Catalogue of American Amphibians and Reptiles.

Russell, A.P. and A.M. Bauer. 1991. *Anolis grahami.*

Anolis grahami Gray

Anolis punctatus Gray, 1840:113 (*not* of Daudin, 1802). Type-locality unknown, restricted to Jamaica by O'Shaughnessy (1875). Syntypes, British Museum (Natural History) (BMNH) 1946.8.5.49, 1946.8.5.55, 1946.8.28.89-91 (formerly BMNH XXII.47a-e), collector and date of collection unknown (not examined by authors). See Nomenclatural History.

Anolius punctatus: Gray, 1845:203.

Anolius Grahami: Gray, 1845:274.

Anolis iodurus Gosse, 1850:344. Type-locality, "Jamaica", restricted to Bluefields, Westmoreland, Jamaica by Underwood and Williams (1959). Syntypes, British Museum (Natural History) (BMNH) 1946.8.5.51-2, 1946.8.5.88-9 (formerly BMNH 47.12.27.42, 47.12.27.44-7), collector and date of collection unknown (not examined by authors). See Nomenclatural History.

Anolis punctatissimus Hallowell, 1856 (1857):225 (part). Type-locality, "Jamaica". Syntypes, Academy of Natural Sciences of Philadelphia (ANSP) 7897-9, collected by Dr. Betton, date of collection unknown (examined by authors).

Anolis heterolepis Hallowell, 1856 (1857):230. Type-locality, "Cuba, Cien Fuegos". Holotype, Academy of Natural Sciences of Philadelphia (ANSP) 7915, collected by Capt. Baker, date of collection unknown (examined by authors).

Anolis Grahami: Cope, 1869 (1871):164. First use of combination.

Anolis grahamii: Cope, 1894 (1895):438.

Anolis grahami grahami: Barbour, 1937:131.

Anolis principalis: McCallan, 1948:23 (part).

Norops grahami: Schwartz and Henderson, 1988:154.

• **Content.** Two subspecies, *grahami* and *aquarum*, are currently recognized.

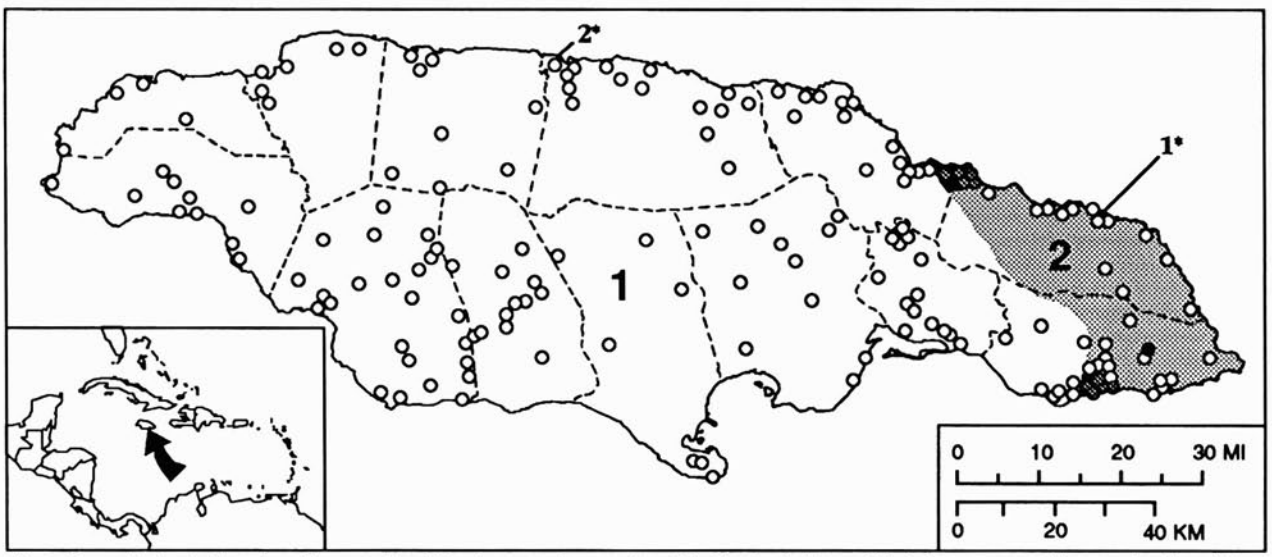
• **Definition.** *Anolis grahami* is a medium-sized anole, males attaining a maximum SVL of 75 mm and females a maximum SVL of 55 mm (Rand, 1967b). Tail length in both sexes is approximately twice the SVL. The dorsal scales are granular and feebly if at all keeled. Two or more middorsal scale rows are enlarged. An erectile nuchal and dorsal fold are present. The ventrals are larger than the dorsals, and are imbricate. The general dorsal body color is green (with or without mottling or speckling), with the pigmentation of the head, rump, and limbs subspecifically variable. Pronounced color change is typical of this species. The dewlap of males is yellow to orange, with the margin of the same or a lighter color. The dewlap is rudimentary in females.

Figure. Male *Anolis grahami grahami* from Marlborough airstrip, Mandeville, Jamaica. Photograph by Anthony P. Russell.

• **Descriptions.** Type descriptions of *A. grahami grahami* are included in Gray (1840, 1845), Gosse (1850), and Hallowell (1856 [1857]). Grant (1940) and Schwartz and Henderson (1991) provided additional detailed descriptions; Underwood and Williams (1959) the type description of *A. grahami aquarum.*

• **Illustrations.** Color illustrations of the head and forebody of both subspecies are included in Schwartz and Henderson (1985). Underwood and Williams (1959) gave diagnostic line drawings and photographs of the two subspecies, including a dorsal view of the head of the holotype of *aquarum.* Jenssen (1977) provided line drawings of the foot and of the head with the dewlap extended. A drawing of an adult male eating a caterpillar is given by Curio (1970). Frontal section diagrams through the central and temporal foveae are included in Fite and Lister (1981). Milton and Jenssen (1979) provided figures of histological preparations of the larynx. Blake (1986) illustrated the karyotype (2n = 30-37).

• **Distribution.** *Anolis grahami* is endemic to and occurs throughout Jamaica, from sea level to 1300 meters. It is essentially arboreal but may also be encountered on the ground and on rock surfaces. It occupies essentially mesic habitats and may be locally abundant. *A. grahami grahami* occurs throughout western and central Jamaica as far east as Port Maria in the north and the Morant



Map. Open circles indicate locality records within the natural range (see Distribution). The solid circle represents the type-locality of *A. g. aquarum*; the type-locality of *A. grahami grahami* is unknown. Shaded circles are in areas in which both subspecies and intergrades have been found. The symbols 1* and 2* indicate sites at which *A. g. aquarum* and *A. g. grahami*, respectively, have been found in the range of the other subspecies.

River mouth in the south. It occurs on Cabarita Island off the coast of St. Mary's Parish (Crombie et al., 1983), and is widespread on Bermuda (Wingate, 1965) where it has been introduced (Harris, 1905; Dunn and Conant, 1937). *A. grahami aquarum* occurs in easternmost Jamaica in Portland and St. Thomas parishes. Intergrades between the two subspecies occur from Windsor Castle to Buff Bay, Portland Parish. No intergradation occurs along the south coast where *aquarum* and *grahami* are found on the east and west banks of the Morant River, respectively (although an occasional individual of each subspecies may be rafted to the opposite bank [Underwood and Williams, 1959]). Single isolated specimens of *A. g. grahami* and *A. g. aquarum* are known from Port Antonio, Portland Parish, and the vicinity of Discovery Bay, St. Ann's Parish, respectively.

• **Fossil Record.** None.

• **Pertinent Literature.** Underwood and Williams (1959) provided the most comprehensive systematic treatment. Grant (1940) summarized useful biological information, although his taxonomy is now outdated. Williams (1969) considered the relationships of *A. grahami* and other Caribbean anoles. Hedges and Burnell (1990) analyzed phylogeny on the basis of electrophoresis and interpreted biogeography. Gorman et al. (1971) discussed aspects of biochemical systematics. Hybridization of *A. grahami* with *A. lineatopus neckeri* was documented by Jenssen (1977). Immunology was discussed by Shochat and Dessauer (1981), and karyology by Gorman (1965, 1973) and Blake (1983, 1986). Aspects of the ecology of *A. grahami* were outlined by Rand (1967a), Schoener (1970, 1975), Schoener and Schoener (1971), Williams (1972, 1983), Lister (1976a, b) and Williams and Rand (1977). Hertz (1983) characterized the animal as a successful invader and Taylor and Gorman (1975) and Chakravarti (1977) examined genetic aspects of the introduced population in Bermuda. Simmonds (1958) provided information on diet and Curio (1970) discussed the predation strategy of *A. grahami*. McFarlane and Garrett (1989) reported predation by owls. Haefner (1988) analyzed the assembly rules of Jamaican anole communities, including data pertinent to *A. grahami*. Losos (1990a, b) studied the coevolution of ecological, morphological, and behavioral attributes of members of West Indian *Anolis* communities, including *A. grahami*. The behavior of this species was studied by Rand (1967a), Jenssen (1978, 1981) and Rothblum et al. (1979). Licht and Gorman (1970), Smith et al. (1972) and Andrews and Rand (1974) treated aspects of reproduction, and Schoener (1969) discussed sexual size dimorphism in this taxon. Lister and McMurtrie (1976) considered body dimensions and growth. Vocalization was considered by Milton (1977) and Milton and Jenssen (1979), and vision by Fite and Lister (1981). Parasite infections of *A. grahami* were investigated by Telford (1975), Bundy et al. (1987), and Lefcourt and Blaustein (1991). Russell (1988) included *A. grahami* in a comparative study of limb musculature in lizards.

• **Nomenclatural History.** The name *punctatus* was preoccupied (Daudin, 1802) and *Anolius Grahami* was provided by Gray (1845) in the additions and corrections addendum to his catalogue as a *nomen substitutum*. *Anolis grahami*, especially under the name *A. iodurus*, has been confused with *A. opalinus* (O'Shaughnessy, 1875; Boulenger, 1885; Barbour, 1910). The recognition of *Anolis iodurus* as a full species as late as 1937 (Dunn and Conant, 1937), and its subsequent subspecific recognition (see below) have added to the already complex history of this taxon. Some of the confusion may relate to the apparent inadvertant mixing of some of the *punctatus* and *iodurus* type specimens (Colin McCarthy in litt. 29.IX.1989 in summary of H. W. Parker's notes in the jars of the types), as first suggested by Grant (1940).

Although the type description of *Anolis punctatus* (Gray, 1840) provides no locality information, Gray (1845) subsequently identified three of his specimens (c, d, and e) as coming from Dr. Gardner's collection from "Brazils". The other two syntypes (a and b) were presented by Sir James MacGregor to the British Museum. On the basis of Parker's notes placed in the type bottles in 1938, these specimens probably correspond to the catalogue numbers as follows: BMNH 1946.8.5.49 (erroneously reported by subsequent authors as 1946.8.4.49) is Gray's "e", a juvenile. 1946.8.28.89-91 includes Gray's "c" and "d" and either "a" or "b". The remaining specimen, 1946.8.5.55, is the other MacGregor specimen. The actual provenance of these specimens still remains unclear due to the aforementioned mixing of specimens in the bottles. The source of the MacGregor specimens is unknown. The specimen bottle labelled 1946.8.28.89-91, containing Gardner's specimens "c" and "d", as well as either "a" or "b" originally had "Brazil" written on the label, but this was subsequently crossed out. O'Shaughnessy (1875) asserted that the specimens stated to be from Dr. Gardner's Brazilian collection were, in fact, obtained from a dealer named Gardiner, without any indication of locality. The bottle containing Gardner's other "a" or "b" specimen and labeled 1946.8.5.55 also contains Gosse's cotype of *Anolis iodurus* (47.12.27.47) and bears the locality data "Bluefields, Jamaica". This almost certainly applies only to the latter and thus the provenance of the *punctatus* specimens still remains in doubt, although O'Shaughnessy (1875) stated that "there can be no doubt that they came from Jamaica".

Grant (1940) separated *A. grahami grahami* from *A. grahami iodurus*. The latter was subsequently relegated to the synonymy of the former by Underwood and Williams (1959), who indicated that the types of these two putative taxa are mixed and, owing to a lack of differentiating characters, cannot be segregated.

• **Etymology.** We have been unable to determine for whom Gray (1845) named the species. Neither Bond (1957) nor Underwood and Williams (1959) state the reasons for the application of the subspecific name *aquarum*, but we assume that it refers to the distinctive coloring of the tail base, the latter being bluish-green (L., *aqua*, "water").

1. *Anolis grahami grahami* Gray

Anolis punctatus Gray, 1840:113. See species synonymy.
Anolius grahami: Gray, 1845:274. See species synonymy.
Anolis iodurus Gosse, 1850:344. See species synonymy.
Anolis grahami grahami Barbour, 1937:131 (part). First use of trinomial.
Anolis grahami iodurus Grant, 1940:86 (part).

• **Diagnosis.** *Anolis grahami grahami* may be differentiated from *A. g. aquarum* by a large interparietal scale separated from the supraorbital semicircles by three to five scales, subdigital lamellae 33-38 (mode 36), and smooth or weakly keeled ventral scales. The color of males is predominantly yellowish-green and the dewlap is deep orange with a yellow border. The head, hindlegs, and rump are bluish green and the tail base is purple to cinnamon. Maximum SVL of males is 75 mm (Rand, 1967b).

2. *Anolis grahami aquarum* Underwood and Williams

Anolis grahami grahami Barbour, 1937:131 (part).
Anolis grahami aquarum Bond, 1957:7. *Nomen nudum*.
Anolis grahami aquarum Underwood and Williams, 1959:28. Type-locality, "Botanical gardens, Bath, St.Thomas [Parish], (17°57'N 76°21W), [Jamaica]". Holotype, British Museum (Natural History) (BMNH) 1954.1.2.61, adult male, collected by G. Underwood, date of collection unknown (not seen by authors).

• **Diagnosis.** *Anolis grahami aquarum* may be differentiated from *A. g. grahami* by a smaller interparietal scale separated from the supraorbital semicircles by four to six scales, subdigital lamellae 32-41 (mode 40), and strongly keeled ventral scales. The color of males is predominantly bright emerald-green and the dewlap is yellow-orange without distinctive marginal coloration. The tail base is blue and the dewlap unicolored. Females have a light dorsal stripe, most evident on the lower back and sacrum. Maximum SVL of males of *A. g. aquarum* is 55 mm (Underwood and Williams, 1959). Certain characteristics of scalation may be used to assist in the differentiation of the subspecies (Underwood and Williams, 1959), but are not, in themselves, diagnostic.

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