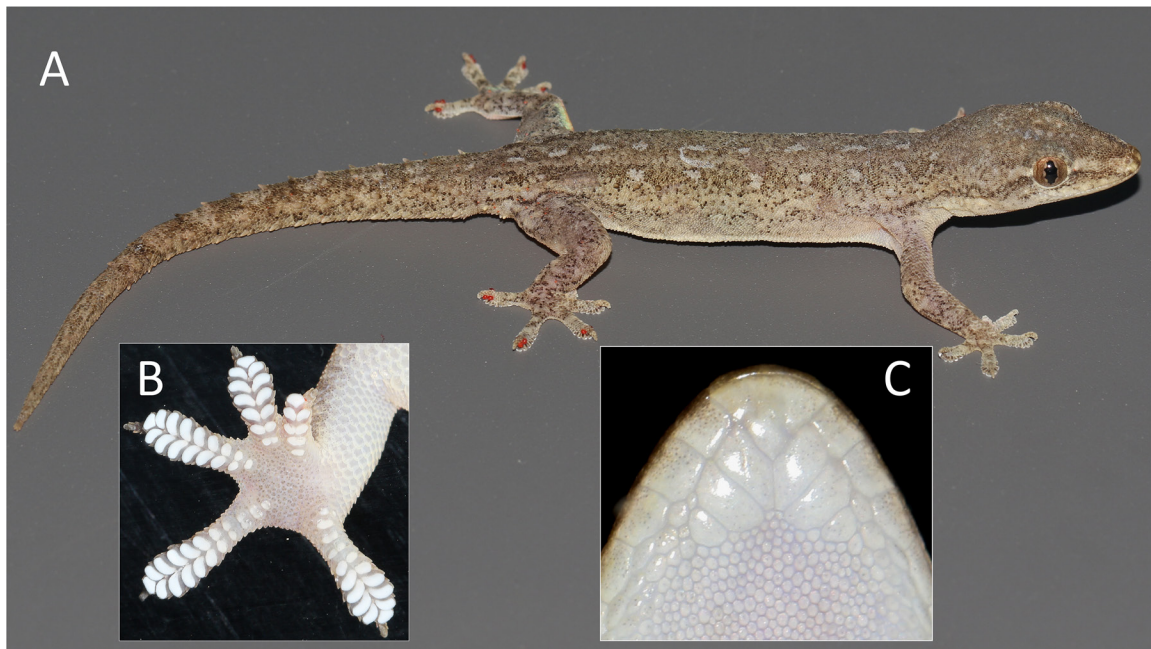


Figure 2. *Hemidactylus frenatus* captured in January 2020 on Dominica [Fig. 1; location 1]. Pictures shown following key in Krysko and Daniels (2005). (A) Dorsal side of specimen with few and small tubercles, showing high number of ectoparasites on the hind toes and the base of the tail; (B) ventral side of feet with subdigital lamellae of digit IV running to base of the digit; (C) ventral side of chin, with second pair of anterior chin shields in contact with infralabials. Photographs taken by Maël Dewynter.

Since then, observations have indicated *H. frenatus* presence from two additional sites. On 10 September 2020 at 20:04 h, a group of *H. frenatus* was discovered on the grounds of Dominica's main seaport (Woodbridge Bay Seaport; 15.3117, -61.3891; Fig. 1). A total of 11 individuals were observed, constituting five adults and six juveniles, of which one of the latter was captured for taxonomic identification. These animals were located around the storage houses. Collectively, another four individuals have since been discovered in a two-block radius within the capital of Roseau (Fig. 1); three adults and one juvenile. At all sites, both *H. frenatus* and *H. mabouia* were present, either in equal numbers or with higher *H. frenatus* presence.

The *H. frenatus* incursion is believed to have been facilitated through a shipment of 15–17 containers transporting ornamental plants to a resort north of Portsmouth from Florida (USA), where it is a known invasive species (Weterings & Vetter 2017), in June 2019. Through direct observations and subsequent interviews (pers. obs. JLKB), it became known that numerous non-native fauna were imported: arachnids, millipedes, and, other invertebrates, as well as Cuban treefrogs, and likely an Argentine black and white tegu (identified by an interviewee

from internet-based images). Contrary to biosecurity guidelines, these containers were not initially opened and checked at the Woodbridge Bay Port (although temporarily stored there) but only opened once on the resort's grounds. The temporary storage at the port of entry can explain the presence of a small population there. Additionally, we note the seemingly high parasitic load of the caught individual (Fig. 2), the overspill of which to native species is a concern as highlighted by other studies (Miller *et al.* 2018). Overall, this note found established and small breeding populations of *Hemidactylus frenatus* on Dominica, making it the 11th non-native established vertebrate on the island and the 3rd established non-native amphibian and reptile since the passage of Hurricane Maria in 2017 (van den Burg *et al.* 2020a; GISD 2020).

To better understand the Lesser Antillean spread of *H. frenatus*, we examined observational records on the online platform iNaturalist (van den Burg *et al.* 2020b). Given that species of *Hemidactylus* can be hard to distinguish (Krysko & Daniels 2005), we assessed all *Hemidactylus* records between Anguilla and Grenada; in total 81 records: 77 *H. mabouia* (Moreau de Jonnès), and two for both *H. frenatus* and *H. palaichthus* Kluge. *Hemidactylus frenatus* is reported from Guadeloupe (French West Indies, iNaturalist record #5560475) and St. Lucia (iNaturalist record #37074494). Although image quality was generally low and often solely taken from the dorsal side, our examination indicated that at least the Guadeloupe *H. frenatus* record is in fact an *H. mabouia*; based on the presence of a clear line between the eyes and the presence, number, and placement of the dorsal tubercles (Krysko & Daniels 2005). Although the main criteria used to diagnose species of *Hemidactylus* are the subdigital lamellae of toe IV (extended or not at the base), this character was not visible. Both image quality and the body angle of the St. Lucia record prevented definitive species identification, but given the species has not been officially recorded from the region, expert judgement favours *H. mabouia* in the absence of proper specimen assessment. Indeed, the taxonomic suggestion was made by iNaturalist (pers. comm. D. Wolfe), which can be erroneous (Wäldchen & Mäder 2018). To confirm the presence of *H. frenatus* on St. Lucia, we suggest monitoring by scientists and local naturalists and/or herpetologists. Although iNaturalist assigns a "Research Grade" status to records for which several users agree on taxonomy; users cannot always assume correct taxonomic assignment, which should be confirmed ahead of data usage (see Hochmair *et al.* 2020).

The arrival of the Common House Gecko (*H. frenatus*) in the Lesser Antilles further emphasises the current high rate of gecko introductions in the Greater Caribbean region (Nania *et al.* 2020; Perella & Behm 2020). As the common name suggests, this species is capable of living in anthropogenic habitats (Hoskin 2011; Muller *et al.* 2020), which promotes dispersal facilitated through cargo transport (Newberry & Jones 2007). Also, as *H. frenatus* eggs are saltwater tolerant (Hsu *et al.* 2020), and can hatch after immersion, natural dispersal to neighbouring islands could be expected if these populations expand over Dominica. The spread of non-native vertebrates through the importation of ornamental plants, as reported here, is not uncommon (Hulme *et al.* 2008; Saul *et al.* 2016), and subsequent incursions from the same place of origin can be expected. We recommend stricter import legislation and its subsequent enforcement, especially during periods following natural disasters when biosecurity capacity is hampered (van den Burg *et al.* 2021). Furthermore, throughout the Lesser Antilles, we call for the promotion and use of native plant species when planning ornamental decoration (Tallamy 2007). Lastly, with the arrival of *H. frenatus*, we call for awareness among regional biosecurity personnel, in addition to monitoring efforts (both visual and acoustic; Hopkins *et al.* 2020) by regional partners, and education efforts in an attempt to prevent its further spread in the Lesser Antilles.

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