The establishment of *Anolis wattsi* as a naturalized exotic lizard in Trinidad

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**Abstract.** Trinidad has a single native *Anolis* species (*A. chrysolepis*) and several introduced exotics (*A. aeneus, A. extremus, A. trinitatis, and A. wattsi*). *Anolis wattsi* is the latest introduction, being first observed in the Waterloo area in 1992. This paper describes the distribution of this species in 2000 and 2004, by which time it had become established as a naturalized exotic lizard in western Trinidad. The species was verified as *A. wattsi* in the strict sense (formerly *A. wattsi wattsi*), differentiated from sibling species (other former subspecies of *A. wattsi*). *A. wattsi* is currently distributed in five discontinuous urban localities within an area of about 15 × 5 km, which suggests jump dispersal across unsuitable habitat (sugar cane fields). The rate of spread was about 100 m yr⁻¹ within urban areas, and >1 km yr⁻¹ for jump dispersal. *A. wattsi* occurred in the same habitat as the larger *A. aeneus* in gardens, parks and vacant lots. The two species differed significantly in perch height (but not in perch diameter) and substrate use. *A. wattsi* used lower perches, and replaced *aeneus* along the series trees (94% *aeneus*), posts and bushes, walls and fences, and ground (87% *wattsi*). Perch height of *A. aeneus* did not differ between locations with and without *A. wattsi*, and there was no correlation between numbers of the two species among sites. Possible interactions among introduced and native *Anolis* species on Trinidad are discussed.

**Key words:** *Anolis aeneus; Anolis wattsi*; Caribbean; competition; exotic; invasive; naturalized; perch height; Trinidad; West Indies.

**Introduction**

There has been a long history of naturalization (establishment of successful populations of an introduced species) of *Anolis* lizards, both between Caribbean islands and in the southern USA (Losos et al., 1993; Campbell, 2003; Lever, 2003). Introduced species in general present problems for native faunas and floras through competition, predation, herbivory and disease (McKinney and Lockwood, 1999; Mack et al., 2000); they are also of basic ecological interest as a model of natural colonization (e.g. Williams, 1969). Small islands with native *Anolis* lizards have either
a single small to medium sized species, or one small and one large species (Roughgarden, 1995). Introductions of Anolis fail where there is already an ecologically similar species (Losos et al., 1993), and most successful introductions to islands have been of large species (Roughgarden, 1995). Introduced Anolis on Trinidad are of interest as there are several naturalized species, all of which are small.

Murphy (1997) lists four species of Anolis in Trinidad; A. (Norops) chrysolepis planiceps (Troschel), A. aeneus (Gray), A. trinitatis (Reinhardt and Lutken), and A. extremus Garman. Only A. chrysolepis is native to Trinidad, and is widespread in forests, into which the introduced species have not spread. A. aeneus is currently the most abundant anole in suburban gardens. This species is native to Grenada, where it occupies sites over a wide range of land use and disturbance, together with the large A. richardii (Germano et al., 2003). Published accounts of A. aeneus in Trinidad date back to 1900 (Murphy, 1997). A. trinitatis is native to St Vincent (where it occurs with the large A. griseus) and is also a long-standing naturalized species in Trinidad. A. extremus (a medium-sized species from Barbados) was released in small numbers on Huevos Island just off N.W. Trinidad (Boos, 1967, 1977) and specimens were also collected in Port of Spain in 1982 (Murphy, 1997). This appears to have been an unsuccessful colonist in Trinidad, although it is naturalized in St Lucia (Gorman, 1976). A. chrysolepis is the most terrestrial of the four species as it forages on the ground (Boos and Urich, 1986), the others being largely trunk-dwellers.

Anolis wattsi was discovered in Trinidad in November 1992 by G. White, in the grounds of the Caroni Research Station (Boos, 1996). This is an agricultural research station at Waterloo in west central Trinidad run by Caroni (1975) Limited. (1975 refers to the date the sugar company was purchased by the state — the research station itself was formed in 1959 as the Central Agricultural Research Station.) The lizards were particularly abundant within a patch of pineapple, including the cultivar “Black Antigua”. It was therefore suspected that planting material brought from Antigua was the source of the population. A. wattsi Boulenger is native to Antigua (Boulenger, 1894), where it occurs with the large A. leachii, and neighbouring islands (Schwartz and Henderson, 1991). Four subspecies have previously been recognised; wattsi on Antigua (and introduced to St Lucia), pogus on St Maarten, schwartzi on St Kitts, Nevis and St Eustatius, and forresti on Barbuda (Lazell, 1972; Schwartz and Henderson, 1991; Uetz, 1999). Recent taxonomic opinion is that at least pogus and schwartzi should be elevated to full species (Powell and Henderson, 2001; Schneider et al., 2001). We therefore use A. wattsi in the strict sense, as equivalent to A. wattsi wattsi, but include discussion of ecological studies on the other former subspecies in view of their similarity (Malhotra and Thorpe, 1999).

No surveys were performed to determine the range of the population upon its discovery in 1992, although it was believed to have been restricted to the grounds of the research station; no specimens were observed in the adjacent housing compound. The present study was performed in July 2000 and April-August 2004 to verify the identity of the species (in the strict sense, differentiating this from other