



## INTRODUCED SPECIES

# A New Locality Record for the Common House Gecko *Hemidactylus frenatus* Schlegel (Squamata: Gekkonidae) in Cuba, with Comments on the Other Colonizing Species of the Genus in the Island

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Photographs by the author.

The Common House Gecko (*Hemidactylus frenatus* Schlegel) is one of several species in the genus that have colonized many places in both the Eastern and Western Hemispheres (i.e., Townsend and Krysko 2003, Carranza and Arnold 2006, Bomford et al. 2009, Kraus 2009, Caicedo-Portilla and Dulcey-Cala 2011, Powell et al. 2011, Ota and Whitaker 2013). Those introductions were largely mediated by human activity and, as a consequence, the species has increased its range considerably during the last century (Rödder et al. 2008). The presence of these geckos was documented recently in the Dominican Republic (Scantlebury et al. 2010) and from the U.S. Naval Base at Guantánamo in eastern Cuba (Powell et al. 2011). No other localities have been reported for this species in Cuba.

Other non-native species of *Hemidactylus* that have become established on the island are the Antillean House Gecko (*H. angulatus* Hallowell<sup>1</sup>), the Tropical House Gecko (*H. mabouia* Moreau de Jonnés), and the Mediterranean House Gecko (*H. turcicus* [Linnaeus]) (Fig. 1), which, together with *H. frenatus*, are among the species in the genus with broad human-mediated distributions (Carranza and

Arnold 2006, Bomford et al. 2009). Shigesada et al. (1995) suggested that introduced species of *Hemidactylus* exhibit a stratified diffusion invasion by combining human-assisted transportation and a gradual colonization of neighboring localities (Meshaka 1995, Caicedo-Portilla and Dulcey-Cala 2011). For example, vehicles transporting household furniture and other items are known to contribute to dispersion (e.g., Somma et al. 2013). An advantage for *H. frenatus* in particular as a successful colonizer is the capacity for long-term sperm storage by females (Murphy-Walker and Haley 1996, Yamamoto and Ota 2006). Herein, besides reporting *H. frenatus* from a new locality in Cuba, I discuss the status of the other introduced species in the genus and the resultant inter-specific dynamics during the past few decades.

On 6 and 7 December 2013, during a weekend stay in the Hotel Husa Cayo Santa María (Fig. 2), Cayo Santa María, Villa Clara Province, more than three dozen *H. frenatus*, including adults and juveniles, were observed in less than two hours on three buildings and in the hotel lobby. Ariatna Linares and I collected nine voucher specimens, which were deposited in the collection of the Museo Nacional de Historia Natural de Cuba (MNHNCu 5060–5068). Aaron M. Bauer confirmed the identity of the specimens from photographs.

Considering the local abundance of *H. frenatus* on Cayo Santa María, the population was probably established some years ago. The hotel was built in 2008 (formerly as the Hotel Barceló Cayo Santa María), and the building materials included wood imported from locations unknown. Shipments of lumber are a known method of introduction for these commensal geckos (Powell 2004). We were unable

<sup>1</sup> The African *H. angulatus* species complex clearly includes the West Indian populations originally described as a subspecies of Brook's House Gecko (*H. brookii* Gray) by Meerwarth (1901). Subsequent references to these populations have followed Meerwarth in referring to them as *H. brookii haitianus* (e.g., Kluge 1969, Powell and Maxey 1990, Lynxwiler et al. 1991), but others have used *H. haitianus* (Powell 1993, Powell and Parmelee 1993, Powell et al. 1996, Estrada 2012) or *H. angulatus* (Henderson and Powell 2009), the latter after taxonomic revisions in Carranza and Arnold (2006), Weiss and Hedges (2007), and Rösler and Glaw (2010). However, further studies of African populations are necessary to resolve the ambiguity regarding the taxonomic status of populations in the Western Hemisphere (see also the subsequent footnote regarding populations in Colombia).



**Fig. 1.** Three species of *Hemidactylus* now established in Cuba: (A) *Hemidactylus angulatus*, adult male from Lawton, La Habana, with distinctive dark banding; (B) *H. angulatus*, juvenile from same locality (note the X-shaped dorsal figures surrounded by paler tubercles); (C) *H. frenatus*, adult male (MNHNCu 5060) from Hotel Husa Cayo Santa María, Cayo Santa María, Villa Clara, with obvious longitudinal dark zones and interspersed light spots; (D) *H. frenatus*, same male in light phase; (E) *H. mabouia*, adult female, from Lawton, La Habana, with a typical chevron pattern; (F) *H. mabouia*, adult male, same locality, with a poorly defined pattern.

to verify the presence of *H. frenatus* in nearby hotels and other tourism facilities on the cay. The presence of *H. frenatus* on Cayo Santa María and at the Naval Base at Guantánamo likely reflect two different pathways of introduction.

The other house gecko present at the hotel on Cayo Santa María was *H. mabouia* (voucher specimens MNHNCu

5069–5070), of which only three individuals were seen in two nights, two of them with regenerated tails. Although unlikely, since this species has been established in Cuba for some time, its relative scarcity could indicate that this species arrived at this locality subsequent to *H. frenatus*. No previous records of *H. mabouia* exist for this cay and no base-line data are avail-



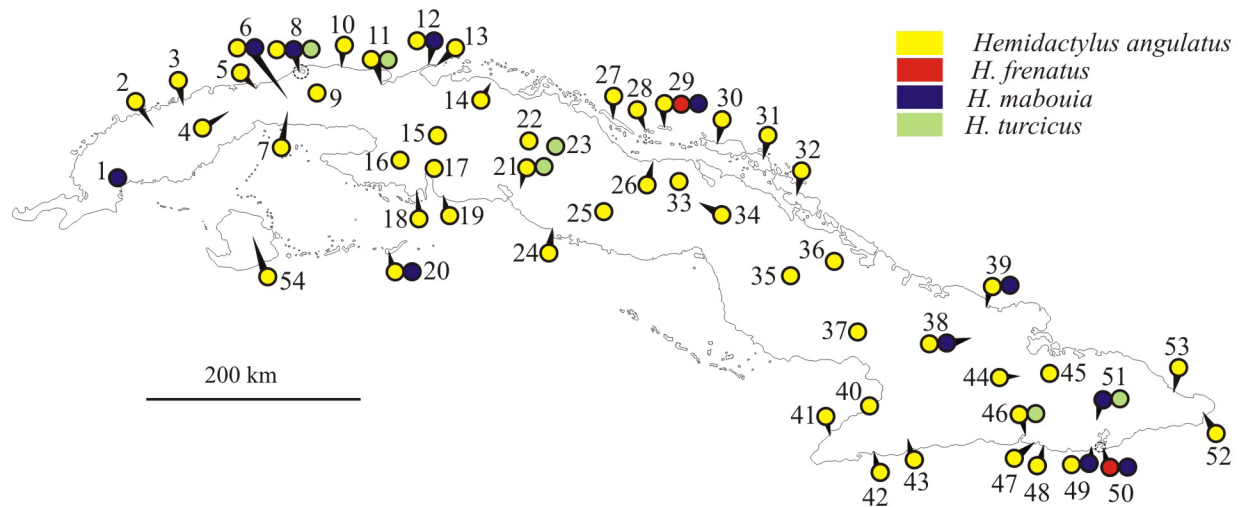
**Fig. 2.** Partial view of the Hotel Husa Cayo Santa María, Villa Clara Province (left), where *Hemidactylus frenatus* (right) was commonly seen on building walls, roofs, and around electric lights.

able for comparing the current population status of the species with that prior to the introduction of *H. frenatus*. Instead, the relative scarcity probably demonstrates the competitive dominance of *H. frenatus* and the possible displacement of *H. mabouia*. Species displacement and replacement among introduced *Hemidactylus* has occurred in several regions. Meshaka et al. (1994) reported *H. mabouia* as an established member of the Florida herpetofauna and suggested that its rapid range expansion indicated that it might be a more successful colonizer than previously introduced *H. turcicus* and *H. garnotii*. The authors noted that the once common *H. turcicus* was nearly absent at localities where *H. mabouia* had been introduced. Short and Petren (2011) demonstrated a complete displacement of *H. garnotii* by *H. mabouia* in less than seven years at some localities of Florida, with *H. mabouia* populations increasing at a very rapid rate (>10% per year). Powell et al. (1998) reported the displacement of *H. mabouia* by *H. frenatus* in the Los Tuxtlas region of Mexico. Caicedo-Portilla and Dulcey-Cala (2011) observed that populations of *H. angulatus*<sup>2</sup> in Colombia showed a notable decline after the recent introduction of *H. frenatus*. Based on climate data, Rödder et al. (2008) predicted that the extent of climatically suitable areas and the potential distribution of *H. frenatus* will increase on a global scale, whereas those of *H. mabouia* will decrease.

The history and dynamics of colonization of *Hemidactylus* geckos in Cuba have been poorly studied, largely due to low collection efforts and frequent species misidentifications. However, alien geckos in Cuba appear to have exhibited a pattern of displacement and replacement similar to those described above. Leavitt (1933) first reported the presence of *H. turcicus*, and at least six localities in Cuba were recorded by Schwartz and Henderson (1991). However, no recent records exist and the species probably is no longer established. *Hemidactylus angulatus* was abundant in Havana until the late 1990s, but *H. mabouia* became the most frequently encountered species during the 2000s, displacing (but not yet replacing) the former. Figure 3 shows that *H. mabouia* has a wider distribution in Cuba than previously reported (Schwartz and Henderson 1991, Powell et al. 1998), and populations seem to be increasing rapidly across the island. *Hemidactylus angulatus* is the species with the widest distribution on the island (Fig. 3) and is the only member of the genus in localities where *H. mabouia* is absent. When both species are found together, *H. angulatus* usually is less abundant than *H. mabouia*. Estrada (2012) reported *H. angulatus* in Cayo Santa María, but we did not find it in December 2013 at the Hotel Husa Cayo Santa María. This probably represents another species succession, with *H. angulatus* being the first introduced species, later being displaced or replaced by *H. mabouia*, and now *H. frenatus* is the most abundant species there. *Hemidactylus angulatus* was the only species found in November 2013 at the Hotel Sol Cayo Coco, Cayo Coco, Ciego de Ávila Province. With the apparently recent introduction of *H. frenatus* into Cuba, the status of both *H. angulatus* and *H. mabouia* might change if *H. frenatus* gradually colonizes new territories and achieves a wider distribution.

The impact of introduced geckos on native Cuban species is unknown. However, whether a coincidence or a con-

<sup>2</sup> Colombian house geckos were originally described as a distinct species (*Hemidactylus leighoni*) by Boulenger (1911). Recent references have variously referred to these populations, undoubtedly part of the African *H. angulatus* species complex, as *H. brookii haitianus* (Mechler 1968), *H. brooki leighoni* (Kluge 1969, Powell and Maxey 1990), *H. leighoni* (Powell et al. 1996, by implication; Rivas Fuenmayor 2002), *H. angulatus* (Caicedo-Portilla and Dulcey-Cala 2011), and *H. angulatus leighoni* (Rösler and Glaw 2010). As for Antillean populations (see previous footnote), the status of populations in the Western Hemisphere must await further studies of African populations before the taxonomic status of Antillean and Colombian populations can be resolved.



**Fig. 3.** Distributional records of *Hemidactylus* in Cuba. Available records underestimate the real distribution of species because of the historically low effort for collecting these geckos throughout the island and their limited representation in collections. Mapped localities are: (1) San Uvaldo, N Cortés, Pinar del Río Province (Rodríguez Schettino et al. 2013); (2) Viñales, Pinar del Río Province (author's visual records; avr); (3) Cajálbana, Pinar del Río (avr); (4) Soroa, Candelaria, Artemisa Province (avr); (5) Mariel, Artemisa (Grant 1932, Kluge 1969); (6) San Antonio de Los Baños, Artemisa (avr); (7) Güira de Melena, Mayabeque Province (avr); (8) La Habana [avr (*H. angulatus* and *H. mabouia*); Kluge 1969 (*H. angulatus*); McCoy 1970 (*H. turcicus*); Schwartz and Henderson 1991 (*H. angulatus* and *H. turcicus*); Iturriaga and Marrero 2013 (*H. mabouia*)]; (9) San José de Las Lajas, Mayabeque (avr); (10) La Sierra, Santa Cruz del Norte, Mayabeque (avr); (11) Matanzas City [Kluge 1969 (*H. angulatus*); Schwartz and Henderson 1991]; (12) Península de Hicacos, Matanzas Province (avr); (13) Cayo Buba, Matanzas (Estrada 2012); (14) Elguea, Villa Clara Province (Rodríguez Schettino et al. 2013); (15) Jagüey Grande, Matanzas (avr); (16) Santo Tomás, Matanzas; (17) Playa Larga, Zapata, Matanzas (avr); (18) La Salina, Zapata, Matanzas; (19) Playa Girón, Zapata, Matanzas (avr); (20) Cayo Largo del Sur, Archipiélago de los Canarreos (avr); (21) Jardín Botánico de Cienfuegos (Soledad), Cienfuegos Province [avr (*H. angulatus*); Leavitt 1933 (*H. turcicus*)]; (22) Monte Ramonal, Villa Clara (Rodríguez Schettino et al. 2013); (23) Santa Clara, Villa Clara (Schwartz and Henderson 1991); (24) Trinidad, Sancti Spiritus Province (avr); (25) Alturas de Banao, Sancti Spiritus (Rodríguez Schettino et al. 2013); (26) Caguanes, Sancti Spiritus (Estrada 2012); (27) Cayo Frágoso, Villa Clara Province (Estrada 2012); (28) Cayo Francés, Villa Clara (Estrada 2012); (29) Cayo Santa María, Villa Clara [avr; Estrada 2012 (*H. angulatus*)]; (30) Cayo Coco, Ciego de Ávila Province (avr; Estrada 2012); (31) Cayo Romano, Camagüey Province (Estrada 2012); (32) Cayo Guajaba, Camagüey (Powell and Maxey 1990, Martínez et al. 2008, Estrada 2012); (33) Chambas, Ciego de Ávila (Rodríguez Schettino et al. 2013); (34) Ceballos, Ciego de Ávila (avr); (35) Camagüey City (avr); (36) 6.4 mi NE of Camagüey (Kluge 1969); (37) Jobabo, Las Tunas (avr); (38) Holguín City (avr); (39) Gibara, Holguín Province (avr); (40) Manzanillo, Granma Province; (41) Niquero, Cabo Cruz, Granma (avr); (42) Marea del Portillo, Granma Province (avr); (43) Santo Domingo, Bartolomé Masó, Granma (avr); (44) La Mensura, Holguín (Rodríguez Schettino et al. 2013); (45) Pico Cristal, Holguín (Idem.); (46) Santiago de Cuba City (avr; Alayo 1951, Kluge 1969, Weiss and Hedges 2007); (47) Siboney, Santiago de Cuba (avr); (48) Playa Juraguá, Santiago de Cuba Province (avr); (49) Hatibonico, Caimanera, Guantánamo Province (avr); (50) U.S. Naval Base at Guantánamo Province (Kluge 1969, Powell et al. 2011); (51) Guantánamo City [avr for *H. mabouia*; Schwartz and Henderson 1991 (*H. mabouia* and *H. turcicus*)]; (52) La Asunción, Maisí, Guantánamo (Weiss and Hedges 2007); (53) Baracoa, Guantánamo (avr; Kluge 1969); (54) La Fe, Isla de la Juventud (avr).

sequence, populations of introduced Yellow-headed Geckos (*Gonatodes albogularis fuscus*) have declined extraordinarily during the time in which populations of *H. mabouia* have increased in the city of Havana. Individuals of *H. mabouia* frequently are seen in the *Ficus* trees along many avenues in Havana where *G. albogularis* was abundant in the 1990s. In localities like La Sierra (Santa Cruz del Norte municipality, Mayabeque Province; see Fig. 3), where *H. angulatus* is the only known species, *G. albogularis* remains very common. Krysko and Daniels (2005) also mentioned a decline of Yellow-headed Geckos in Florida, coincidentally where *H. mabouia* also has established rapidly growing populations. Either attributing or ruling out the increased number and sizes of *H. mabouia* populations as a cause for the decline of *G. albogularis* in some localities in Cuba is premature, but the impact of introduced *Hemidactylus* on other species around the world, both native (i.e., Cole et al. 2005, Hoskin 2011) or previously introduced, has been documented. Some native

Cuban geckos (e.g., *Sphaerodactylus elegans*, *S. argus*, and *S. torrei*) often are associated with buildings and might be negatively affected by the increased presence of larger introduced geckos in the genus *Hemidactylus*. Some effort should be made in the future to monitor the population dynamics of introduced geckos in Cuba and to evaluate their impact on those native species that also are associated with humans. Especially with the rapid development of new tourism facilities in Cuba, special efforts must be made to monitor imported wood and other building materials since they are common vectors of invasive fauna.

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