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Confirmation of the presence of the sphaerodactylid lizard *Gonatodes vittatus* in Guyana, and an indication of a reproductively active population in Georgetown

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Introduced species can have potentially uncontrollable negative effects on ecological integrity and biodiversity (Lowe et al. 2000). They can disrupt locally established equilibria in a variety of ways, including competition, predation, and hybridisation (Mooney et al. 2001). The human-mediated introduction of species (e.g., by transport, see Kraus 2009) often has powerful, usually unintended consequences, and is considered a major cause of biodiversity loss (e.g., Sala et al. 2000, Olden et al. 2004, Clavero & García-Berthou 2005). Reliable data on the distribution and abundance of non-indigenous species are essential for an accurate assessment of their potential environmental impact.

The streaked clawed day gecko, *Gonatodes vittatus* (Lichtenstein, 1856) (Sphaerodactylidae), was originally described from the central Venezuelan coast (La Guaira, Puerto Cabello, and Caracas; Lichtenstein 1856). In addition to coastal Venezuelan localities (Rivas et al. 2012), the species is known from northern Colombia, several Caribbean offshore islands along the Venezuelan coast, Trinidad, and Tobago (Murphy 1997, Gorzula & Señaris 1999, Ugueto & Rivas 2010, Rivas et al. 2012) (Fig. 1). Identifying the exact native range of the species is difficult because part of its present distribution has probably resulted from introductions (as suggested by Murphy [1997] for Tobago). One introduced population in the Venezuelan interior (Bolívar state) apparently has been extirpated (Gorzula & Señaris 1999). The species appears to have been introduced into French Guiana, but even though no voucher specimen has as yet been mentioned, a photograph has been published (Anonymous 2010).

Cole et al. (2013) recently reported *Gonatodes vittatus* from Guyana, northern South America, on the basis of six museum specimens from two localities: Georgetown (capital city), and Rockstone Landing along the Essequibo river. Although not mentioned by Cole et al. (2013), these specimens apparently were collected more than 70 years ago, during the Terry-Holden British Guiana Expedition of 1937–1938 (as stated in the catalogue of the University of Michigan, Museum of Zoology, and confirmed by D. Dickey and D. Frost from the American Museum of Natural History [pers. comm.]). Cole et al. (2013) hypothesised a human-mediated introduction. No additional specimen has since been recorded from Guyana, and Cole et al. (2013) emphasized that the continued presence of the species needs confirmation.

We hereby document the rediscovery of *Gonatodes vittatus* in Guyana based on specimens collected in the urban area of Georgetown, the coastal capital city. Observations of an adult male and a juvenile (Fig. 2) suggest a reproductively active population. The apparent rarity of the species in Guyana and its localised geographic distribution support the hypothesis of introduction by human-mediated transport.

Gonatodes vittatus is a small (snout–vent length [SVL] ca. 35 mm) diurnal lizard that primarily inhabits beaches, thorn scrubland, forest edges, and deciduous, semi-deciduous, and premontane evergreen forests below 500 m a.s.l., as well as human habitations (Murphy 1997, Ugueto & Rivas 2010). These lizards are sit-and-wait predators that feed primarily on insects, including mosquitoes, their larvae, and eggs, mostly depending on visual cues for prey detection (Persaud et al. 2003, Ugueto & Rivas 2010).

In their native habitat, they tend to prefer rough vertical surfaces with cracks or crevices, such as small tree trunks (Demeter & Marcellini 1981). In urban areas, *G. vittatus* can occur on stonewalls, buildings, fences, and trash piles (Ugueto & Rivas 2010). The species is territorial, with males engaging in display behaviour and chasing away intruding males and females doing the same to unfamiliar females (Stamps 1969, Ugueto & Rivas 2010).

Our specimens, an adult male and a juvenile, were collected on the front porch of a predominantly wooden house in Georgetown, Guyana (06°48'38" N, 58°08'57" W, 25 m a.s.l.) in the afternoon hours of 25 November 2012. Both specimens will be deposited in the herpetological collections of the Royal Belgian Institute of Natural Sciences (export permits pending). The adult male (IRSNB 18303, 31.0 mm SVL) was moving about on a woven clothes basket in the corner of the porch, and the juvenile (IRSNB 18304, 16.8 mm SVL) was found soon after in the same spot.

Species identification is not in doubt and conforms to descriptions and photographs available in the literature (e.g., Murphy 1997, Ugueto & Rivas 2010). The male has a conspicuous white vertebral stripe bordered with slightly narrower black stripes, tapering posteriorly. These extend from the snout to the base of the tail, which is missing. Head and dorsum are yellowish orange. Flanks are bluish grey, limbs pinkish grey (Fig. 2). The juvenile is brown with pale and dark round spots, and has a conspicuous white antehumeral stripe (Fig. 2).

The impact of *Gonatodes vittatus* on Guyana's biodiversity is unknown. At present, the species appears to occur only in human-disturbed areas. In Georgetown, the species was found syntopically with *Hemidactylus mabouia* (Gekkonidae, another non-indigenous species, see below). Although *H. mabouia* is nocturnal, competition between the two species has been reported from parts of the native range of *G. vittatus*. On Isla Margarita (Venezuela), for instance, *G. vittatus* is reported as declining, probably due to the increase in the numbers of introduced *H. mabouia*, which is now the dominant gecko species in most human habitations in the area (Ugueto & Rivas 2010). Rivas et al. (2005) reported a similar decline in Caracas, mainland Venezuela, and hypothesised competition with, or even predation by, *H. mabouia*. The presence of *H. mabouia* could therefore be a limiting factor to the expansion of *Gonatodes vittatus*, which otherwise could be a successful invader in the urban area of Georgetown because its ecological niche is essentially unoccupied. Interestingly, a third non-indigenous species, the frog *Eleutherodactylus johnstonei* (Eleutherodactylidae), was observed in the garden of the same house where we observed *G. vittatus* and *H. mabouia*. The herpetofauna at this urban site is thus largely non-native.

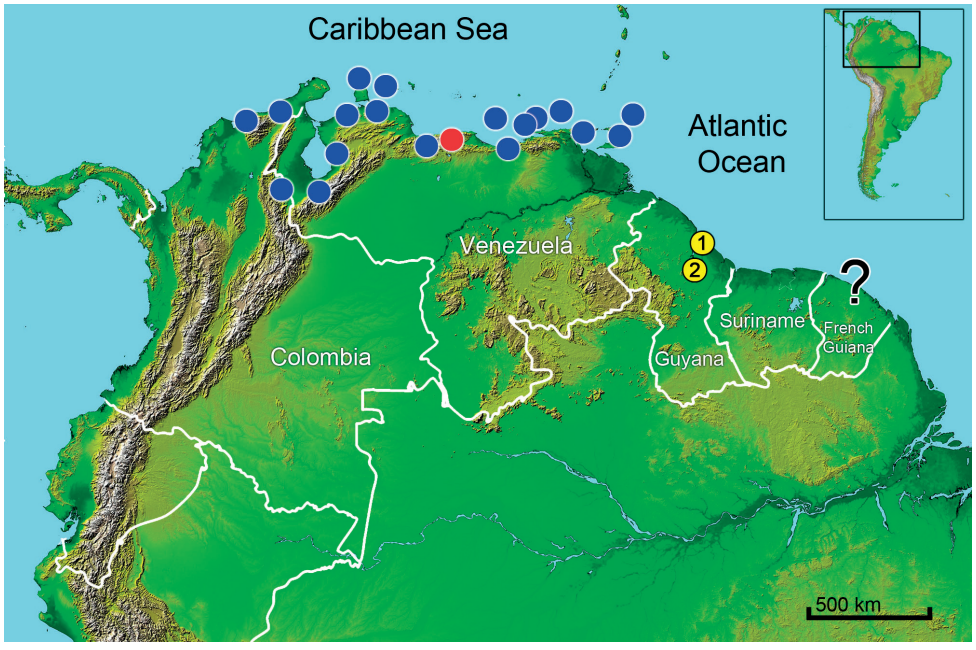

Figure 1. Map of the known geographical distribution of *Gonatodes vittatus*. Dots represent major collecting localities. The red dot represents the type locality (La Guaira, Vargas state, Venezuela). Yellow dots represent the distribution in Guyana: (1) Georgetown; (2) Rockstone Landing. The question mark refers to a putative record from French Guiana. Specimen localities were obtained from the literature (Murphy 1997, Anonymous 2010, Ugueto & Rivas 2010) and from the Global Biodiversity Information Facility (GBIF, http://www.gbif.org/).

To date, four additional non-indigenous reptilian species (one turtle, three lizards) have been reported from Guyana:

Trachemys scripta (Emydidae). Native to the eastern and central United States of America, the species has been reported from Guyana by Lever (2006). *Trachemys scripta* was not reported from Guyana by Cole et al. (2013), and no voucher specimen seems to have been collected. The presence and exact distribution of this species in Guyana needs confirmation.

Basiliscus basiliscus (Corytophanidae). Native to the Pacific lowland forests of Central America and northwestern South America, *B. basiliscus* was reported from Guyana by Ávila-Pires (2005). The continued presence of a reproductively stable population needs to be confirmed (Ávila-Pires 2005, Cole et al. 2013) since no recent voucher specimen is available.

Anolis aeneus (Dactyloidae). Native to the Lesser Antilles, this species was reported from Guyana by Underwood (1964), and its presence confirmed by Cole et al.

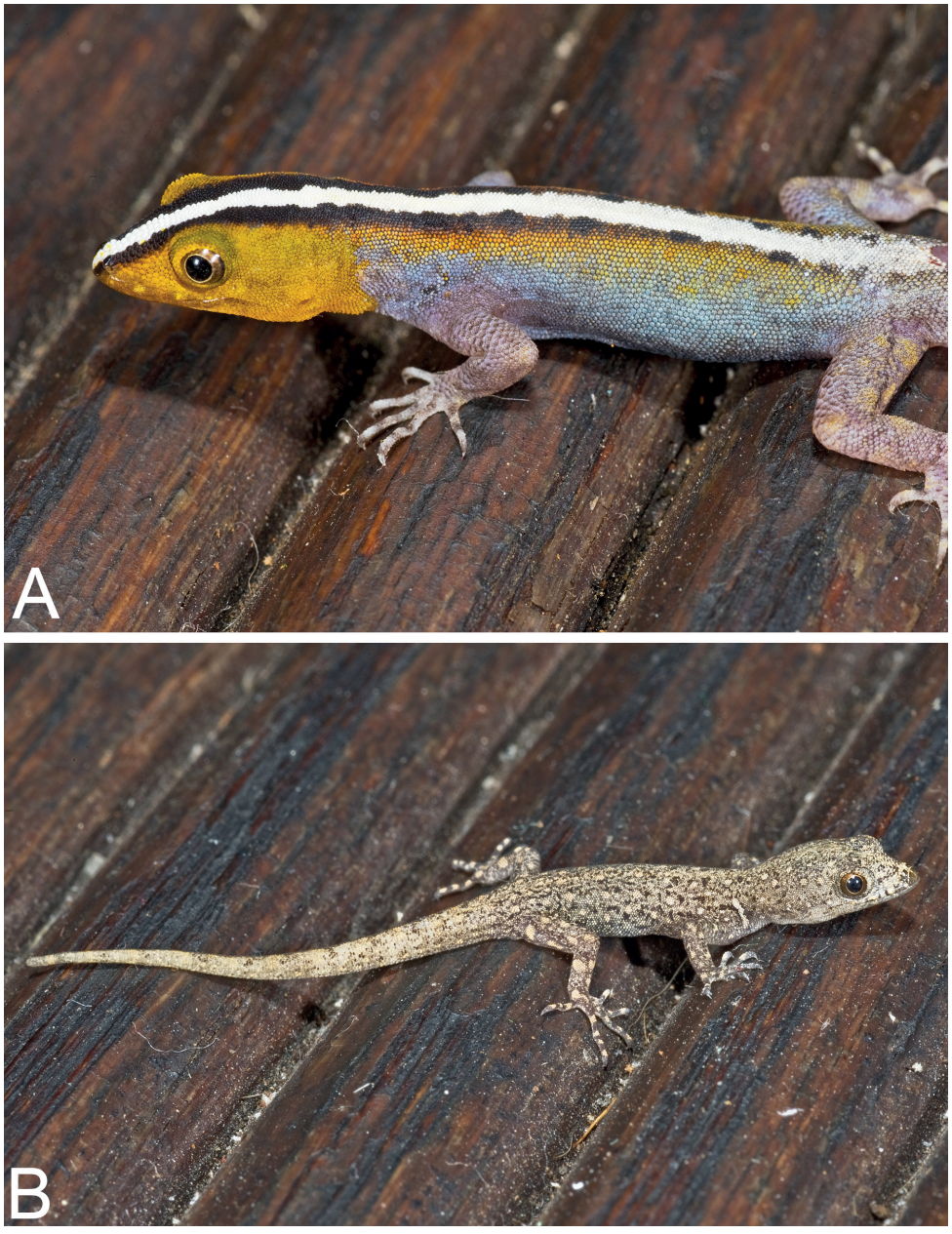

Figure 2. *Gonatodes vittatus* from Georgetown, Guyana. (A) Adult male (IRSNB 18303, 31.0 mm SVL). (B) Juvenile (IRSNB 18304, 16.8 mm SVL). Photographs by P. J. R. Kok.

(2013) on the basis of numerous voucher specimens. We observed a few individuals in the gardens of the Georgetown Zoo at the end of November 2012. Cole et al. (2013) suggested that "the taxonomic status of *Anolis aeneus* versus *Anolis extremus* needs further investigation, both in areas where they occur in the West Indies and where they have been introduced on islands and the mainland of South America".

Hemidactylus mabouia (Gekkonidae). Native to sub-Saharan Africa, *H. mabouia* was reported from Guyana by Kluge (1969). The presence of the species in Guyana has been formally confirmed by several authors (e.g., Ávila-Pires 2005, Cole et al. 2013) on the basis of numerous voucher specimens. We observed the species in Georgetown.

Herpetofaunal endemism in Guyana is estimated at 15% (Cole et al. 2013), highlighting the importance of monitoring introduced non-indigenous amphibians and reptiles in the country. However, the long-undocumented presence of *Gonatodes vittatus* in Guyana suggests a lack of such efforts.

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