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Accepted: 11 September 2000.

Journal of Herpetology, Vol. 35, No. 3, pp. 378–383, 2001

A New Anole from the Northern Slope of the Sierra Maestra in Eastern Cuba (Squamata: Iguanidae)

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ABSTRACT.—A new species of anole is described from a region of wet limestone forest in the province of Santiago de Cuba in eastern Cuba. It is sympatric with its close relative *Anolis isolepis* and differs from that taxon in scalation and coloration. Variation in the two subspecies of *A. isolepis* is reconsidered, and they are here regarded as separate species. These three small species with short limbs, a relatively flat head, striate head scales, and green coloration in the light phase are placed in the *isolepis* group of the *carolinensis* series. At least 14 and as many as 20 species of *Anolis* are sympatric in this region of eastern Cuba.

RESUMEN.—Se describe una nueva especie de *Anolis* de los Bosques húmedos de "diente perro" de la provincia de Santiago de Cuba en la región oriental. Esta especie es simpátrida con la formaafin *Anolis isolepis*, differenciándose de este táxon en escamación y coloración. Se reconsidera la variación entre las dos subspecies de *A. isolepis* considerandon a ambas formas como especies differentes. Estas tres especies de miembros cortos, de cabeza relativamente plana, con sus escamas estriadas, y coloración verdosa en la fase clara, son consideradas bajo el grupo *isolepis* de la serie *carolinensis*. No menos de 14, y posiblemente 20 especies de *Anolis* son simpátridas en la región oriental de Cuba.

Anolis isolepis is a small, short-limbed, greenish Cuban species of anole placed in the *carolinensis* series along with other mostly green- or blue-colored species (Williams, 1976; Burnell and Hedges, 1990). It was described by Cope (1861) from material sent to him by the botanist Charles Wright (Underwood, 1905) from Monte Verde, Yateras Muncipio, Guantánamo Province, Cuba. Since its original description, it has been encountered infrequently and is considered to be rare (Gundlach, 1880; Barbour and Ramsden, 1919; Ruibal, 1964; Schwartz and Henderson, 1991). Garrido (1985) reported on some new material and described a subspecies, *Anolis iso-*

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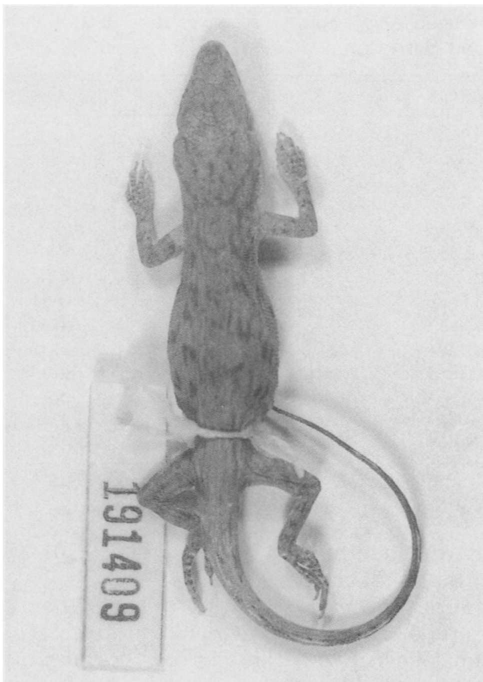

FIG. 1. *Anolis oporinus* (MNHNCU 4522), adult female, holotype.

lepis altitudinalis, from the south slope of Pico Turquino, in the Sierra Maestra. It differs from *Anolis isolepis isolepis* in being larger and in aspects of scalation and coloration. In the course of this study, we have identified new characters further distinguishing *A. i. altitudinalis* from *A. i. isolepis* (see below) and, therefore, consider the former taxon as a separate species, *Anolis altitudinalis*.

Additional material of *A. isolepis* was collected during three joint U.S./Cuban expeditions to the eastern provinces in 1989, 1990, and 1994. During each of these expeditions, a rugged area of wet limestone forest on the northern slope of the Sierra Maestra, near the coffee-growing settlement of La Pimienta, was visited, and herpetological collections were made. Among the new taxa discovered at that site were two species of *Sphaerodactylus* and one of *Anolis*. The geckos have since been described (Thomas et al., 1992; Thomas et al., 1998), and the *Anolis* is described herein. The new anole is related to *A. isolepis* but differs from that species in several aspects of size, scalation, and coloration. We believe that we are justified in describing this new species, represented by a single specimen, because no other individuals were found despite intensive collecting efforts during those three visits to La Pimienta and other nearby areas.

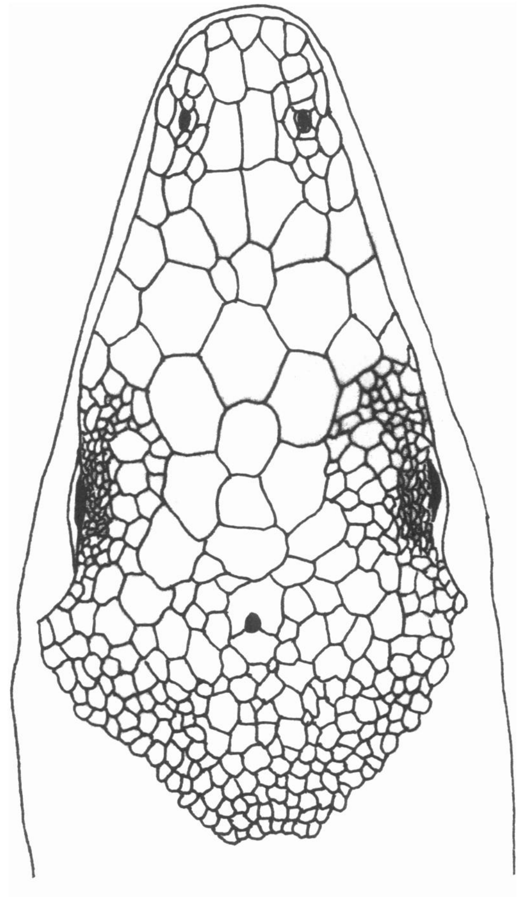

FIG. 2. *Anolis oporinus* (MNHNCU 4522), showing details of head scalation (bar = 5 mm).

Also, typical *A. isolepis* was collected along with the new species at the same locality.

MATERIALS AND METHODS

Measurements were made with a digital readout micrometer caliper and recorded to the nearest 0.1 mm. Illustrations of head scalation were made with a camera lucida. Abbreviations are CZACC (Institute of Ecology and Systematics, Havana, Cuba), MHNH (Museo de Historia Natural "Carlos de la Torre," Holguín, Cuba), MNHNCU (National Museum of Natural History, Havana, Cuba), SVL (snout–vent length), and USNM (United States National Museum of Natural History). Comparisons of the new species with described species of *Anolis* were made by examination of comparative material (see Appendix 1).

Anolis oporinus sp. nov.
(Figures 1–2)

Holotype.—MNHNCU 4522, an adult female from 1.5 km WSW La Tabla, Santiago de Cuba

TABLE 1. Comparison of characters of three species of Cuban *Anolis*. Sample sizes are indicated in parentheses; sexes are combined because of small sample sizes and lack of pronounced sexual dimorphism.

Character	*A. oporinus* (1)	*A. altitudinalis* (7)	*A. isolepis* (36)
Maximum SVL (mm)			
Maximum tail length (mm)	47	52	42
Supraoculars bordering supraorbital semicircle	62	67	50
Supraoculars between granular ciliaries and supra-	15–16	8–10	12–13
ocular semicircle	8–9	5–6	5–6
Size of largest supraocular scale (% SVL)	1.41	2.18–3.10	2.46–3.07
Loreals in contact with first supralabial	Two	One	One
Total loreal scales	11–12	8–10	6–10
Dark bar above pale lateral stripe	Present	Present	Absent
Dark phase coloration	Brown	Purple	Purple
Dewlap color	Yellow	White/pale yellow	Yellow
Shape of mental scale	Squarish	Squarish	Elongate
Sublabials in contact with first infralabial	One	One	Two
Scales between interparietal and rostral	Nine	9–10	10–11

Province, Cuba, 465 m, collected on 4 July 1990 by Emilio Alfaro, Orlando Garrido, S. Blair Hedges, Alfonso Silva, and Richard Thomas (field tag number USNMFS 191409).

Diagnosis.—*Anolis oporinus* is a member of the *carolinensis* series, composed of primarily green, greenish, or blue species with relatively long snouts and biochemical similarities; this group also includes several gray or tan twig anoles of the *angusticeps* group (Ruibal, 1964; Burnell and Hedges, 1990). Aside from this series, the only other green anoles are the canopy giants of the *equestris* series and the small and slender *A. cyanopleurus* with its long tail and large keeled body scales; in both cases they would be unlikely to be confused with *A. oporinus*. Among the species in the *carolinensis* series it is closest to *A. isolepis* and *A. altitudinalis* in being smaller in body size, having short limbs, and possessing a flat dorsal surface of the head with striate head scales (Garrido, 1985). From both species, it can be distinguished by its 15–16 supraoculars bordering the supraorbital semicircles (vs. 12–13 in *A. isolepis* and 8–10 in *A. altitudinalis*), small size of largest supraocular scale (1.41% SVL vs. 2.46–3.07% SVL in *A. isolepis* and 2.18–3.10% SVL in *A. altitudinalis*), two loreals in contact with first supralabial (vs. one in *A. isolepis* and *A. altitudinalis*), 11–12 total loreal scales (vs. 6–10 in *A. isolepis* and 8–10 in *A. altitudinalis*), and in dark phase coloration (brown vs. purple in *A. isolepis* and *A. altitudinalis*). The purple coloration of *A. isolepis* and *A. altitudinalis* is a feature that persists for years in preservative. Additionally, *A. oporinus* can be distinguished from *A. isolepis* by its larger body size (47 mm SVL vs. 42 mm SVL in *A. isolepis*), a squarish mental (vs. mental with elongate labial extensions in *A. isolepis*); one sublabial in contact with first infralabial (vs. two in *A. isolepis*), and nine scales between interparietal and rostral (vs. 10–11 in *A. isolepis*; Table 1).

Description of the holotype.—SVL 46.7 mm, tail length 62.1 mm; head moderately elongate, 14.8 mm long (snout to anterior ear opening) and 8.37 mm wide; head scales large, flat-lying, striate; nostril circular; nasal opening separated from rostral by three scales; rostral wide, in contact with six scales posteriorly. Supraorbital semicircles large, separated by one row of scales of same size or slightly smaller; supraocular scales variable in size, 15 (left)/16 (right) along inner border of supraorbital semicircles, 8/9 between granular ciliaries and supraorbital semicircle at widest (interocular) transect; length of largest supraocular 0.66 mm; one elongate superciliary (anterior); canthal ridge of seven scales well-defined, anteriormost in contact with rostral (Fig. 2); 11/12 total loreals (not counting suboculars and preoculars) in three rows; temporal scales small, flat, separated from supratemporal region by two rows of slightly enlarged scales, in same position as upper postocular dark mark, and arranged in a linear fashion such that the scale junctions form a line emanating from behind eye and arching down to the ear opening; supratemporal scales variable in size but larger around interparietal; interparietal irregular, semidivided, 1.55 × 1.00 mm, separated from supraorbital semicircles by 2/1 scales; ear opening small, vertically elliptical, 1.01 × 0.76 mm, located posterior to and slightly dorsal to the commissure of the mouth.

Suboculars directly in contact with the supralabials, anteriorly grading into loreals, posteriorly continuous with the postoculars; 10/9 total enlarged supralabials, 7–8 to center of eye; 9/10 enlarged infralabials; mental large, divided, each half squarish, in contact with two small elongate postmental scales (Fig. 3); first infral-

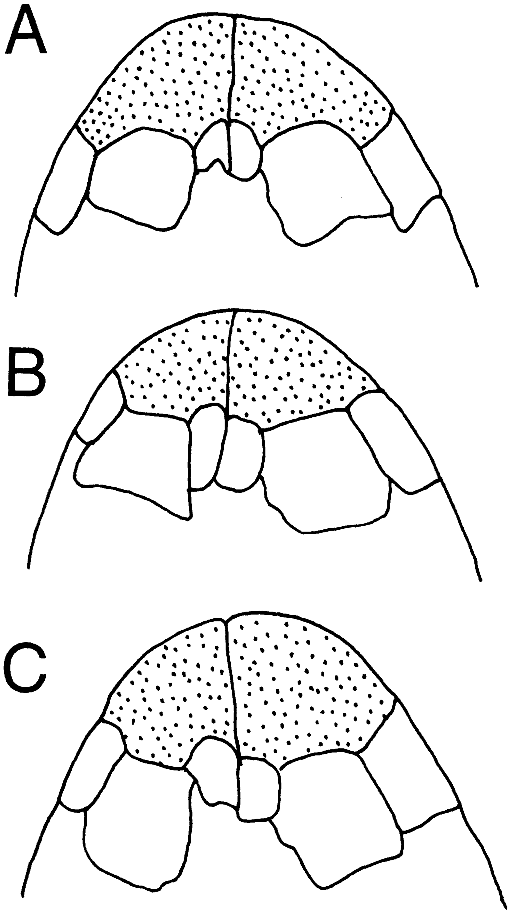

FIG. 3. Shape of mental scales (shaded) in three species of *Anolis*. (A) *A. isolepis* (USNM 538870). (B) *A. oporinus* (MNHNCU 4522). (C) *A. altitudinalis*

abial in contact with first enlarged sublabial only (not first and second); gulars granular, elongate anteriorly, becoming more granular and ovoid posteriorly, gradually merging with ventral scales. Dorsal scales small, granular, merging with slightly larger ventral scales, 24 dorsal scales in distance from snout to anterior edge of orbit; ventral scales swollen and weakly keeled, 21 ventral scales in same distance. Dewlap small; limbs short; femur 9.06 mm; tibial length (8.00 mm) shorter than distance from tip of snout to center of eye (9.01 mm); 29 lamellae under phalanges II and III of fourth toe (lowermost 10 rows divided on each toe); scales of limbs smooth (anterior) or keeled (posterior) dorsally, granular ventrally, those on anterior surface of limb slightly enlarged; supradigital scales smooth. Tail laterally compressed with shallow groove on each side (except near base); no enlarged postanal scales; tail scales evenly keeled posteriorly (above and below); scales around vent and under base of tail granular.

In life, green (in light phase) with darker green or greenish brown marks, including two narrow and nearly parallel postocular bars on each side, the two uppermost bars almost connecting behind head (forming a "U"); irregular marks (spots and chevrons) about 10–15 scales in size scattered over dorsal surface in a camouflage fashion; dark spots on labials; a pale stripe on side of head extending from subocular region to just above insertion of forearm, contrasting with dark postocular bar just above; tail with about 10 brownish verticils; throat with scattered dark spots; throat fan yellow. In the dark phase, the specimen was brown, with darker brown markings.

Natural History.—The type locality is in a region of limestone mogotes (haystack hills), with coffee fields (cafetales) and some cattle grazing. The specimen was collected during the day in vegetation along the road. Nothing is known about its microhabitat or behavior. Other species of reptiles collected at this site were *Alsophis cantherigerus, Amphisbaena cubana, Anolis allogus, Anolis alutaceus, Anolis guazuma, Anolis homolechis, Anolis isolepis, Anolis lucius, Anolis noblei, Anolis porcus, Anoilis sagrei, Sphaerodactylus cricoderus, Sphaerodactylus pimienta,* and *Typhlops lumbricalis*. In addition, *Anolis argenteolus, Anolis loysianus, Anolis ophiolepis,* and *Anolis porcatus* are known to occur at that locality (A. Fong, pers. comm.).

Etymology.—The specific name *oporinus* is derived from the Greek word for autumn, *opora*. It is used here in allusion to the color change in this species, from green to brown.

Distribution.—*Anolis oporinus* is known only from the type-locality, which is located roughly south of Jiguaní near the border of Granma and Santiago de Cuba provinces. It is on the northern slopes of the Sierra Maestra at an elevation of 465 m.

DISCUSSION

The sympatry between *A. isolepis* and *A. oporinus* is the best evidence that the latter taxon is a valid species. *Anolis altitudinalis* originally was described as a subspecies of *A. isolepis* (Garrido, 1985), but apparently they are sympatric in the region of Pico Cardero on the south slope of Pico Turquino (see Appendix 1). *Anolis altitudinalis* is not known to be sympatric with *A. oporinus*, but we consider the two to be separate species because there are more diagnostic differences (nine characters) separating them than separating the sympatric species *A. altitudinalis* and *A. isolepis* (seven characters; Table 1). Nonetheless, several characters not present in *A. isolepis* are shared by *A. altitudinalis* and *A. oporinus* and may indicate that they are sister species: a more compact (squarish) mental, infralabial one in contact with only one enlarged sublabial, and some details of the color pattern. The significance of these characters for the relationships of the three taxa must await more detailed study of species in the *carolinensis* series of *Anolis*.

Recently, another species in the carolinensis series, *A. incredulus*, was described from Cuba (Garrido and Moreno, 1998). It is a small species known only from the type locality on Pico Turquino in the Sierra Maestra. Although it was compared with *A. altitudinalis*, with which it is sympatric, it is quite different in scalation from the three species in the *isolepis* group. For example, the head scales are smooth (not striate), it has a large interparietal surrounded by many small scales, and one or two greatly enlarged supraocular scales (Garrido and Moreno, 1998). Its relationship to other species in the series remains unknown, and perhaps it should be placed in its own species group.

With the addition of *A. oporinus*, 14 species of *Anolis* are now known from La Pimienta (see Natural History above). This is one of the largest numbers of sympatric species of *Anolis* known from the West Indies (Williams, 1983) and is second only to the recent report of 15 sympatric species at a locality in the Cabo Cruz region of eastern Cuba (Diaz et al., 1998). However, six additional species of *Anolis* are known to occur in areas near La Pimienta and thus may also occur at this locality: *Anolis argillaceous*, *Anolis centralis*, *Anolis chamaeleonides*, *Anolis rejectus* (Garrido and Hedges, 2000), *Anolis smallwoodi*, and *Anolis vanidicus*. Therefore, it is possible that as many as 20 species of *Anolis* occur sympatrically in this area. It will be of great interest to know more about the ecological habits of these species so that we can better understand how such a large number of niches are partitioned.

Acknowledgments.—We thank the members of the 1989–1994 Penn State/Cuba herpetological expeditions (E. Alfaro, R. Arencibia, A. R. Estrada, A. Pérez-Asso, O. Perez-Beato, L. González, D. McCallister Jr., A. Silva, A. Sampedro, and R. Thomas) for their assistance; the Cuban National Museum of Natural History and Institute of Ecology and Systematics for permits and support; the staff of the United States National Museum of Natural History (Washington, DC) for accession of specimens; and T. Jackman and R. Powell for comments on the manuscript. This research was supported by grants from the U.S. National Science Foundation (to SBH).

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Accepted: 21 September 2000.

Appendix 1

Specimens Examined

Anolis isolepis (36).—Holguín Prov.: Arroyo Bueno, La Melba (MHNH 14280); La Soilita, Sierra Cristal (MHNH 14203); Pinares de Mayarí (MHNH 14210); Cabonico, Mayarí (MHNH 14265); Playa Pesquero, R. Freyre (MHNH 14262); El Peñon, Estero Ciego, R. Freyre (MHNH 14279); Río Piloto, Mayarí (MHNH 14315); Río Cabonico, Mayarí (MHNH 14319); 3 km W Caletones, Gibara (MHNH 14318); El Jobal, Los Hoyos, Gibara (MHNH 14278); Campamento Los Rusos, Yateras (MHNH 14361); No data (MHNH 14264); Cupeyal (CZACC 4-7030, 4-7035); Base del Monte Iberia, Nibujón (IZ

3534, 7031, 7034); Arroyo los Gatos, Jaguaní (MNHNCU 110); Cabezadas del Jaguaní (MNHNCU 3789). Guantánamo Prov.: El Molino, 405 m (USNM 538869); 4.9 km S La Tagua, 660 m (USNM 538870); Camino a Santa Rosa de Sabana, Maisi (MNHNCU 14315). Granma Prov.: Meseta de Cabo Cruz (MNHNCU, 4 uncataloged specimens). Santiago de Cuba Prov.: 1.5 km WSW La Tabla, 465 m (USNM 538871–872); Isabelica, Gran Piedra (MNHNCU 2194); Alto del Cardero, Pico Turquino (CZACC 4-7039); Cardero, Turquino (CZACC 4-7036); Loma del Gato, Honsolosongo (CZACC 4-7038, 4-7040); Sancti Spíritus Prov.; Cafetal de Gaviñas, Sierra de Trinidad (CZACC 4-7033); San Blás, Sierra de Trinidad (CZACC 4-7041, 4-4511).

Anolis altitudinalis (7).—Santiago de Cuba Prov.: Pico Turquino (CZACC 4-7027, holotype); near Pico Turquino (CZACC 4-7024; 4 specimens); Pico Cardero, 1230 m (USNM 538873); Pico Cuba, 1720 m (USNM 538874).

Journal of Herpetology, Vol. 35, No. 3, pp. 383–395, 2001

Distribution of Maximum Snout–Vent Length among Species of Scincid Lizards

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ABSTRACT.—The distribution of maximum snout–vent length for 1206 of the approximately 1227 described species of scincid lizards ranges from 23–490 mm, has a mode of 55 mm, a median of 69 mm, a mean of 82 mm, and is strongly right skewed. At both the small and large ends of the distribution, there are noticeable lineage effects, that is, a few lineages contribute a large proportion of the species. Perhaps surprisingly given the surface-volume relationships of small animals, many of the smallest species occur in arid or seasonally arid habitats. Egg size may be the limiting factor in the evolution of small adult size. The larger species tend to be burrowers (litter and sand swimmers), have diets different from the usual (for scincids) arthropods, occur on small oceanic islands (absence of predators?), or are live-bearing. Species of skinks that have gone extinct in the last 200 years have been relatively larger than species that have survived. The overall shape of the size distributions for scincids and gekkonids, the only other major group for which there are comparable data, are surprisingly similar, suggesting a common cause such as tracking evolutionarily the same size spectrum of arthropod prey.

Size is a key feature in the biology of most animals because of its relationship to a wide variety of ecological and physiological attributes (Peters, 1983; Calder, 1984; Schmidt-Nielsen, 1984; Harvey and Pagel, 1991). But what determines size? One approach to this question is to examine the distribution pattern of some measure of size both within and among lineages. Here I present the distribution curve for one aspect of size, maximum snout–vent length, for the largest family of lizards, the skinks; make some observations about its shape and some attributes of the species at its extremes (where correlating factors are likely to be most pronounced), and compare it with the only other large group of lizards for which there are similar data, the geckos.

There are approximately 1227 described species of living and recently extinct (since European expansion) scincid lizards (pers. obs.). These species comprise approximately 31.7% of all lizard species (based on a total of 3865 species, Bauer, 1992). Skinks are also one of the most diverse lizard groups, in part, because of their repeated reduction of limbs and their consequent extension into subsurface microhabitats. Data on size for 1206 species of skinks (98.3% of all skink species) form the basis of this analysis.

MATERIALS AND METHODS

Maximum snout–vent length (SVL and henceforth, size), measured to the nearest whole millimeter, was the variable chosen to estimate species size. There were two reasons for choosing this variable. First, it is easy to determine, especially from the literature, and, hence, it can be broadly surveyed. Second, it is indicative of the