



Competitive Interference between an Endemic Cuban Green Anole (*Anolis porcatus*) and Invasive Tropical House Geckos (*Hemidactylus mabouia*)

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Competition between species can occur where an introduced species occupies the same microhabitat, operates along the same temporal niche and utilizes the same resource(s) as resident species (Pianka 1973). Competition for food, refugia, perches, and resources can also change the behavioral or spatial ecology of natives and this has led to the widest array of impacts (e.g., Echternacht 1999; Suzuki and Nagoshi 1999; D'Amore et al. 2009b; Cole and Harris 2011; Kraus 2015).

In the classical definition of interference competition, interacting species incur only costs but no benefits. For instance, each consumer species suffers a reduction in individual growth rates because acts of interference divert time and

energy from resource exploitation; in addition, interference can increase the risk of injury or death by predation (Case and Gilpin 1974; Schoener 1983; Vance 1984).

The rate at which non-native reptiles are being introduced around the world has increased in recent times (e.g., Kraus 2009). The resultant competition can affect native species, and evidence of such instances must be studied and understood (Case and Bolger 1991; Rodda and Fritts 1992; Losos et al. 1993; Case et al. 1992, 1994; Petren and Case 1998; Losos and Spiller 1999; Brown et al. 2002; Cole et al. 2005; Dufour et al. 2018). However, the paucity of evidence for competition as a causal or contributing mechanism for extinction could be because interactions between invasive and



Fig. 1. (A) Initial position of two Tropical House Geckos (*Hemidactylus mabouia* = *Hm*) on a wall (left arrow) and a fence post (right arrow). (B) Initial position of *Hm* on a fence post. (C) A Cuban Green Anole (*Anolis porcatus* = *Ap*) approaches *Hm*. (D) *Ap* displays to *Hm*.



Fig. 2. (A) The Cuban Green Anole (*Anolis porcatius* = *Ap*) continues the display and approaches the Tropical House Gecko (*Hemidactylus mabouia* = *Hm*). (B) *Ap* jumps to the wall close to *Hm* and they circle one another. (C and D) *Ap* and *Hm* continue circling.

native competitors can occur without obvious direct negative effects, rendering long-term deleterious effects difficult to measure (Crawley 1986; Petren and Case 1996).

Factors proposed to explain why animals do or do not defend territories range from predation risk (Stamps 1977, 1983; Myers 1980) to energetic economics (Davies and Houston 1984). The energetics of competition and the cost of display behavior to avoid or reject a possible competitor are other unknown mechanisms. Brown (1964) first clearly formulated an economic cost-benefit approach indicating that animals living under energetic constraints should defend territories when the benefit (exclusive food use) exceeds the cost

(defense and risks) and the resulting net benefit exceeds that of non-territorial behavior.

Anoles display a variety of competitive behaviors that include dewlap extension and retraction combined with head and other body movements in various species-specific patterns; although used as predator deterrents, such behaviors also serve to facilitate intraspecific communication during mating and when maintaining territories (Jenssen 1977; Leal and Rodriguez-Robles 1997; Nicholson et al 2007).

The Cuban Green Anole (*Anolis porcatius*) is endemic, abundant, and widely distributed across the Cuban Archipelago where it is frequently associated closely with

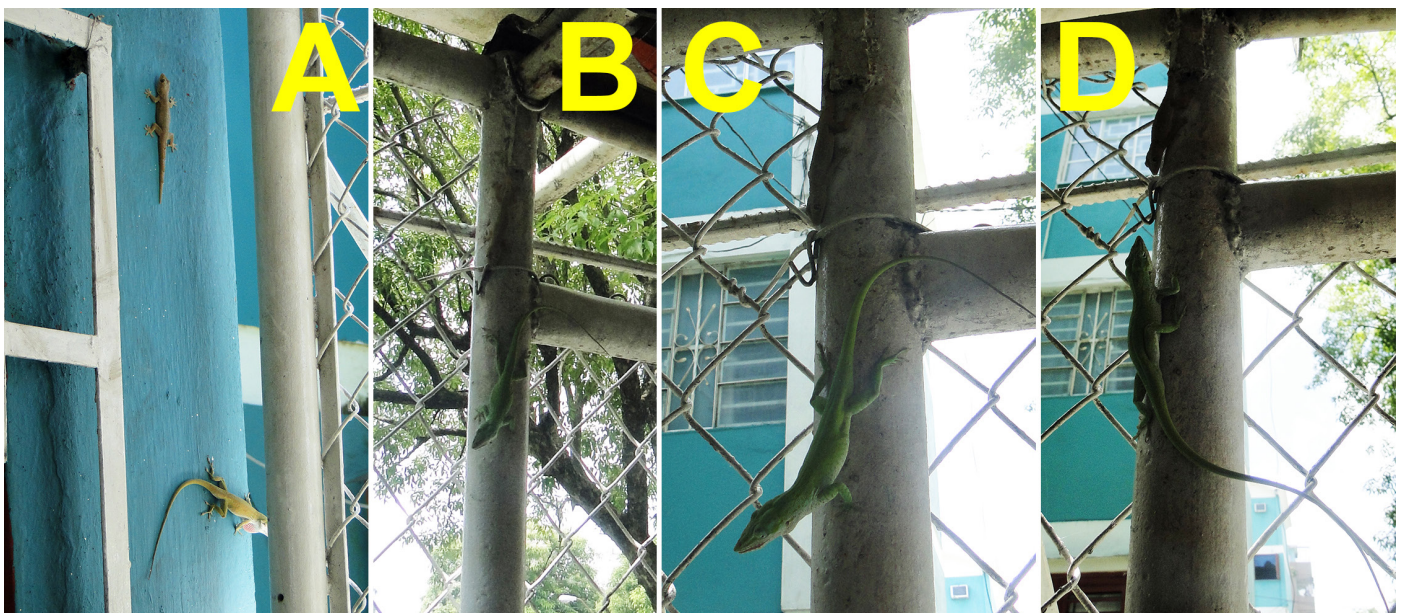


Fig. 3. (A) The Tropical House Gecko (*Hemidactylus mabouia* = *Hm*) moves up and the Cuban Green Anole (*Anolis porcatius* = *Ap*) moves down before jumping back onto the fence. (B) *Ap* confronts the other *Hm* on the fence. (C) *Ap* displays in close proximity to *Hm*. (D) *Ap* turns face-to-face with *Hm*.



Fig. 4. (A) The Tropical House Gecko (*Hemidactylus mabouia* = *Hm*) assumes an aggressive posture. (B) *Hm* maintains the aggressive posture in close proximity to the Cuban Green Anole (*Anolis porcatatus* = *Ap*). (C) *Ap* retreats.

humans (e.g., Schwartz and Henderson 1991; Henderson and Powell 2009; Rodríguez-Schettino et al. 2013). The Tropical House Gecko (*Hemidactylus mabouia*), often called a “Woodslave” on English-speaking West Indian islands, was likely introduced to the region in concert with the slave trade during colonial times. It is now ubiquitous in Cuba, most frequently functioning as a human commensal (Borrito-Páez et al. 2013). Although largely nocturnal (e.g., Henderson and Powell 2009), individuals are sometimes active by day. Although the Woodslave has a long history in the Antilles, very little information documents competitive interactions and potential effects on native species.

During the morning of 7 April 2018, in Vibora Town, Ciudad Habana, we observed two *Hemidactylus mabouia* that were diurnally active in a residential yard. Geckos are relatively abundant in the apartments of the building (surveys having documented 2–3 individuals/apartment). One gecko was on the facade of the ground floor of the building and the other was about a meter away on one of the metal posts of a chain-link fence (Figs. 1A–B). Both were separated at a height of about 2 m. By day, the fence usually is occupied by *Anolis porcatatus*. When a resident anole noted the presence of the gecko on the wall at about 0930 h, it moved to confront it (Figs. 1C–2A), displaying from a fence post (Fig. 1D) and the wall (Fig. 3A). Shortly thereafter, the anole jumped to the wall near to the gecko and approached it very closely. The two lizards circled one another for a few minutes (Figs. 2B–3A). When the anole moved higher on the wall, the gecko move to an adjacent wall and hid in a crack. The anole then jumped onto the fence and remained motionless until, at about 1120 h and an ambient temperature of 32 °C, it noticed the other gecko and moved to confront it. The gecko responded to the anole that approached while displaying (Figs. 3B–D) by assuming a defensive position (Figs. 4A–B) that was maintained until the anole moved away (Fig. 4C). Both lizards remained separated until about 1200 h when the second gecko disappeared without us having observed it.

The entire sequence clearly demonstrates an example of competitive interference. For more than 2 h, the anole confronted and attempted to expel the house geckos from its territory. The movements, confrontations, and displays certainly came at a high energetic cost.

Few published references have documented interactions between introduced House Geckos and native species in Cuba and throughout the Caribbean. Not all were at the expense of the native species. For example, Powell and Henderson (1992) described Anguilla Bank Tree Anoles (*Anolis gingivinus*) displacing Tropical House Geckos (*H. mabouia*) at artificial night lights on St. Maarten and Owen and Perry (2005) described a Tropical House Gecko (*H. mabouia*) being eaten by a Puerto Rican Crested Anole (*A. cristatellus*) in the British Virgin Islands. Others, like the event illustrated in Fig. 1, came at a cost to the native species. Powell (2003) noted that introduced Common House Geckos (*H. frenatus*) appeared to be displacing native Honduran Leaf-toed Geckos (*Phyllodactylus palmeus*) on Utila in the Honduran Bay Islands. R. Montes Espín (pers. comm.) reported predation on an anole by a Tropical House Gecko (*H. mabouia*) in Cuba. In addition, we observed an interaction similar to that described herein between a Cuban Blue Anole (*A. allisoni*) and a Tropical House Gecko (*H. mabouia*) in Corralillo, in central Cuba, also during the day and with displays and territorial defense by both species — but of such short duration that we were unable to document the event with photographs. However, these few reports speak to the possibility that interactions between *Hemidactylus* geckos and native species could be more common than has been recorded, especially when both parties are functioning as human commensals.

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