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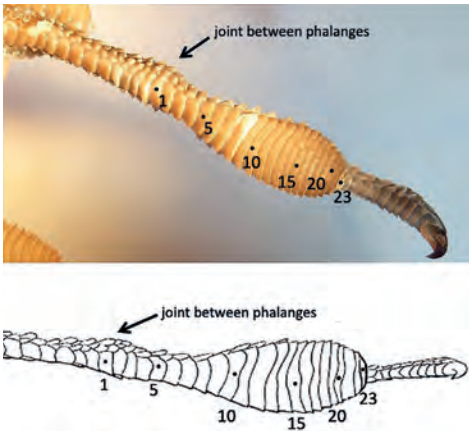


FIG. 3.10. Method for counting the number of toe lamellae in anoles.

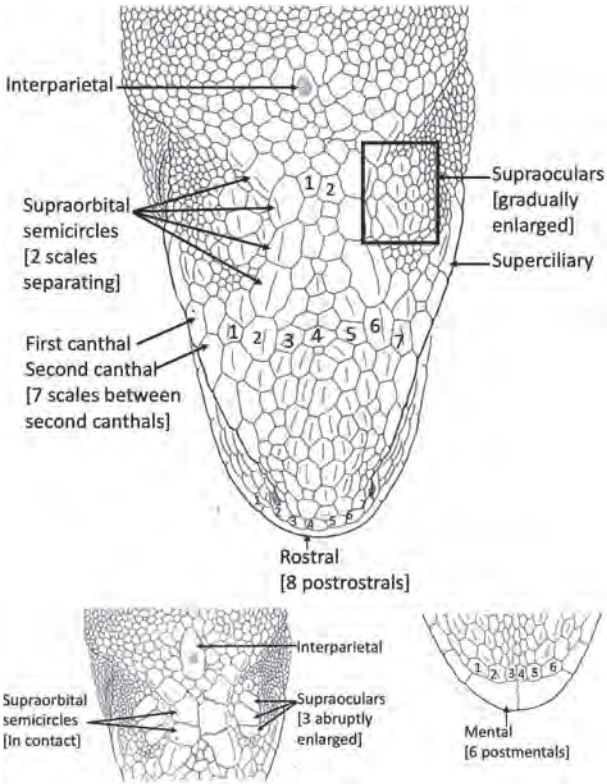


FIG. 3.11. Anole head scales and associated character states. Dorsal (top, lower left), ventral (lower right).

(fig. 3.10). This can be a difficult count, best done with a magnifying glass or from a photo, and some interobserver variation in number is to be expected.

Number of *scales across the snout at the second canthals* is a standard measure of the size of dorsal head scales (fig. 3.11). The canthals are elongate scales along the interface of the dorsal and lateral surfaces of the head anterior to the eye.

The *supraorbital semicircles* may be in contact or separated by one or more rows of scales. The supraorbital semicircles are large squarish scales that follow a medial arc around the smaller scales above the eye (fig. 3.11).

Rows of *subocular* and *supralabial* scales may be in contact or separated by one or two rows of scales (fig. 3.12). Suboculars are enlarged scales below the eye; supralabials are elongate scales along the upper edge of the mouth.

There is variation in the size of the tympanum, or external membrane of the ear, and of the *interparietal* scale among anoles. The interparietal is an enlarged scale on the posterior dorsal surface of the head, usually with a dark central spot (fig. 3.11). Comparison of tympanum size and interparietal size will distinguish some species.

The *supraocular* scales are dorsally placed scales above the eye. These usually include some enlarged scales and some smaller scales presenting in a continuous range. Extreme conditions of approximately equal-sized supraocular scales, or especially of including two to four abruptly and greatly enlarged scales, are telling for anole species identification (fig. 3.11).

The extent of the tip of the *anteriorly adpressed hindlimb* (i.e., the end of the longest toe's claw) is compared to landmarks on the head on live specimens as a crude means to assess relative limb length (fig. 3.13). This measure, traditionally important in mainland anole identification, invites

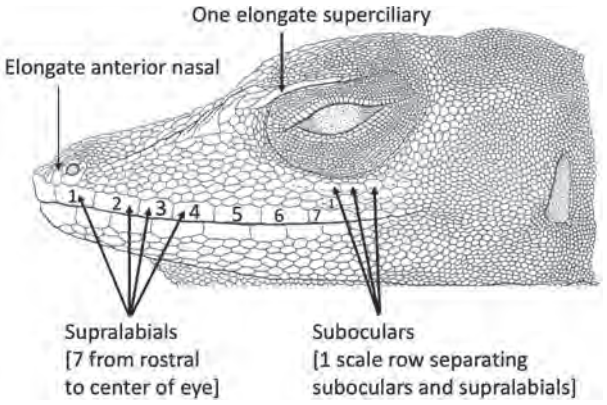


FIG. 3.12. Lateral head scales in an anole.

some subjectivity but remains useful for gross comparisons.

The overall dorsal *body color* of an anole is generally green, brown, or whitish. Many species are always some shade of brown. Those that are green may change between green and brown. Anoles also may vary in body pattern, which may be solid or composed of transverse bands, blotches, longitudinal stripes, or other adornments. The body plates show several anole color patterns.

The *dewlap color* pattern is the single best character for distinguishing anole species. In some species of mainland anole both males and females display large dewlaps, which may or may not be colored similarly between sexes. In others only the male has a dewlap (see "Variation within Species," below). Dewlap variation among species is shown in the dewlap plates.

Scores for the traits listed above are included for each species in the species accounts (chapter 4). Additional traits are used in the *AnoleKey* and variably in the species accounts. Among these potentially useful traits, a deep axillary pocket (aptly called "tubelike" by Köhler [2008] and "puncturelike" by Savage [2002]) is distinctive and seldom found in more than one species at a given locality. Eye color may be a helpful trait in a few cases, as blue eyes are uncommon in anoles (fig. 3.14). Some anole species possess a narrow toepad that does not appear distinct from the scales at the base of the claw (fig. 3.15).

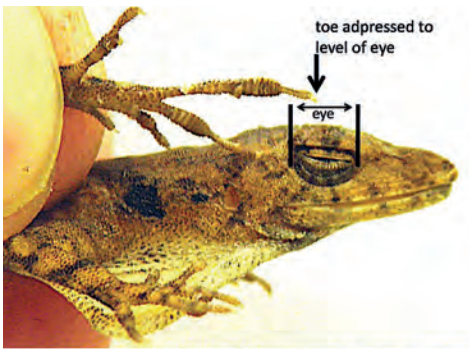


FIG. 3.13. Method for adpressing hindlimb and marking toe reach to assess anole hindlimb length.

FIG. 3.14. Most anoles have brown, copper, or red eyes as in *Anolis orcesi* (top; photo by Tom Kennedy), but some have blue eyes, as in *A. cristifer* (bottom).

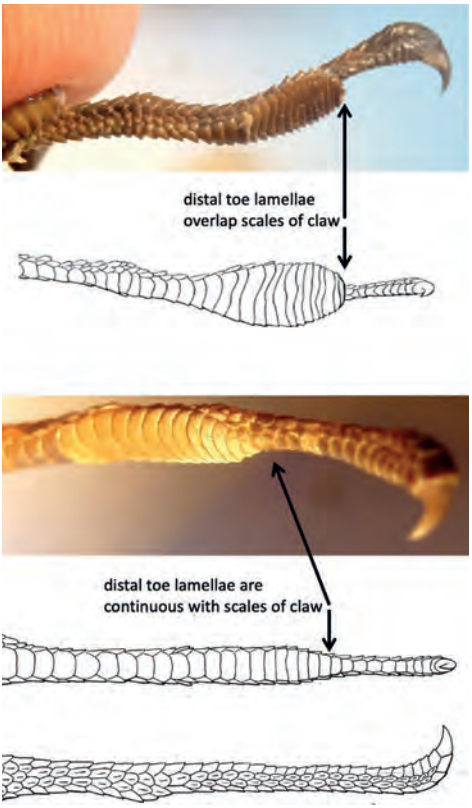


FIG. 3.15. Most anoles possess a distinct expanded toepad (top); some species display a narrow pad continuous with the terminal phalanx (bottom).

Structure of the scales in the nostril region varies in species-specific ways in anoles. Many species have an elongate teardrop-shaped scale reaching from the nostril to the rostral (called an "anterior nasal"), whereas others lack differentiated scales in the nasal region (fig. 3.12). Counts of scales in the loreal region (i.e., anterior to the eye), above the mouth ("supralabials"), at the dorsal edge of the orbit ("superciliaries") and posterior to and in contact with the mental ("postmentals") or rostral ("postrostrals") scales may be useful (figs. 3.11, 3.12). Most species display a single row of middorsal tail scales which may form a crest, but a double row is characteristic of a few species. Dewlap scalation may include rows of single or multiple scales according to species (compare among dewlap plates). Postcloacal scales are abruptly enlarged in males of some species, undifferentiated or variably enlarged in males of others, and always absent in females (fig. 3.3). Variation in relative tail, toe, head, and limb length will distinguish some groups of anole species.

— COMPUTER IDENTIFICATION KEY[11] —

The program *AnoleKey* (Poe, manuscript) operates on the Lucid platform (Lucidcentral.org 2014) to present a set of candidate anole species, given some set of entered character states for an unidentified individual. As data are entered, incompatible species are downgraded and matching species are presented. Species may be ranked according to their degree of matching or completely eliminated as candidates depending on the settings entered by the key user. During this process of species matching, as states are entered any species can be evaluated for its suitability according to the traits it possesses. That is, you can access what trait values caused a species to be eliminated or favored. Photo links offer the opportunity to view images of species and of traits. Ranges of trait values may be examined for any species, and differences between species may be listed in order to focus on decisive traits.

For example, suppose you are in Podocarpus National Park in Ecuador on the eastern slope of the Andes at 1600 meters and you find a large anole. You may enter information on approximate body size, approximate elevation, and location into the *AnoleKey* to see what candidate species are suggested. Limited and easily scored information such as this, coupled with a dewlap photo or data on some other key character, often is enough for a secure identification. In the above case, entering just location, elevation, and body size reduces the number of candidate species to two, *Anolis fitchi* and *A. podocarpus* (fig. 3.16). The user can then compare photos of these two species or assess distinguishing traits recommended by the key. In this case, dewlap photos are available for both species, and the "differences" function decrees that these species may be distinguished by dewlap scalation (rows of single scales in *A. fitchi*, rows of multiple scales in *A. podocarpus*). With just a handful of traits and the *AnoleKey*, a potentially difficult identification has been rendered straightforward.

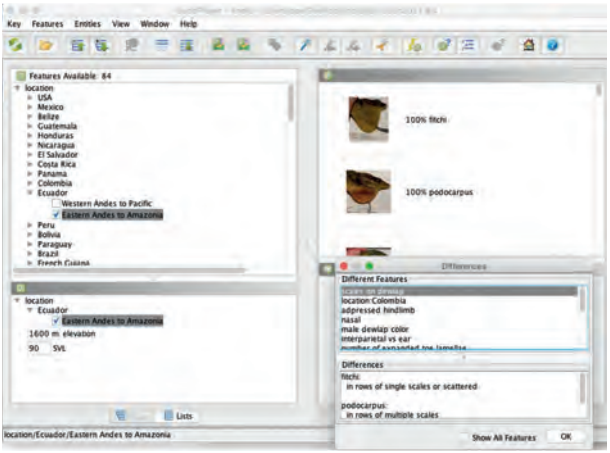


FIG. 3.16. Panel from AnoleKey showing identification of a large anole found at high elevation on Ecuador's eastern Andean slope. Based on provided information, (1600 meters elevation, 90 mm SVL, eastern Andes), *Anolis fitchi* and *A. podocarpus* are likely identifications. Knowledge of the arrangement of scales on the dewlap ("Different features") would allow distinction between these two species.

The *AnoleKey* is described in detail in Poe (manuscript), and that paper should be consulted as an introduction to its use. This paper also describes caveats on the reliability of the key; most of these concern difficulties with poorly known or inadequately sampled species.

— SPECIES ACCOUNTS —

The species accounts of chapter 4 of this book are intended to serve as a resource for anole identification in the lab and (especially) the field. In particular, the "Morphology," "Similar Species," and "Range" sections should be informative. Figure 3.17 gives an example procedure for anole identification using the resources of chapter 4, described in more detail below.

A pillar of the identification aspect of the species accounts is the categorization of anoles by morphological and in some cases ecological gestalt. Herpetologists in the field have some sense of the general semblance of lizard they have grabbed. We tend first to determine what appearance-category of lizard (anole) we have in hand—small and brown, aquatic, etc.—and then move on to subtleties of scales and proportion, all the while focusing on geographically likely species (see figs. 3.1, 3.2 for geographic divisions assumed here). In the spirit of these tenets, I have categorized each anole species according to its gestalt so that candidate species may be narrowed. The categories:

Small brown: This is the commonest version of anole and the version, in my experience, that causes the most difficulty for identification.[12] The anole fauna of some localities is composed entirely of species of small brown anole (e.g., most of Pacific Mexico). These anoles have maximum body length less than 60 mm and a constant brown or grayish-brown dorsum. The shade of brown may vary based on mood or temperature, but these forms do not have the capacity to turn green. Many species of small brown anole may be alternatively solid brown or strongly patterned with bars, blotches, or stripes, depending on mood or temperature.

Large brown: These species range in maximum body size from 60 mm up to approximately 90 mm. As in small brown anoles, large brown species may be patterned or solidly colored and may turn many shades of brown to white but will never appear completely green.

Small green: A few species of mainland anole are both small (body < 55 mm) and predominantly green. The green dorsum is the baseline appearance for these species, but it must be noted that most anoles that usually are green may change to brown. For all species categorized as *small green* or *large green* (see below), individuals are green during sleep. It is only when agitated or otherwise influenced (e.g., when turning brown to better absorb heat) that these species change from green.

Large green: These species range from about 65 to 90 mm. All the color comments for *small green*

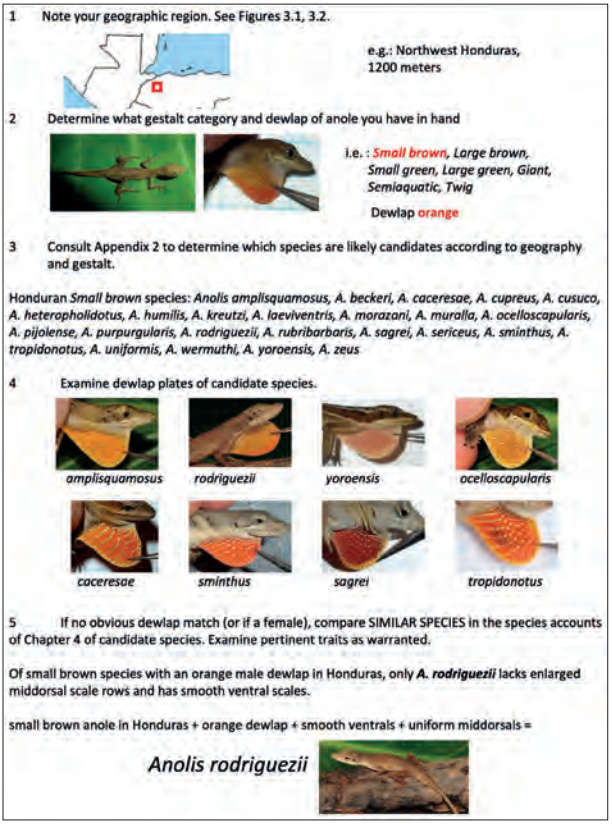


FIG. 3.17. Example procedure for identifying anoles in the field using the species accounts and dewlap plates of this book.

species apply to *large green*. That is, all large green species may turn brown under some circumstances, but green is the usual color.

Giant: Traditionally for Caribbean anoles (e.g., Williams 1983), the moniker "giant" is applied to species larger than 100 mm body length regardless of color. This category is useful on the mainland as well. Large species of mainland anole often are limited in range overlap—unlike "small brown" anoles, there generally are few "giant" anoles per locality—and several giant species incorporate both greens and browns in dorsal coloration (examples: *A. ventrimaculatus*, *A. brooksi*, *A. fitchi*), so it seems reasonable to treat very large anoles as their own category.

Twig: This category is reserved for species that share a particular complement of unusual traits and usually are not easily categorized as "brown" or "green." Twig anoles have a long head and short limbs, a whitish to brownish lichenous dorsal coloration, slender body, usually a short tail, and ecology wherein they tend to occupy twigs, at least at night. Most South American species that fit this category are highland forms, whereas Central American twig species may be high- or lowland inhabitants.

Semiaquatic: The ecologically most distinctive anoles are the semiaquatic forms. These species generally are some shade of brown, of intermediate to large size (60–100 mm SVL), usually with long hindlimbs and a light lateral stripe extending along the body. They are most distinctive in behavior and habitat use. They swim, frequently diving into the water to escape capture; may sleep on boulders rather than vegetation; and are almost never found farther than 2 meters from the edge of a stream or river. The ecology of semiaquatic anoles makes their elimination as a potential identification simple in most cases—that is, if the anole you have found is not by a stream or river, it is highly unlikely that you have found a semiaquatic anole.

I would like to be clear that *small brown*, *large brown*, *small green*, *large green*, *giant*, *twig*, and *semiaquatic* are informal categories, my attempt at communicating how we in my lab preliminarily identify anoles. As will be clear in the species accounts, certain species cross over categories. But there are many more species that are easily categorized as one of the above. These categories are a convenient means to narrow down potential identifications and determine which species are appropriate for comparison.

Once the gestalt of a species is hypothesized, the next step is to examine candidate species according to geography in appendix 2. If an adult male is evaluated, dewlap photos of the candidate species of appendix 2 may be surveyed for a match. Supplementally and in the case of females and juveniles,

the "Similar Species" section of candidate species may be examined, as well as the body photos. This procedure (gestalt + geography → dewlaps, body, similar species distinctions; fig. 3.17) should suffice to identify almost any mainland anole in the field.

— VARIATION WITHIN SPECIES —

Apparently the herpetology gods deemed the degree of interspecific variation in anoles insufficiently challenging for species identification and so interjected additional inconstancies into the group. Intraspecies variation between sexes, across ontogeny, between individuals of the same sex, and within a single individual at different times of day further complicate anole identification. Moreover, degree of intraspecific variability varies between traits and between species. Here I review these additional sources of variation.

Variation between sexes is common in body size, dewlap presence and size, and color pattern. In 89 mainland anole species, the size of the largest known male is at least 5 percent larger than the size of the largest known female. The pattern is reversed, with females larger than males, in 32 mainland species.[13] Sexual size differences tend to be more extreme in species where the male is larger. In well-sampled species *Anolis carolinensis*, females are about 75 percent the length of males. Among extreme and well-sampled species with the reverse pattern, *A. vittigerus* males are about 85 percent the length of females. Body size may be a useful identifying trait if an extremely large individual is evaluated.

Dewlap size and color tend to be uniform among comparably sized males of most species[14] (exceptions: *Anolis nebulosus*, *A. fuscoauratus*; fig. 3.18), especially within populations, but variation in each of these characteristics is not uncommon in females of some species. The dewlap may be absent in females (e.g., *A. chloris*, *A. auratus*), present but smaller than the male's (e.g., *A. pentaprion*, *A. vittigerus*), or, most infrequently, of equal size to the male's (e.g., *A. brooksi*, *A. aequatorialis*). Female dewlap color often duplicates the male's but may be white or otherwise different than the male's

FIG. 3.18. Intraspecific variation in male dewlap color pattern in *Anolis fuscoauratus*: from Pilcopata, Peru (top left); Tingo María, Peru (top right); Estación Tunquini, Bolivia (middle left); Trinidad, Bolivia (middle right); Iquitos, Peru (bottom left); Camiaco, Peru (bottom right). The Camiaco specimen is from the type locality for *A. fuscoaurautus*; the Trinidad specimen is from near the type locality for *A. fuscoauratus*. Genetic divergences between these populations are well below levels between distinct species (data not shown).

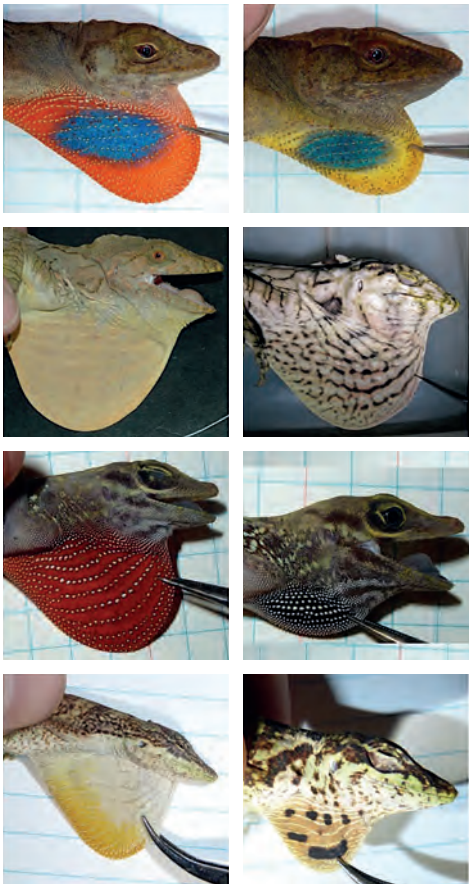


FIG. 3.19. Sexual dimorphism in dewlap color pattern in anoles. Males, left; females, right. *Anolis johnmeyeri* (top), *A. brooksi* (second from top), *A. alvarezdeltoroi* (second from bottom), *A. menta* (bottom).

(fig. 3.19). In some species, the female dewlap is patterned but not colored like the male's (e.g., *A. johnmeyeri*, *A. vittigerus*), whereas in others the sexes possess differently patterned and colored dewlaps (e.g., *A. biporcatus*, *A. brooksi*). A wide range of female dewlap color patterns has been documented in *A. lemurinus* (White et al. 2019) and *A. salvini* (Bientreau et al. 2013).

Body color and pattern may vary between and within sexes (figs. 3.20, 3.21), across ontogeny, and by mood within an individual (fig. 3.22). In some species, relatively distinct male and/or female morphs exist (e.g., *Anolis proboscis*), whereas in others variation appears continuous (e.g., *A. ventrimaculatus*). A common female morph of many species is the addition of a broad dark or light middorsal stripe, sometimes bordered by contrasting narrow parallel stripes, layered upon solid green or brown or upon a male-like pattern (fig. 3.20). This morph is present as a variant among one or more pattern alternatives, often with one of these alternatives similar to the male's pattern (fig. 3.21); I know of no species for which all females possess the middorsal stripe pattern. Males and females also may differ in the amount of green, brown, or blue. For example, males but not females of *A. kunayalae* often display a blue wash anteriorly. Most species show little variation in color pattern across ontogeny, but some (e.g., *A. brooksi*, *A. parilis*) are more strongly patterned as juveniles; I know of no species with the reverse condition of stronger pattern in adults. As discussed above, green species may change to brown, but brown species are always some shade of brown or gray. Some green species become more starkly patterned when brown (e.g., *A. soinii*, *A. biporcatus*; fig. 3.22). Individuals of several brown species may appear either solid brown or gray or patterned with blotching, banding, or striping of different shades of brown.

Scale counts such as the number of postmentals or of scales across the snout vary among individuals of all species, and this variation standardly is not correlated with sex or ontogeny. In a few species (e.g., *Anolis punctatus*) ventral scales may be keeled or smooth, but degree of keeling usually is constant within species for a given anatomical region. The specific number of enlarged middorsal scale rows and of enlarged supraocular scales varies within species, but the condition itself does not. That is, for example, all individuals of *A. tropidonotus* display rows of abruptly enlarged middorsal scales, but there is variation in number of rows, from approximately 10 to 15. Cresting on the tail and/or middorsum may be more pronounced in large individuals or males or may vary without regard for sex (see, e.g., Lazell 1969: fig. 1). Males of two species possess scaly rostral extensions that are absent in females (*A. proboscis*, *A. phyllorhinus*; fig. 1.1).[15]

The bewildering degree of intraspecific variation in anoles complicates species identification. The species accounts of chapter 4 discuss intraspecific variation and should be invaluable for adjudicating

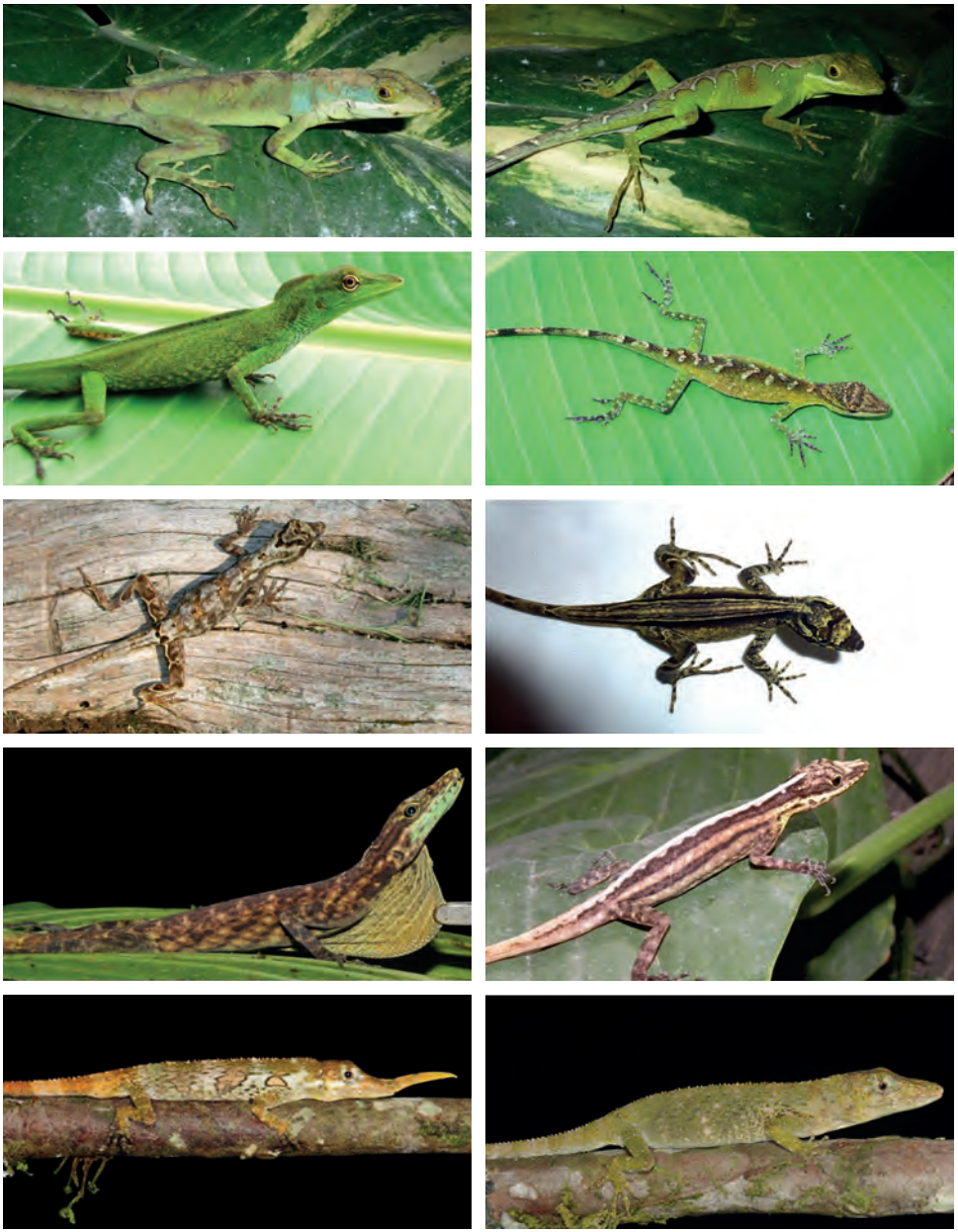


FIG. 3.20. Sexual dimorphism in body color pattern in anoles. Males, left; females, right. *Anolis apollinaris* (top), *A. cuscoensis* (second from top), *A. vittigerus* (middle), *A. anchicayae* (second from bottom; left photo by Guido F. Medina-Rangel), *A. proboscis* (bottom; photos by Tom Kennedy).

FIG. 3.21. Sexual dimorphism in body color pattern in *Anolis solitarius*: female (top), female (middle), male (bottom). The three lizards are from the same locality.

many difficult cases, as should the figures in this chapter taken as examples. Catching and examining multiple individuals for comparison, if possible, also is likely to help. Finally, awareness of the above issues will go a long way toward avoiding identification errors and difficulties related to intraspecific variation. Expect that females may have a middorsal stripe and that complexly patterned species are likely to come in different pattern flavors. Understand that males, females, and possibly juveniles may be patterned differently.[16] If these precepts are kept in mind, the hurdle of intraspecific variation for anole identification will be lowered considerably.

— CONCLUSION —

As implied by the epigraph for this chapter, identifying anoles can be difficult. There is no definitive trait or foolproof system that can guarantee accurate identification of all individual anoles. In this chapter I have presented a diversity of methods and information for anole species identification, and the species accounts should be helpful as complements for each species. Male dewlap color pattern coupled with geography is a supremely valuable combination but the species accounts, body photos and *AnoleKey* can supplement dewlap information and apply to females or preserved specimens for which male dewlap details are unavailable. L. C. Stuart (1955) stated of his key to Guatemalan anoles, "The worker who knows what species he has before him should experience few difficulties in its use." I hope that the combination of tools presented here will be useful for workers, even in those unfortunate cases where species identity is a priori unknown.

FIG. 3.22. Intraindividual color pattern variation in *Anolis punctatus* (left, top and bottom), *A. soinii* (middle), *A. biporcatus* (right). In each case, the same individual is shown in both photos.

SPECIES ACCOUNTS

1.1 *A. aenus* p.66 RS

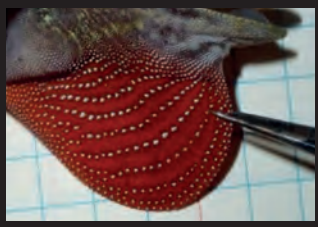
1.2 *A. aequatorialis* p.67

Small, apparently white.
(PERSONAL OBSERVATION OF PHOTOS)

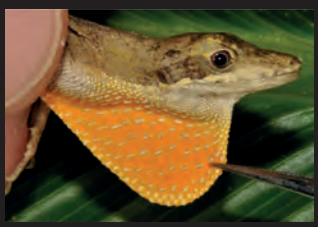
1.3 *A. agassizi* p.68

1.4 *A. allisoni* p.69 CA

1.5 *A. altae* p.70



1.6 *A. alvarezdeltoroi* p.71

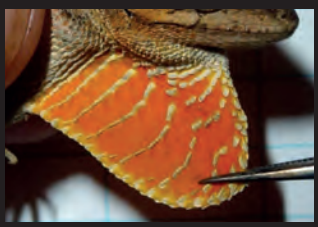


1.7 *A. amplisquamosus* p.72 TK

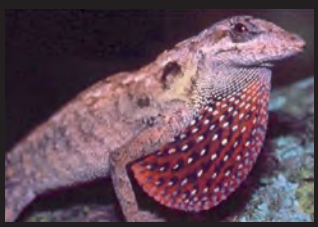
"Turquoise-green (bluer on center and anteriorly, pale green elsewhere) with pale or dark greenish scales."
(UGUETO ET AL. 2007)

1.8 *A. anatoloros* p.73

1.9 *A. anchicayae* p.74 GM



1.10 *A. anisolepis* p.75



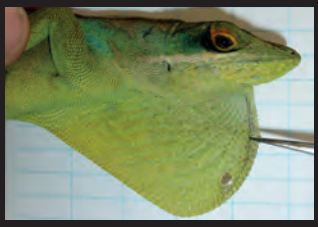
1.11 *A. annectens* p.76 CBA

1.12 *A. anoriensis* p.77 JD

1.13 *A. antioquiae* (female) p.78 EA

1.14 *A. antonii* p.80

1.15 *A. apletophallus* p.81

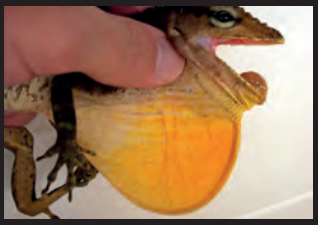


1.16 *A. apollinaris* p.82

1.17 *A. aquaticus* p.83

1.18 *A. arenal* p.85

1.19 *A. auratus* p.86



1.20 *A. baleatus* p.87 RG

1.21 *A. barkeri* p.88

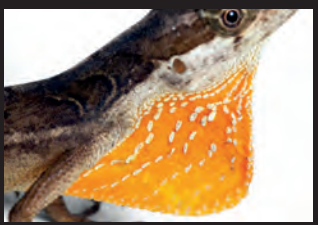
1.22 *A. beckeri* p.89

"Pale yellow … with rows of light brown scales that show through strongly translucent skin from one side to the other."
(MYERS AND DONNELLY 1996)

1.23 *A. bellipeniculus* p.90

1.24 *A. benedikti* p.91

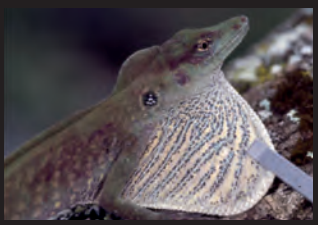
1.25 *A. bicaorum* p.92 TK



1.26 *A. binotatus* p.93 SR

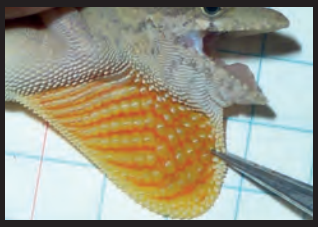
1.27 *A. biporcatus* p.95 TK

1.28 *A. biscutiger* p.96 RF



1.29 *A. boettgeri* p.97 EL

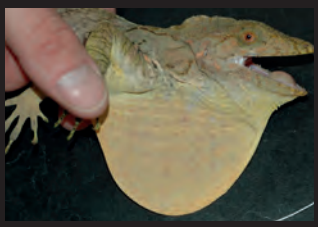
1.30 *A. bombiceps* p.98



1.31 *A. boulengerianus* p.99

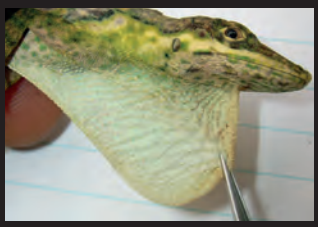
1.32 *A. brasiliensis* p.100 MT

1.33 *A. brianjuliani* p.101 GK



1.34 *A. brooksi* p.102

1.35 *A. caceresae* p.103 DJ



1.36 *A. calimae* p.104

1.37 *A. callainus* p.105 DM

"Reddish-pink."
KÖHLER AND SMITH 2008

1.38 *A. campbelli* p.106

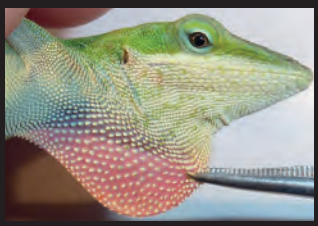
1.39 *A. capito* p.107

Dewlap color unknown.

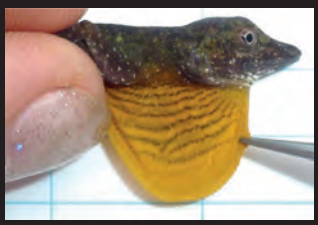
1.40 *A. caquetae* p.109

"Bluish gray color on the gular fan when extended."
("FROM GORZULA'S FIELD NOTES" IN WILLIAMS ET AL. 1996)

1.41 *A. carlostoddi* p.110

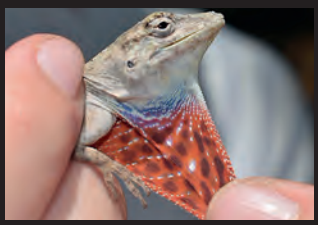


1.42 *A. carolinensis* p.111

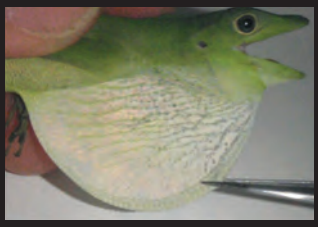


1.43 *A. carpenteri* p.112

1.44 *A. casildae* p.113



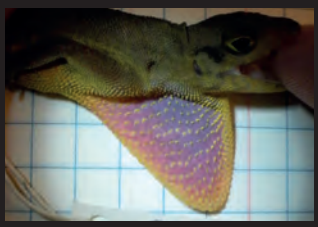
1.45 *A. charlesmyersi* p.114 KP



1.46 *A. chloris* p.115

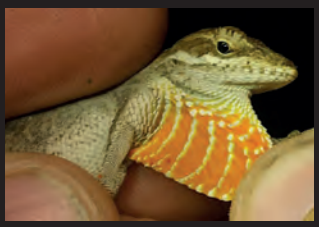
1.47 *A. chrysolepis* p.116 RL

1.48 *A. cobanensis* p.117 ZK

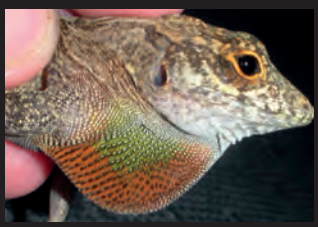


1.49 *A. compressicauda* p.118

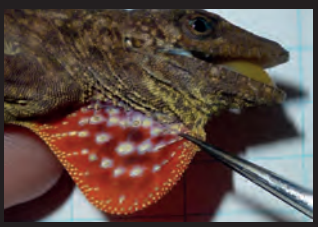
1.50 *A. concolor* p.119 DG



1.51 *A. crassulus* p.120 JS



1.52 *A. cristatellus* p.121



1.53 *A. cristifer* p.123

1.54 *A. cupreus* p.124 DM

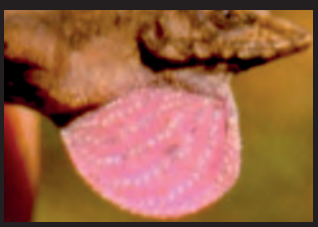
"Bright red, [with] no differentiation of color at margin or center" (Smith, 1964:32). The dewlap in specimens from the Cerro Baul area is rose-colored or pinkish purple (Campbell et al., 1989; Jonathan A. Campbell, pers. comm.), or pink (Jerry D. Johnson, field notes)."
(NIETO MONTES DE OCA 1994)

1.55 *A. cuprinus* p.125

1.56 *A. cuscoensis* p.126

1.57 *A. cusuco* p.127

1.58 *A. cybotes* p.128 RG



1.59 *A. cymbops* p.129 ANi

1.60 *A. danieli* p.130

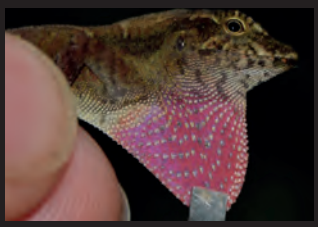
1.61 *A. datzorum* p.131

1.62 *A. dissimilis* p.132 FO

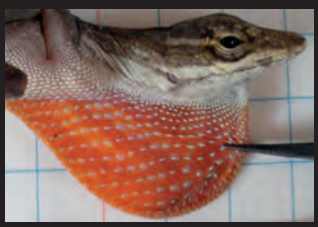
1.63 *A. distichus* p.133 JJ

1.64 *A. dollfusianus* p.134

1.65 *A. dracula* p.136 SR

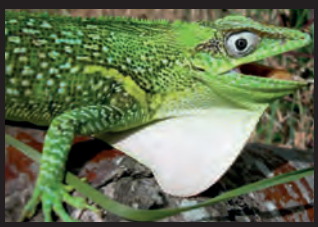


1.66 *A. duellmani* p.137 ABM



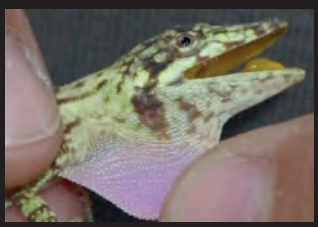
1.67 *A. dunni* p.138

1.68 *A. elcopeensis* p.139



1.69 *A. equestris* p.140

1.70 *A. eulaemus* p.141



1.71 *A. euskalerriari* p.142 TB

1.72 *A. extremus* p.143 IL

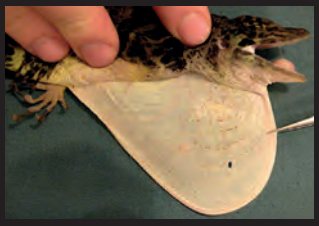
1.73 *A. fasciatus* p.144 SR

1.74 *A. festae* p.146

1.75 *A. fitchi* p.147 TK

1.76 *A. fortunensis* p.148

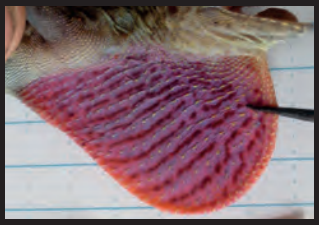
1.77 *A. fraseri* p.149 TK



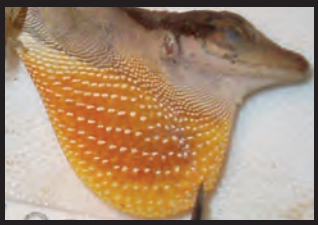
1.78 *A. frenatus* p.150

1.79 *A. fungosus* (female) p.152

1.80 *A. fuscoauratus* p.153

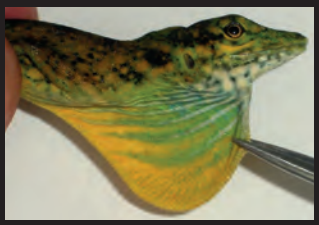


1.81 *A. gadovii* p.154



1.82 *A. gaigei* p.155

1.83 *A. garmani* p.157 IL



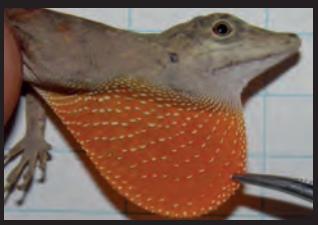
1.84 *A. gemmosus* p.158 TK

1.85 *A. ginaelisae* p.159

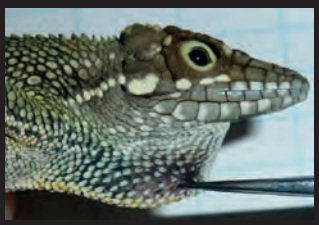
1.86 *A. gorgonae* p.160 DM

1.87 *A. gracilipes* p.161 TK

1.88 *A. granuliceps* p.162



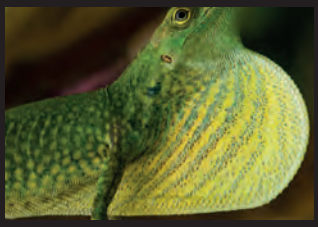
1.89 *A. gruuo* p.163



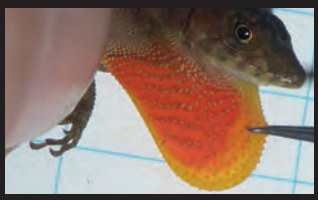
1.90 *A. heterodermus* p.164

1.91 *A. heteropholidotus* p.166 HV

1.92 *A. hobartsmithi* p.167



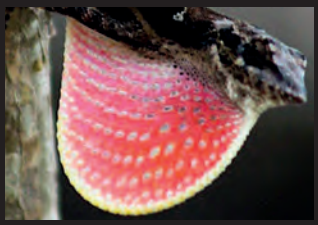
1.93 *A. huilae* p.168 DB



1.94 *A. humilis* p.169

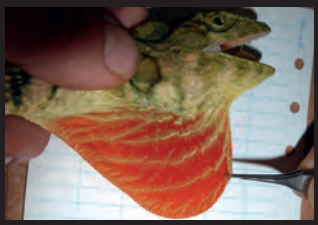
1.95 *A. hyacinthogularis* p.170 OT

1.96 *A. ibanezi* p.171



1.97 *A. immaculogularis* p.172 RA

Distal portion of the dewlap reddish-brown, rows of pale green scales, basally yellow-orange.
(TRANSLATED FROM RUEDA AND HERNANDEZ-CAMACHO 1988)



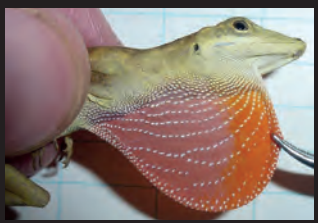
1.98 *A. inderenae* p.173

1.99 *A. insignis* p.174

1.100 *A. jacare* p.175 EA

1.101 *A. johnmeyeri* p.176

1.102 *A. kathydayae* p.176



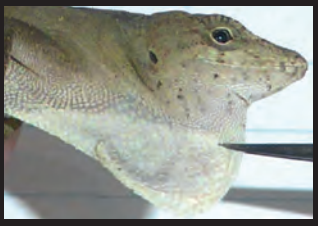
1.103 *A. kemptoni* p.178

"Dewlap pale yellow with purple gorgetal scales."
(MCCRANIE ET AL. 2000)

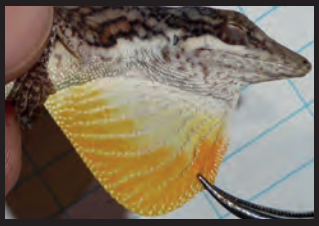
1.104 *A. kreutzi* p.179

1.105 *A. kunayalae* p.180

1.106 *A. laevis* p.181 PV



1.107 *A. laeviventris* p.182

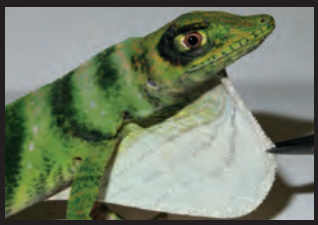


1.108 *A. lamari* p.183

1.109 *A. latifrons* p.185

1.110 *A. lemurinus* p.186

1.111 *A. limifrons* p.187



1.112 *A. limon* p.188 JH

1.113 *A. lineatus* p.189 AO

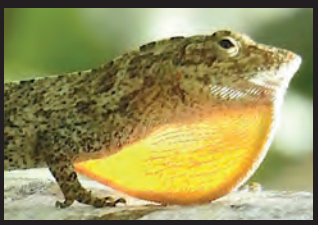
1.114 *A. liogaster* p.190

1.115 *A. lionotus* p.191

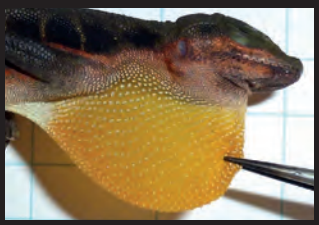
1.116 *A. lososi* p.192 SR

1.117 *A. loveridgei* p.193 JG

1.118 *A. lynchi* p.194 OT



1.119 *A. macrinii* p.195 MK



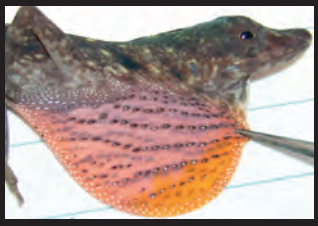
1.120 *A. macrolepis* p.196

Dewlap pale pink with dull orange blotch proximally.

(PERSONAL OBSERVATION OF LIVE ECIMEN)

1.121 *A. macrophallus* p.197

1.122 *A. maculigula* p.199



1.123 *A. maculiventris* p.200

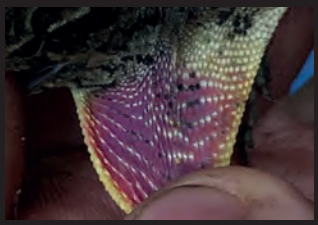
1.124 *A. magnaphallus* p.201

1.125 *A. maia* p.202

1.126 *A. mariarum* p.204

1.127 *A. marmoratus* p.205

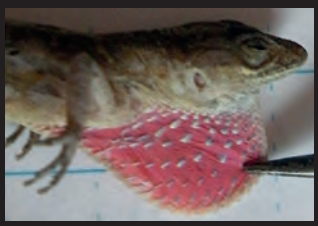
1.128 *A. marsupialis* p.206 MR



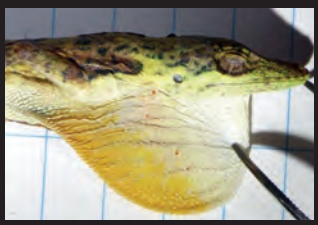
1.129 *A. matudai* p.207 ANa

1.130 *A. medemi* p.208 DM

1.131 *A. megalopithecus* p.209



1.132 *A. megapholidotus* p.210



1.133 *A. menta* p.211

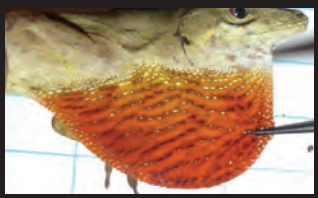
1.134 *A. meridionalis* p.212 RL

1.135 *A. microlepidotus* p.214

1.136 *A. microtus* (female) p.215 MR

1.137 *A. milleri* p.216

1.138 *A. mirus* p.217



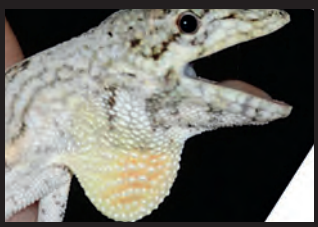
1.139 *A. monteverde* p.218

"Red with cream gorgetal scales."
(TOWNSEND AND WILSON 1999)

1.140 *A. morazani* p.219

Red with brown scales.
(PERSONAL OBSERVATION OF PHOTOS)

1.141 *A. muralla* p.220

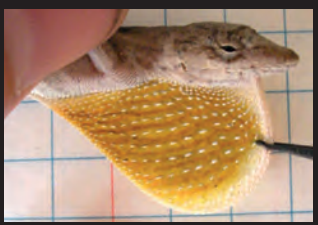


1.142 *A. nasofrontalis* (female) p.221 PS

1.143 *A. naufragus* p.223

1.144 *A. neblininus* p.224 IP

1.145 *A. nebuloides* p.225



1.146 *A. nebulosus* p.226

1.147 *A. neglectus* p.227 PS

1.148 *A. nemonteae* p.228 AN

Dull yellow-orange with white scales.
(PERSONAL OBSERVATION OF ILLUSTRATION BY GABRIEL UGUETO)

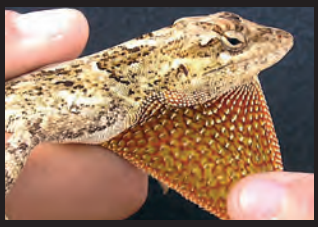
1.149 *A. nicefori* p.229

1.150 *A. notopholis* p.230

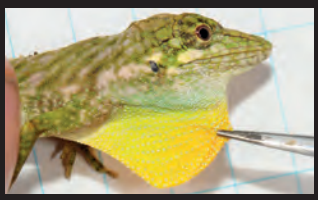
1.151 *A. ocelloscapularis* p.231 TK

See dewlap of *A. peucephilus*.

1.152 *A. omiltemanus* p.232



1.153 *A. onca* p.233 AM



1.154 *A. orcesi* p.234 TK

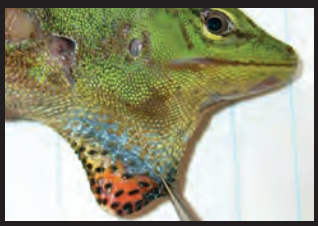
1.155 *A. ortonii* p.235

1.156 *A. otongae* p.237 OT

1.157 *A. oxylophus* p.238 CA

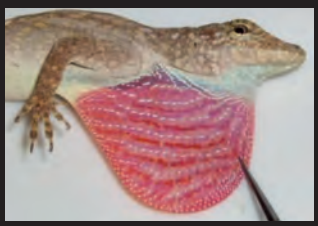
1.158 *A. pachypus* p.239

1.159 *A. parilis* p.240 DQ



1.160 *A. parvauritus* p.241

1.161 *A. parvicirculatus* p.242

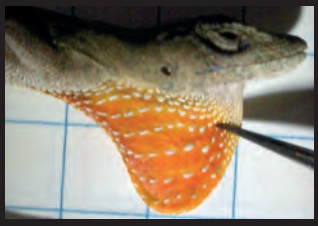


1.162 *A. pentaprion* p.243

1.163 *A. peraccae* p.244

1.164 *A. peruensis* p.245

1.165 *A. petersii* p.247

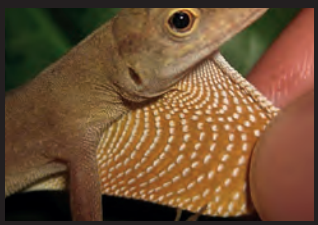


1.166 *A. peucephilus* p.248

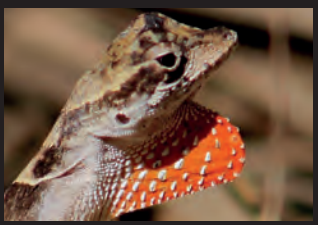
1.167 *A. phyllorhinus* p.249 MT

Pink, purple-pink centrally with light scales.
(PERSONAL OBSERVATION OF PHOTOS)

1.168 *A. pijolense* p.250



1.169 *A. pinchoti* p.251 DG



1.170 *A. planiceps* p.252 FOm

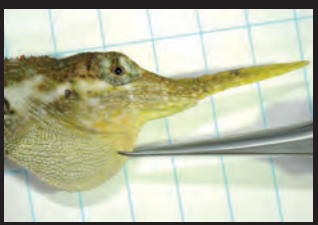
1.171 *A. podocarpus* p.253 SR

1.172 *A. poecilopus* p.254

1.173 *A. poei* p.255 OT

1.174 *A. polylepis* p.256

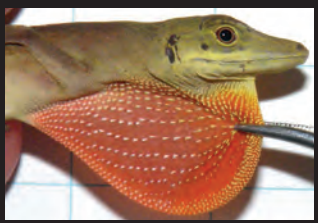
1.175 *A. princeps* p.257



1.176 *A. proboscis* p.258 TK

Unknown.

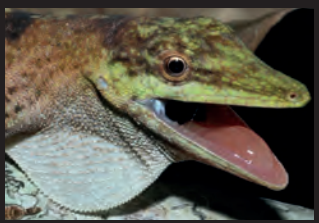
1.177 *A. propinquus* p.259



1.178 *A. pseudokemptoni* p.260

"Dewlap uniform Orange Yellow (18) with Dusky Brown (19) gorgetals."
(KÖHLER ET AL. 2007)

1.179 *A. pseudopachypus* p.261



1.180 *A. pseudotigrinus* (female) p.262 MT

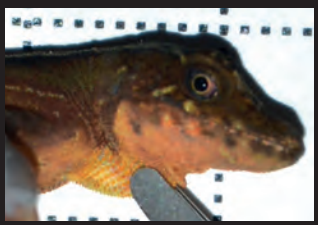
1.181 *A. punctatus* p.263

1.182 *A. purpurescens* p.265

"Dewlap Purple (color 6) with dirty white scales."
(MCCRANIE ET AL 1993)

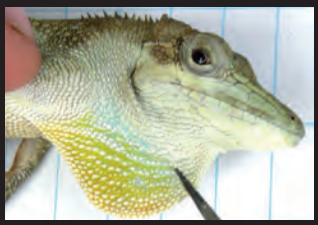
1.183 *A. purpurgularis* p.266

1.184 *A. purpuronectes* p.267



1.185 *A. pygmaeus* (female) p.268 AH

1.186 *A. quercorum* p.269



1.187 *A. quimbaya* p.270

"Pink or white-cream."
MORENO-ARIAS ET AL. 2023

1.188 *A. richteri* p.272

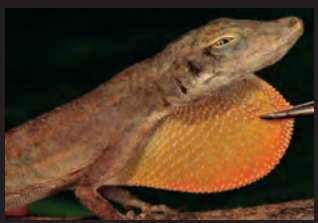
1.189 *A. riparius* p.273 DL

1.190 *A. rivalis* p.274

"Pink red … with suffusion of black pigment centrally, gorgetal scales white."
(KÖHLER AND MCCRANIE 2001)

1.191 *A. roatanensis* p.275

1.192 *A. robinsoni* p.276



1.193 *A. rodriguezii* p.277 TK

1.194 *A. rubiginosus* p.278

Pale red with light scales.
(PERSONAL OBSERVATION OF PHOTOS)

1.195 *A. rubribarbaris* p.280

Pale yellow with white scales.
(TRANSLATED FROM RUEDA AND WILLIAMS 1986)

1.196 *A. ruizii* p.281

1.197 *A. sagrei* p.282

1.198 *A. salvini* p.283

1.199 *A. santamartae* p.284 JPG

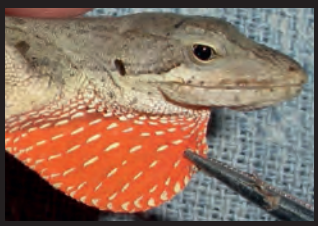
1.200 *A. savagei* p.285

1.201 *A. schiedii* p.286

1.202 *A. scypheus* p.287

1.203 *A. sericeus* p.289 TK

1.204 *A. serranoi* p.290



1.205 *A. sminthus* p.291

1.206 *A. soinii* p.292

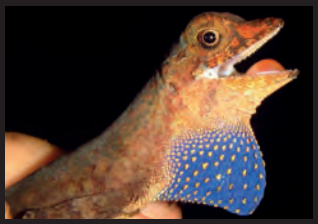
1.207 *A. solitarius* p.293

Yellow posteriorly, red-orange anteriorly, with light-greenish scales.
(PERSONAL OBSERVATION OF ILLUSTRATION BY GABRIEL UGUETO)

1.208 *A. squamulatus* p.294

1.209 *A. subocularis* p.295

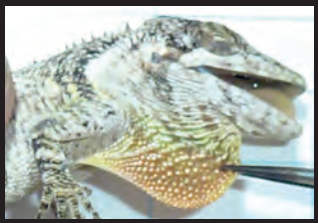
1.210 *A. sulcifrons* p.296



1.211 *A. tandai* p.297 IP

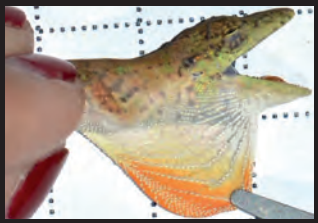
1.212 *A. taylori* p.298

1.213 *A. tenorioensis* p.299



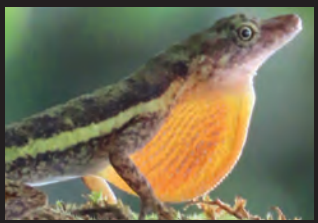
1.214 *A. tequendama* p.301

1.215 *A. tetarii* p.302 AMCZ



1.216 *A. tigrinus* p.303 RC

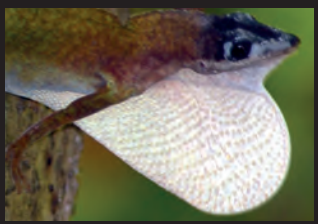
1.217 *A. tolimensis* p.304



1.218 *A. townsendi* p.305 OK

1.219 *A. trachyderma* p.306

1.220 *A. transversalis* p.307 OT

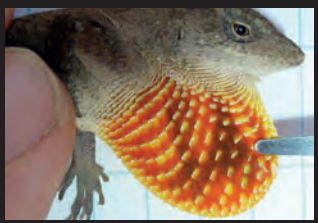


1.221 *A. trinitatis* p.308 RP

1.222 *A. triumphalis* p.309 RM

1.223 *A. tropidogaster* p.310

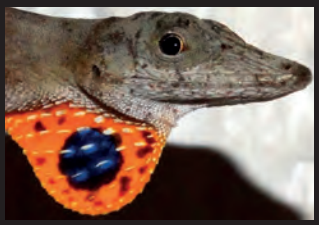
1.224 *A. tropidolepis* p.311



1.225 *A. tropidonotus* p.313

1.226 *A. uniformis* p.314

1.227 *A. urraoi* p.315 FG



1.228 *A. ustus* p.316 JL

1.229 *A. utilensis* p.317 TK

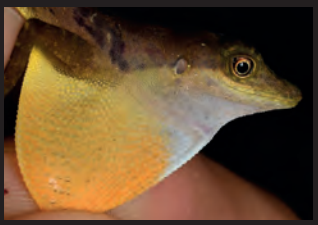
1.230 *A. vanzolinii* p.318

"Dewlap skin black; scales of dewlap grey."
(F. PYBURN [COLLECTOR OF HOLOTYPE] IN WILLIAMS 1982)

"Dewlap 'morado'—violet, mulberry-colored."
(F. MEDEM IN WILLIAMS 1982)

1.231 *A. vaupesianus* p.319

1.232 *A. ventrimaculatus* p.321



1.233 *A. vicarius* p.322 JV

"Dark, chocolate-colored."
(FITCH AND HENDERSON 1976)

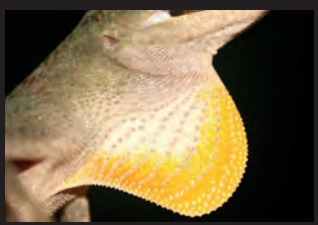
1.234 *A. villai* p.323

1.235 *A. vittigerus* p.324

"Flame Scarlet (Color 15) with white scales."
(KÖHLER AND OBERMEIER 1998)

1.236 *A. wermuthi* p.325

1.237 *A. williamsmitter-meierorum* p.326



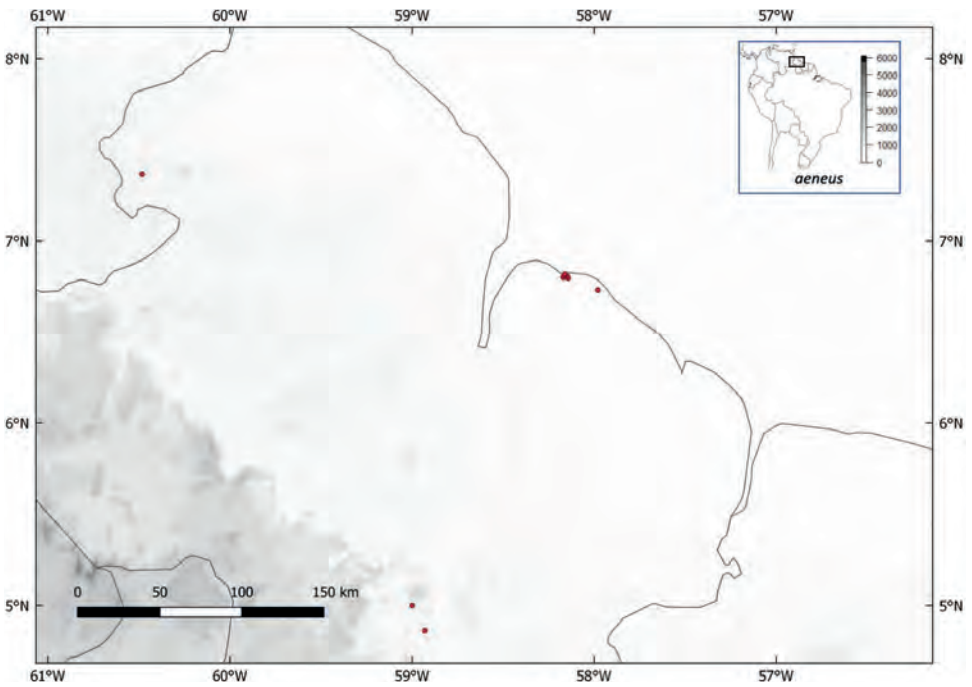
1.238 *A. woodi* p.327

1.239 *A. yoroensis* p.328 TK

1.240 *A. zeus* p.330 TK

— *ANOLIS AENEUS* — PLATE 1.1, 2.156

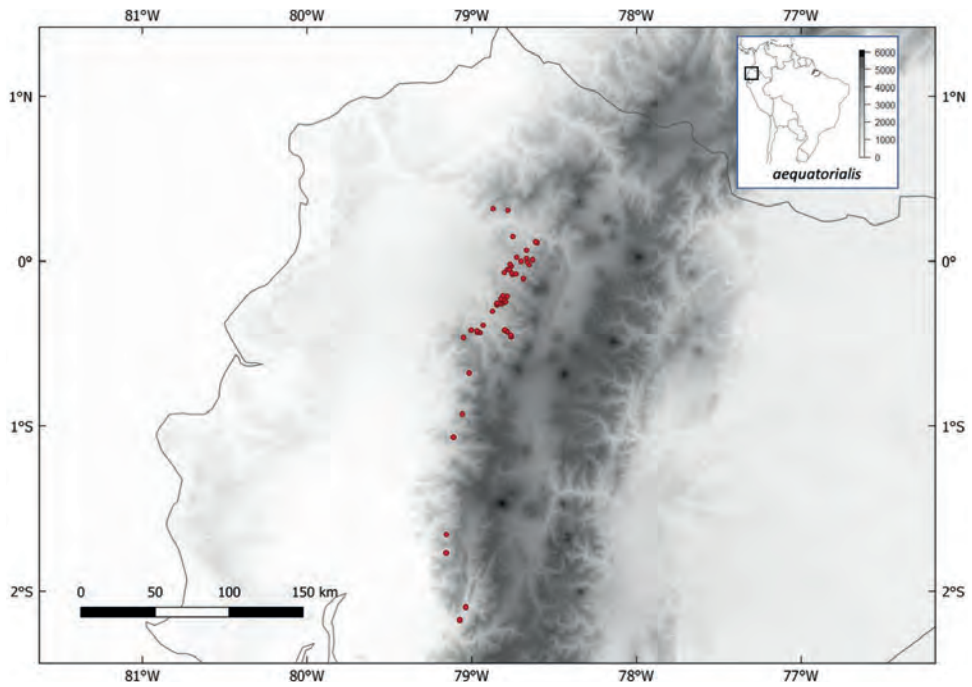
DESCRIPTION — Gray, J. E. 1840. Catalogue of the species of reptiles collected in Cuba by W. S. MacLeay, esq.; with some notes on their habits extracted from his MS. *Annals and Magazine of Natural History* 5 (1):108–115.
TYPE SPECIMEN — BMNH 1946.8.28.7.
TYPE LOCALITY — None given. Restricted by Lazell (1972) to "Point Saline, Grenada." Point Salines is at the southwest tip of Grenada, at approximately lat 12.01 lon –61.78, 20 m.
MORPHOLOGY — Body length to 80 M, 55 F; ventral scales smooth; middorsal scales enlarged in 0–2 rows; interparietal usually larger than tympanum; scales across the snout between the second canthals 5–11; toe lamellae 19–28; suboculars and supralabials in contact; supraorbital semicircles in contact; supraocular scales gradually enlarged; hindlimbs short, adpressed toe to ear or just beyond; body color gray to brown to bright green with blue and/or yellow, sometimes with speckling, a lateral stripe, and/or spots arranged in transverse bars (regarding the color pattern of *Anolis aeneus*, Lazell [1972: 80] stated "There is so much variation that verbal description is wasteful"); iris brown; male dewlap gray-green to yellow; female dewlap absent.
SIMILAR SPECIES — *Anolis aeneus* is a *large brown* or *large green* anole that can be distinguished from potentially sympatric congeners on the mainland by its large posterior head scales, wherein the supraorbital semicircles strongly abut (usually several pairs in contact) and are in contact with the interparietal. *Anolis ortonii* and *A. punctatus* may have the supraorbital semicircles in contact but *A. punctatus* is solid green (variable in *A. aeneus*) and *A. ortonii* is lichenous white to brown and smaller than *A. aeneus* (SVL to 59 mm; to 80 mm in *A. aeneus*). Also, on the mainland *A. aeneus* is most likely to be found in human-altered environments, whereas the other forms are more likely to occur in less disturbed areas.
RANGE — From 0 to 300 meters in northern and central Guyana; also throughout Grenada, the Grenadines, and associated cays, and Trinidad and Tobago.



NATURAL HISTORY — Very common on vegetation and the ground. Caribbean populations of this species are well-studied by Judy Stamps (e.g., 1983) and others. Also see, e.g., Schwartz and Henderson (1991) and Lazell (1972) for information on the Caribbean populations of this species.
COMMENT — I consider *Anolis deltae* to be a synonym of one of the *roquet* species that has "invaded" Venezuela and the Guyana shield (*A. extremus*, *A. aeneus*, possibly *A. roquet*).

— *ANOLIS AEQUATORIALIS* — PLATE 1.2, 2.113

DESCRIPTION — Werner, F. 1894. Über einige Novitäten der herpetologischen Sammlung des Wiener zoolog. vergl. anatom. Instituts. *Zoologischer Anzeiger* 17:155–157.
TYPE SPECIMEN — NMW 16233.
TYPE LOCALITY — "Ecuador." Cisneros-Heredia's (2017) detailed study restricted the type locality to "The mountain pass between the south-western slopes of the Pichincha volcano and the northern slopes of the Atacazo volcano, at 2300 m elevation, province of Pichincha, Ecuador. Coordinates focus point: −0.278660° −78.709697°, radius: 1 km."
MORPHOLOGY — Body length to 92 M, 83 F; ventral scales smooth; middorsal scales enlarged in 0–2 rows; interparietal smaller than tympanum; scales across the snout between the second canthals 10–16; toe lamellae 19–26; suboculars and supralabials usually separated by a row of scales; supraorbital semicircles separated by at least three scales; supraocular scales subequal; hindlimbs long, adpressed toe reaches anterior to eye, often beyond tip of snout; overall body color may appear brown or green, usually with complex pattern of dorsal bands and lateral ocelli; male and female dewlap both large, black and green with blue, sometimes with orange; iris usually blue, may appear brown or green.
SIMILAR SPECIES — *Anolis aequatorialis* is a *large brown* or *large green* anole that is unlikely to be confused with sympatric forms due to its large distinctive dewlaps in males and females (dewlap black



and green with blue, sometimes with orange). *Anolis dracula* shares similar gestalt and dewlap color with *A. aequatorialis* and geographically replaces it in far northern Ecuador (these species appear to be molecularly distinct [Yañez-Muñoz et al. 2018]).

RANGE — From 1100 to 2400 meters on the western Andean slope of central Ecuador.

NATURAL HISTORY — Common at several mid-elevation localities on the Andean slope of central Ecuador, in forest and edge habitat, often sympatrically with *Anolis gemmosus*, abundant but less abundant than *A. gemmosus*. Diurnally active on vegetation or the ground. See Fitch et al. (1976); Savit (2006); Miyata (2013); Arteaga et al. (2013); Narváez (2017); Ramirez-Jaramillo (2018); Torres-Carvajal et al. (2019); Arteaga et al. (2023).

— *ANOLIS AGASSIZI* — PLATE 1.3

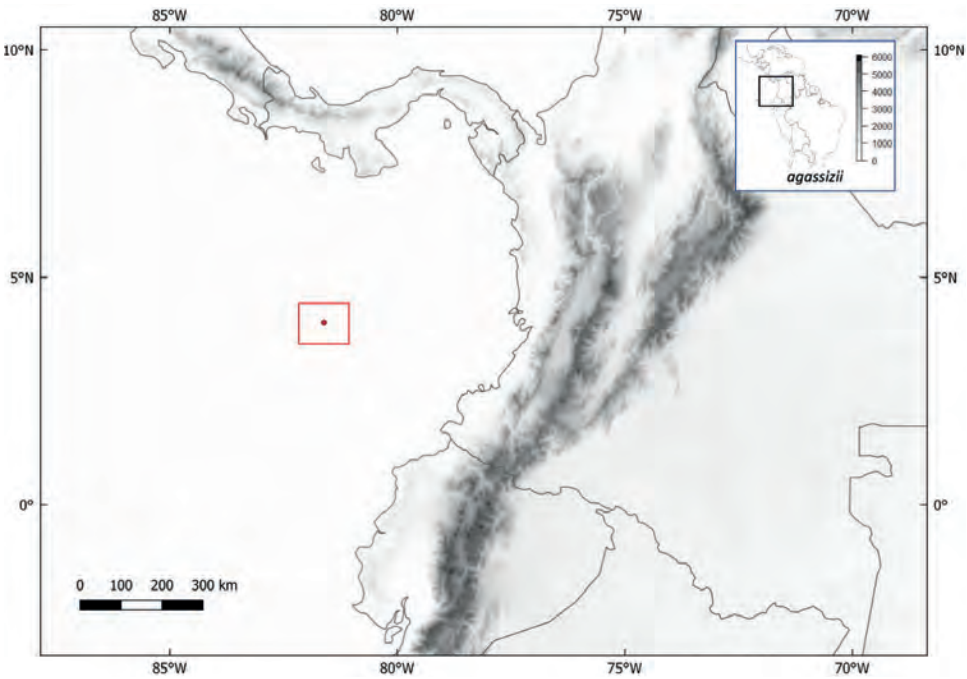
DESCRIPTION — Stejneger, L. 1900. Description of two new lizards of the genus *Anolis* from Cocos and Malpelo Islands. *Bulletin of the Museum of Comparative Zoology* 36:161–4.

TYPE SPECIMEN — USNM 22101.

TYPE LOCALITY — "Malpelo Island, Pacific Ocean, off Columbia, South America." Malpelo Island is at lat 4.00 lon −81.61, 0–360 m.

MORPHOLOGY — Body length to 127 M, 97 F; ventral scales keeled; middorsal scales enlarged in 0–2 rows; interparietal equal to or larger than tympanum; scales across the snout between the second canthals 4–9; toe lamellae 29–39; suboculars and supralabials in contact; scales separating supraorbital semicircles 0–2; supraocular scales gradually enlarged; hindlimbs long, adpressed toe to between eye and tip of snout; body color brown with tiny light dots; male dewlap small, white; female dewlap absent.

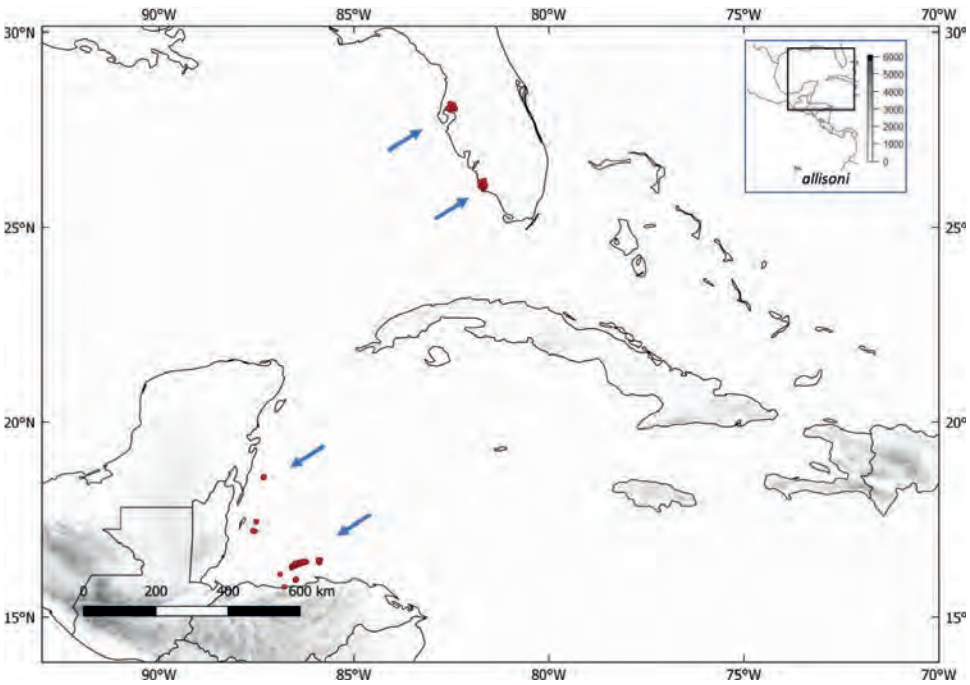
SIMILAR SPECIES — *Anolis agassizi* is a *giant* or *large brown* anole; the only anole found on Malpelo Island.



RANGE — Throughout Malpelo Island off the western coast of Colombia.
NATURAL HISTORY — Highly abundant and nonterritorial on most surfaces of Malpelo Island; sleeps on "large rocks, surfaces on hills or on man-made structures" (Lopez-Victoria et al. 2011). See Rand et al. (1975); Wolda (1975); Lopez-Victoria (2006); Lopez-Victoria et al. (2011); Phillips et al. (2019).

— *ANOLIS ALLISONI* — PLATE 1.4, 2.170

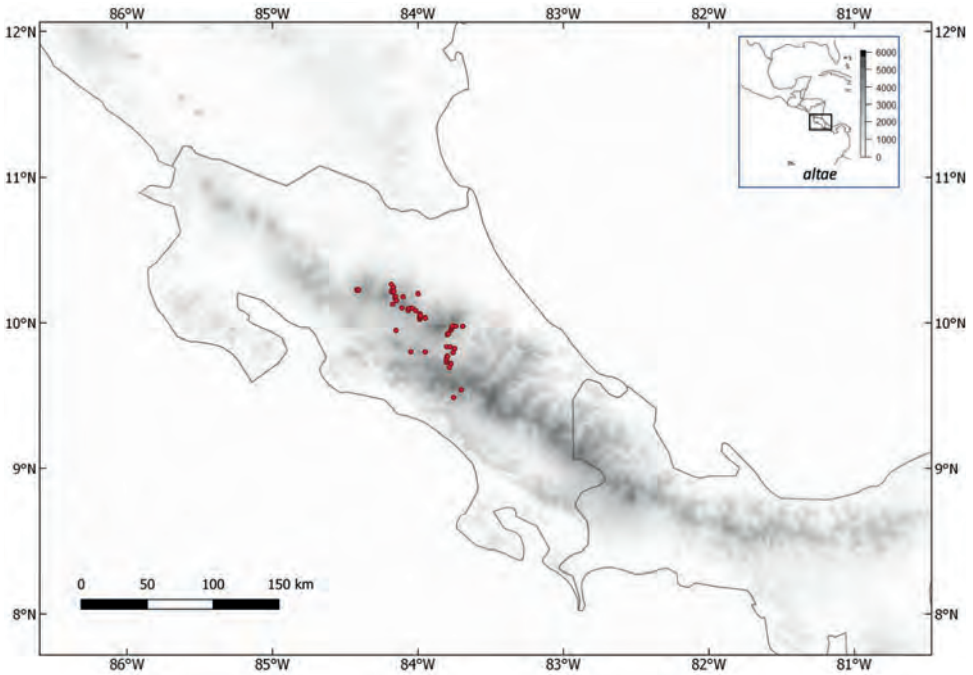
DESCRIPTION — Barbour, T. 1928. Reptiles from the Bay Islands. *Proceedings of the New England Zoölogical Club* 10:55–61.
TYPE SPECIMEN — MCZ 26725.
TYPE LOCALITY — "Coxen Hole, Ruatan, Bay Islands of Honduras." Coxen Hole, the largest town on the island of Roatán, is at lat 16.32 lon –86.54, 10 m.
MORPHOLOGY — Body length to 91 M, 66 F; ventral scales keeled; middorsal scales enlarged in 0–2 rows; interparietal larger or smaller than tympanum; scales across the snout between the second canthals 5–8; toe lamellae 23–34; suboculars and supralabials in contact; scales separating supraorbital semicircles 0–2; supraocular scales gradually enlarged; hindlimbs short, adpressed toe to ear or posterior to ear; body color green, blue anteriorly in large males, changeable to brown; male dewlap pink; female dewlap absent.
SIMILAR SPECIES — *Anolis allisoni* is a *large* or *small green* anole. Sympatric anoles on islands off Honduras are brown. In Florida, this species is unlikely to be confused with brown species *A. sagrei*, *A. cristatellus*, *A. cybotes*, *A. trinitatis*, or giant species *A. equestris* and *A. garmani*. *Anolis allisoni* differs from green species *A. callainus* in its keeled ventral scales (smooth in *A. callainus*). *Anolis allisoni* and *A. carolinensis* are very similar species but differ in external ear shape (anteroposteriorly elongate in *A. allisoni*, small and round in *A. carolinensis*).



RANGE — From 0 to 50 meters, on Caribbean islands off Belize and Honduras, and southwestern Florida, USA. Native to Cuba (and the Bay Islands).
NATURAL HISTORY — Common; a "trunk-crown" anole (Williams 1983), active diurnally on tree trunks and branches, usually above 2 meters above ground; sleeps on leaves. See Medina et al. (2016). See Schwartz and Henderson (1991) and references therein for ecology on Cuba.

— *ANOLIS ALTAE* — PLATE 1.5, 2.33

DESCRIPTION — Dunn, E. R. 1930. Notes on Central American *Anolis*. *Proceedings of the New England Zoological Club* 12:15–24.
TYPE SPECIMEN — MCZ 29385.
TYPE LOCALITY — "Near the Acosta Farm, at about 7,000 feet elevation on the Volcan Barba in Costa Rica." Savage (1974) stated that the Acosta farm is "On the southwestern slope of Volcan Barba, at 2133 m, on the main road from Alajuela to Varablanca, Heredia Province." Given the elevation and Savage's description, I estimate the locality to be at approximately lat 10.1 lon −84.1.
MORPHOLOGY — Body length to 49 M, 51 F; ventral scales weakly keeled; middorsal scales enlarged in 0–2 rows; interparietal usually equal to or smaller than tympanum; scales across the snout between the second canthals 5–12; toe lamellae 13–17; suboculars and supralabials in contact or separated by a row of scales; scales separating supraorbital semicircles 0–3; supraocular scales gradually enlarged; hindlimbs short, adpressed toe to ear or to between ear and eye; body color brown; male dewlap orange.
SIMILAR SPECIES — *Anolis altae* is a *small brown* highland anole that may be distinguished from geographically proximal similar forms as follows: *A. humilis* has greatly enlarged middorsal scale rows and a puncturelike axillary pocket (middorsals undifferentiated, puncturelike axillary pocket absent in *A. altae*); *A. pachypus*, *A. tropidolepis*, *A. cupreus*, *A. limifrons*, *A. biscutiger*, and *A. polylepis* have



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