Caribbean Journal of Science, Vol. 31, No. 1-2, 65-72, 1995

University of Puerto Rico, Mayagüez

A New Species of *Anolis* (Sauria: Iguanidae) from Eastern Cuba

ALBERTO R. ESTRADA[1] AND S. BLAIR HEDGES[2]

1 *Instituto de Investigaciones Forestalls, Apartado 5152, La Habana 5, C.P. 10500, Cuba*
'Department of Biology, 208 Mueller Laboratory, Pennsylvania State University, University Park, Pennsylvania 16802, USA

ABSTRACT. – *Anolis alayoni* is described from upland localities in eastern Cuba. It is a cryptic species, and the fourth member of the twig ecomorph of Cuban *Anolis*. Morphological data suggest that its closest relative is the partly sympatric species *A. angusticeps*.

The largest amniote genus, *Anolis* (>300 sp.), is represented in Cuba by more than 50 species (Estrada and Garrido, 1991; Garrido and Hedges, 1992; Hass et al., 1993). One of the most unusual groups of this widespread genus on Cuba is the *angusticeps* group, of which there are three species: *Anolis angusticeps, A. guazuma,* and *A. paternus* (Williams, 1976; Burnell and Hedges, 1990). All three are members of the twig ecomorph (Williams, 1983), characterized by a cryptic morphology (resembling a twig) and behavior.

Anolis angusticeps has been the focus of attention of several previous studies. Hardy (1966) studied variation in the Cuban and Bahama Islands populations, and described *A. angusticeps paternus* from Isla de la Juventud. Schwartz and Thomas (1968) examined variation in *A. angusticeps* in more detail, including in their analysis specimens from eastern Cuba. Later, Garrido (1975) analyzed variation in western populations and treated *A. paternus* as a distinct species. Finally, Garrido (1983) described *A. guazuma* from Pico Turquino in Santiago de Cuba province. In this paper, we describe a fourth Cuban twig anole from localities in two eastern provinces of Cuba: Holguín and Guantánamo.

In the account below, the following abbreviations are used: MNHNCU (Museo National de Historia Natural de Cuba), CZACC (Colecciones Zoologicas, Instituto de Ecología y Sistemática, Academia de Ciencias de Cuba), USNM (United States National Museum of Natural History, Smithsonian Institution), and CARE (A. R. Estrada Collection).

Anolis alayoni sp. nov.
(Fig. 1A)

Holotype. —MNHNCU 2746, an adult male from La Fangosa, Yateras, Guantánamo Prov., Cuba, collected by Alberto R. Estrada on 22 June 1990.

Paratypes. —(29) CARE 60800, male, same collecting data as holotype; MCZ R178768 (male) and CARE 60721 (female), between Cayo Fortuna and Riito, Yateras, Guantánamo Prov., 11 March 1989, collected by A. R. Estrada; MCZ R178769, CARE 60801, female, Arroyón, San Antonio del Sur, Guantánamo Prov., 22 June 1990, collected by A. R. Estrada; CARE 60872, female, Cayo Fortuna, Yateras, Guantánamo Prov., 16 March 1987, collected by Antonio Pérez-Asso; CARE 60759, 60819, females, Piedra la Vela, Yateras, Guantánamo Prov., 22 March 1989, collected by A. R. Estrada and A. Pérez-Asso; CARE 60299, female, Farallones de la Italiana, Levisa, Mayarí, Holguín Prov., 18 September 1987, collected by A. R. Estrada and Orlando H. Garrido; CARE 60327 female, Cayo Guan, Mea, Holguín Prov., 3 October 1987, collected by A. R. Estrada; CARE 60797, 60799 females, España Chiquita, Sierra de Canasta, El Salvador, Guantánamo Prov., 20 June 1990, collected by A. R. Estrada; CARE 60186, male, Arroyo Culebra de Hacha, Mea, Holguín Prov., 21 September 1986, collected

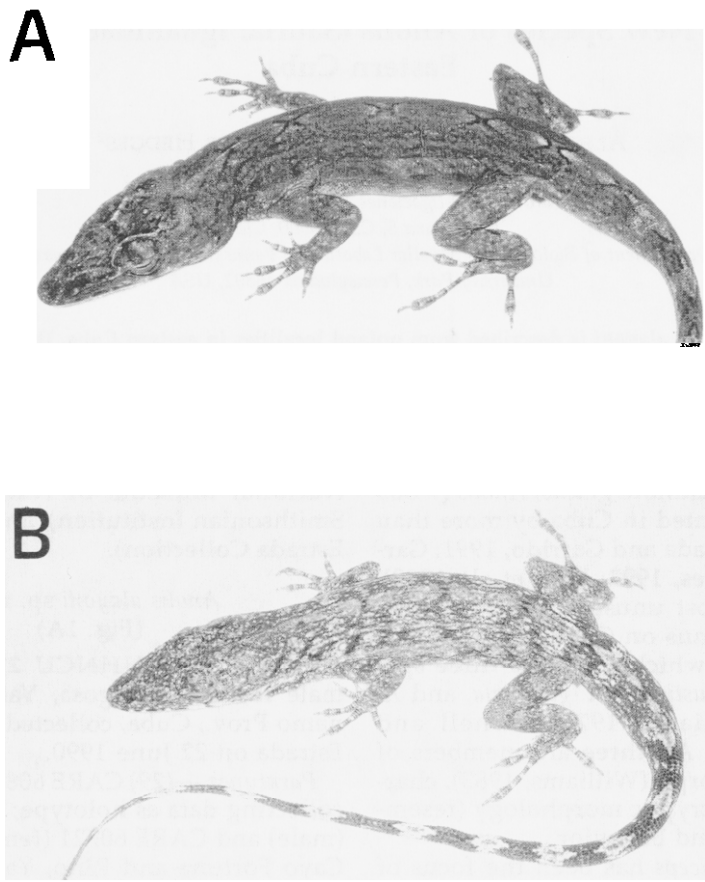

FIG. 1. (A) *Anolis alayoni* (El Molino, Guantánamo Prov.), and (B) *A. angusticeps* (9 km W Trinidad, Sancti Spíritus Prov.).

by A. R. Estrada; MNHNCU 31, male, 3 km E La Melba, Mea, Holguín Prov., 23 September 1987, collected by Carlos Peña and Orlando H. Garrido; MNHNCU 2762, female, Sumidero del Río Cuzco, El Salvador, Guantánamo Prov., 16 June 1990, collected by Alfonso Silva Lee; USNM 335020, El Molino (ca. 7 km W Palenque), Yateras, Guantánamo Prov., 21 June 1990, collected by S. Blair Hedges; MNHNCU 51,70, males, La Poa, Sabanilla, Baracoa, Guantánamo Prov., between November 1986 and March 1987, collected by O. H. Garrido; MNHNCU 1607, male, Yumurí, Maisí, Guantánamo Prov., 27 July 1989, collected by Riberto Arencibia; CZAZZ 7400, (old number IZ 6267), male, Yumurí, Maisí, Guantánamo Prov.., 20 September 1980. collected by Noel González; CZACC 7302 (old number IZ 4220), male, Arroyo Blanco, Baracoa, Guantánamo Prov., 27 May 1974, collected by O. H. Garrido; CZAZZ 9778 (old number IZ5272), male, Sabanilla, Baracoa, Guantánamo Prov., May 1978, collected by Anfiloquio Suárez; CZACC 7325, female, La Florida, Baracoa, Guantánamo Prov., 14 September 1965, collected by O. H. Garrido; CZACC 7326, 7332, female and male, Base de Monte Iberia, Baracoa, Guantánamo Prov., 9-10 March 1972, collected by Jorge de la Cruz and Luís F. de Armas; CZACC 7377, male, Base de Monte Iberia, Baracoa, Guantánamo Prov., 9 March 1972, collected by O. H. Garrido; CZACC 7264

(old number IZ 5941), male, Gran Tierra, Maisí, Guantánamo Prov., 10 May 1972, collector unknown; CZACC 7266 (old number IZ 5929), male, Nibujón, Baracoa, Guantánamo Prov., Lorenzo Zayas; CZACC 7329-30, female and male, 9 km S from Aserrío.

Diagnosis. —A small species ($\bar{x}$ SVL 42.2 mm males; 36.6 mm females) of *Anolis* with short limbs, long snout, short semiprehensile tail, and enlarged scales on dorsal surface of head. *Anolis alayoni* is a member of the *angusticeps* species group of *Anolis,* which includes *A. angusticeps, A. guazuma,* and *A. paternus.*

From A. guazuma, it can be distinguished by a tail longer than SVL (shorter in *guazuma),* 1-2 scales between supraorbital semicircles (modally 0 in *guazuma),* keeled head scales (smooth in *guazuma),* well-developed yellow dewlap (small and whitish in guazuma), and other scale and pattern features. From *A. paternus,* it can be distinguished by smooth ventral scales (keeled in paternus) and larger body size.

From its closest relative, *A. angusticeps,* it can be distinguished by large size of the males ($\bar{x}$ SVL = 42.2 mm in *alayoni;* 39.9 mm in *angusticeps*) and the color of the dewlap: dark yellow in *alayoni,* pale orange or peach in *angusticeps*. Scale characters which can distinguish most *A. alayoni* from most *A. angusticeps* are: modally 11 (8-12) scales around the interparietal in males, 10 (9-13) in females of *alayoni* (modally 13 [11-16] in males, bimodally 13 and 14 [12-15] in females of *angusticeps);* modally two [2-3] scales between naris and rostrum in *alayoni* (modally three [2-3] in *angusticeps),* modally four (3-5) scales between nares in *alayoni* (modally five [3–6] in *angusticeps),* modally 15 (13–16) lamellae under phalanges II and III of fourth toe in *alayoni* (modally 13 [12-20] in *angusticeps),* modally four (2-6) postmarital scales in *alayoni* (modally six [4-7] in males, four [4-6] in females of *angusticeps),* bimodally 20 and 22 (18-28) middorsal scales in *alayoni* (bimodally 35 and 37 [26-37] in *angusticeps).* In combination, these color, measurement and modal scale differences clearly distinguish all specimens of *alayoni* and *angusticeps.*

Description .—Head narrow and elongate; head scales enlarged, hexagonal, more or less keeled, smallest anteriorly; nostril circular; nasal scale separated from rostral by 2-3 (modally two; two in holotype) irregularly shaped scales; supraorbital semicircles large, convex, rugose laterally, separated by 1-2 (modally one; one in holotype) rows of scales of small size; canthal ridge with five scales well-defined, second canthal longest, diminishing in size anteriorly; supraorbital ridge well-defined in both sexes; frontal ridge well-defined, confluent anteriorly; 10-29 loreal scales (modally 24; 22 in holotype); temporal scales small; interparietal about 1.4 times as long as wide, separated from supraorbital semicircles by one scale or in contact (one in holotype); 8-13 scales around the interparietal (modally 11; 10 in holotype); ear opening small, elliptical or subcircular, behind mouth commisure; 5-9 (modally 7; 7 in holotype) scales between second canthals; 3-5 (modally four; five in holotype) scales between nasal scales; suboculars directly in contact with supralabials, anteriorly grading into loreals; 6-10 (modally eight; eight in holotype) supralabial scales; mental large, divided, in contact with 4-6 small, granular postmarital scales (modally four; five in holotype).

Trunk with dorsal scales small, granular; two middorsal rows larger, 25-35 scales in 0.5 cm on middorsal region (modally 28; 26 in holotype); ventral scales larger than dorsals, smooth, rounded, arranged in transverse rows, 18–28 scales in 0.5 cm on midventral region (bimodally 20 and 22; 22 in holotype); dewlap large (Fig. 2), present in both sexes, but vestigial in females; scales large and arranged in rows, larger than throat scales; limbs short, tibial length shorter than femoral length, quotient of humeral length/tibial length 0.74- 1.0 (0.88 in holotype); 13–16 (15 in holotype) lamellae under phalanges II and III of fourth toe; scales of supracarpal smooth; scales of hind limbs smooth, keeled on supratarsals; tail laterally compressed, broader at the base.

Coloration in life pale grayish-brown (in light phase), with black and brown linchenate markings; 4-5 brown or black crossbands or blotches with "X" form on middorsal line; 5–7 more distinct brown bands on tail, alternating with gray bands;

TABLE 1. Measurements of *Anolis alayoni* and *A. angusticeps.* Snout-vent length (SVL); head length (HL); head width (HW); jaw length (JL); interorbital distance (IO); naris-snout distance (NS); snout-orbit distance (SO); internarial distance (IN); interparietal scale length (IPL); interparietal scale width (IPE); ear opening vertical diameter (EVD); ear opening horizontal diameter (EHD); humeral length (HUL); tibial length (TL); femoral length (FL); tail length (TAL); axilla-groin distance (AG); mean (1); standard deviation (SD); minimum-maximum (m-M); sample size *(n).*

	A. alayoni		*A. angusticeps*	
	Males	Females	Males	Females
Character	$\bar{x}$ SD *n* m - M	$\bar{x}$ SD *n* m-M	$\bar{x}$ SD *n* m-M	$\bar{x}$ SD *n* m-M
SVL	42.2 2.89 16 35.8 -46.8	36.6 1.74 13 33.3 -38.9	39.9 2.7 10 34.3 -44.8	38.7 2.22 6 36.6 -42.2
HL	12.6 0.79 16 10.9-13.8	10.2 0.47 13 8.9-10.7	11.6 0.99 10 10-13.1	10.1 0.44 6 9.5-10.8
HW	7.5 0.66 16 6.2-8.8	6.0 0.59 13 5.2-7.4	6.5 0.52 10 5.6-7.2	5.8 0.52 6 5.4-6.7
JL	10.9 0.77 16 9.2-12.2	8.8 0.41 13 7.8-9.3	9.9 0.93 10 8.2-11.5	8.8 0.56 6 8.2-9.4
IO	4.3 0.38 16 3.7-5.0	3.6 0.28 13 3.1-4.0	3.9 0.42 10 3.2-4.5	3.5 0.28 6 3.1-3.8
NS	1.3 0.10 16 1.1-1.5	1.1 0.09 13 1.0-1.3	1.2 0.19 10 1.0-1.6	1.1 0.18 6 0.7-1.2
SO	5.7 0.40 16 5-6.5	4.5 0.33 13 3.8-5.1	5.3 0.72 10 4.5-6.8	4.8 0.35 6 4.4-5.2
IN	1.6 0.16 15 1.2-1.8	1.3 0.10 13 1.2- 1.5	1.4 0.17 9 1.1-1.6	1.5 0.17 6 1.3-1.6
IPL	1.8 0.26 16 1.1-2.2	1.49 0.21 12 1.2- 1.9	1.7 0.33 10 1.4-2.0	1.4 0.34 6 1.0-1.8
IPW	1.2 0.26 16 0.9-2	1.0 0.15 12 0.9-1.4	1.4 0.25 10 1.0-1.8	1.1 0.19 6 0.8-1.3
EVD	0.8 0.1 16 0.5-1.0	0.6 0.1 12 0.4-0.9	0.6 0.09 10 0.6-0.9	0.5 0.08 6 0.4-0.6
EHD	0.7 0.1 16 0.5-1.0	0.6 0.1 12 0.4-0.9	0.5 0.1 10 0.3-0.7	0.5 0.1 6 0.4-0.7
HUL	6.6 0.5 16 5.6-7.6	5.7 0.3 13 5.1-6.2	6.1 0.7 10 4.3-7.2	5.4 0.2 5 5.1-5.6

TABLE 1. Continued.

Character	*A. alayoni* Males $\bar{x}$ SD *n* m - M	*A. alayoni* Females $\bar{x}$ SD *n* m-M	*A. angusticeps* Males $\bar{x}$ SD *n* m-M	*A. angusticeps* Females $\bar{x}$ SD *n* m-M
TL	7.4 0.5 16 6.2-8.6	6.4 0.3 13 5.7-7.6	7.1 0.5 10 6.0-8.1	6.3 0.19 6 6-6.6
F1	8.9 0.6 16 7.6-9.8	7.5 0.6 13 6.4-8.7	8.3 0.6 10 6.7-8.8	7.5 0.3 6 7.2-8
TAL	46.4 5.15 6 41.9-53.3	44.5 5.83 8 36.0 -55.0	45.3 5.68 7 38.6-54.8	54.6 4.66 3 50.5 -59.7
AG	16.9 1.5 16 13.5 -19.4	15.3 1.3 13 13.5 -16.9	15.3 1.9 10 11.5-18.6	15.4 1.3 6 12.9 -16.6

a simple black or brown dot postventral to ear opening; about 4 narrow dark brown lines radiating from eye; orbital region reddish-brown; dorsal surface of head light brown; yellowish-beige lateral stripe from ear to hind limb insertion; grayish-brown flanks above and below lateral stripe; pale yellow postmarital and throat, with 5-6 brown bands on each side; yellow from chest to belly, with brown spots; base of tail reddish; dewlap yellow ochre in males, pale yellow anteriorly; scales in margin

TABLE 2. Meristic characters of *A. alayoni* and *A. angusticeps.* Scales around interparietal (SAI); scales between naris and rostral (SNR): middorsal scales in 0.5 cm (SMD); midventral scales in 0.5 cm (SMV); rows of scales between supraorbitals (RSS); scales between interparietal and supraorbital (SSI); supralabial scales (SSL); infralabial scales (SIL); loreal scales (SL); internarial scales (SIN); lamellae under II-III fourth toe phalanges (L4T); postmarital scales (SPM); scales between second canthal (SSC). Mean (z); mode (M); sample size (n).

	$\bar{x}$ M *n*	SAI	SNR	SMD	SMV	RSS	SSI	SSL	SIL	SL	SIN	L4T	SPM	SSC
A. alayoni														
Males		10	2	28	22	1		8	9	22	4	15	5	7
		11	2	28	20-22	1	1/1	8	8	24	4-5	15	4	7
		15	14	16	16	16	16	16	16	16	16	16	16	16
Females		11	2	30	19	1		8	8	19	4	15	5	8
		10	2	28	20	1	0/0	8	8	—	4	15	4	7
		13	13	13	13	13	13	13	13	13	13	10	13	13
A. angusticeps														
Males		13	3	32	26	1		8	9	26	5	15	5	7
		13	3	—	—	1	1/1	8	8	24	5	13-14	6	7
		10	10	10	10	10	10	10	10	10	10	10	10	10
Females		14	3	31	21	1		9	10	20	5	15	5	7
		13-14	3	—	—	1	1/1	—	9	—	5	13	4	6
		6	6	6	6	6	6	6	6	6	6	6	6	6

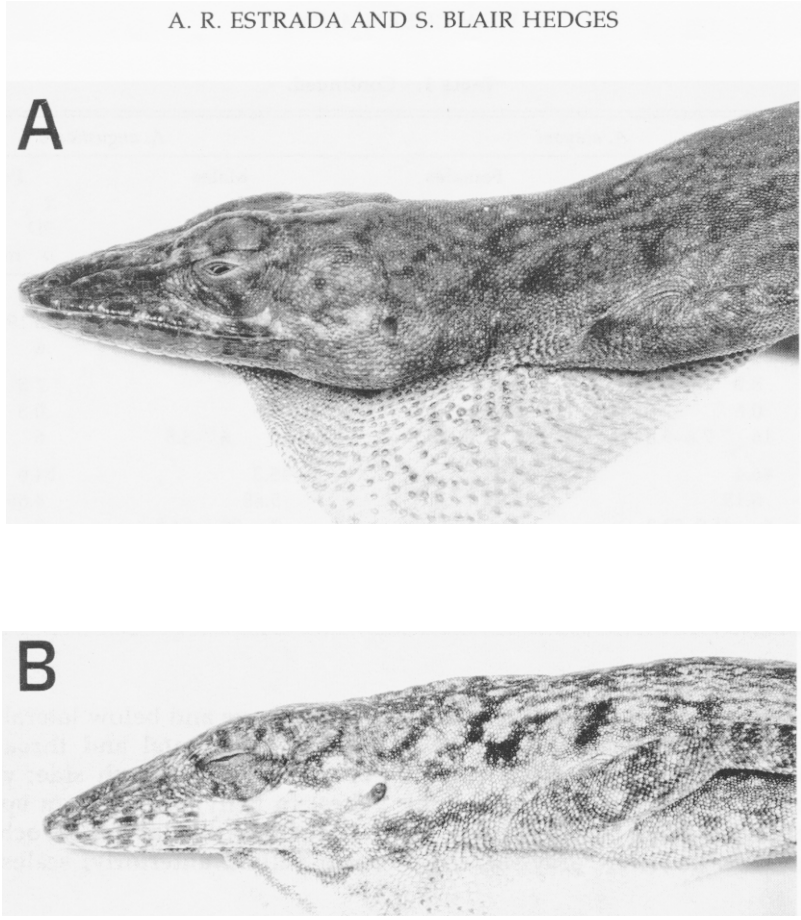

FIG. 2. Extended dewlaps of (A) *Anolis alayoni* (El Molino, Guantánamo Prov.), and (B) *A. angusticeps* (9 km W Trinidad, Sacti Spiritus Prov.).

yellow, light brown inside. Animals with dark phase have the same patterns, but with some differences general coloration dark reddish-brown; dark brown orbits; dorsal surface of head and lores dark brown; mid-dorsal brown stripe with a light fine line in the middle; brown belly with dark spots (CARE 60800). Some animals have black or dark brown blotches on sides below the mid-dorsal stripe and above the lateral light stripe (MCZ R178769, CARE 60798).

Measurements of Holotype.— SVL 46.8, 13.8, 7.1, tibial length 8.0, femoral length 9.4, and tail length 53.3. Complete measurements for *A. alayoni* and comparison with *A. angusticeps* are given in Tables 1 and 2.

Distribution (Fig. 3).—Known only from upland areas of Holguín and Guantánamo provinces in eastern Cuba. Alitudinal range 200-900 m.

Etymology. –The new species is dedicated to our friend, and distinguished Cuban arachnologist, Giraldo Alayón.

Natural History. –Anolis alayoni occurs in various kinds of forest. In the Sierra de la Canasta (España Chiquita), it was observed on tree trunks and twigs at two or three meters above the ground, in very dry woods. Animals from Cayo Fortuna, Piedra

FIG. 3. Distribution of two species of *Anolis* in eastern Cuba. Localities for *A.alayoni* (circles) are (from west to east): Farallones de la Italiana (Sierra del Cristal), Sumidero del Río Cuzco (western Meseta del Guaso), España Chiquita (Sierra de Canasta), Culebra de Hacha (Cuchillas de Mea), Piedra la Vela (Cuchillas de Tea), Cayo Fortuna (Cuchillas de Toa), Riíto (Cuchillas de Toa), Cayo Cuan (Alturas de Baracoa), 3 km E de la Melba (Cuchillas de Toa), Arroyón (Sierra del Purial), Base de Monte Iberia (Alturas de Baracoa), Aserrío Nuevo Mundo (Alturas de Baracoa), Nibujón (Alturas de Baracoa), Nibujón and La Florida (Alturas de Baracoa), Sabanilla (Cuchillas de Baracoa), Boca del Yumurí y Gran Tierra (Meseta de Maisí). The localities of *A. angusticeps* (triangles) are: San Ramon, Bajada del Pesquero de la Alegría (Meseta de Cabo Cruz), Finca La Bahia, Pico Turquino, La Mula, 4 km W del Uvero, Santiago de Cuba, Playa Siboney, Playa Jaragua, Sardinero, Cuchillas de Guajimero, 9 km SE Mea, Ovando Arriba.

la Vela a Culebra de Hacha, and Cayo Guan, were collected in very dry vegetation associated with *Pinus cubensis*, termed "Charrascal." These animals were perched on twigs and tree trunks at about the same height. The specimens from Arroyón were collected on twigs very close to the river in secondary rainforest. The same situation was observed for specimens from La Melba, Rio Cuzco, and Farallones de la Italiana. Animals collected at El Molino were sleeping on twigs at night several meters above ground next to a small stream.

Remarks. -Ruibal (1964:488) reported a peach dewlap color for Cuban examples of *A. angusticeps*, and in our experience this is the typical color throughout the range of that species. However, there is some variation, and Schwartz and Thomas (1968: 55-56) reported a male from Pinar del Río with a yellow dewlap. The dewlap color of *alayoni* is always yellow, and females have a yellow throat.

Although *A. alayoni* has not been taken syntopically with *A. angusticeps*, the distributions of these two species overlap broadly (Fig. 3). Three localities for *A. angusticeps* lie within the range of *A. alayoni* and are only a few kilometers from localities of *A. alayoni* (Fig. 3), therefore these two species should be considered sympatric.

Acknowledgments. —For collecting permits and general support, we thank Gilberto Silva and the staff of the Museo Nacional de Historia Natural de Cuba. Luis V. Moreno and Luis F. de Armas (I.E.S. Habana, Cuba) loaned us comparative material from CZACC, Academia de Ciencias de Cuba. The curatorial staffs of the American Museum of Natural History, Museum

of Comparative Zoology, and the National Museum of Natural History (Smithsonian Institution) kindly allowed the senior author to examine specimens in their collections. This research was supported in part by grants from the U.S. National Science Foundation (BSR 8906325 and DEB 9123556) to S.B.H.

Literature Cited

Burnell, K. L., and S. B. Hedges. 1990. Relationships of West Indian *Anolis* (Sauria: Iguanidae): an approach using slow-evolving protein loci. Carib. J. Sci. 26:7-30.

Estrada, A. R., and O. H. Garrido. 1991. Dos nuevas especies de *Anolis* (Lacertilia: Iguanidae) de la región oriental de Cuba, Carib. J. Sci. 27:146-161.

Garrido, O. H. 1975. Variación de *Anolis angusticeps* Hallowell (Lacertilia: Iguanidae) en el Occidente de Cuba. Poeyana 144:1-18.

——. 1983. Nueva especie de *Anolis* (Lacertilia: Iguanidae) de la Sierra del Turquino, Cuba. Carib. J. Sci. 19(3-4):71-76.

——, and S. B. Hedges. 1992. Three new grass anoles (Sauria: Iguanidae) from Cuba. Carib. J. Sci. 28:21-29.

Hardy, J. D. 1966. Geographic variation in the West Indian lizard, *Anolis angusticeps*, with the description of a new form, *Anolis angusticeps paternus*, subsp. nov., from the Isle of Pines, Cuba (Reptilia: Iguanidae). Carib. J. Sci. 6(1-2):23-31,

Hass, C. A., S. B. Hedges, and L. R. Maxson. 1993, Molecular insights into the relationships and biogeography of West Indian anoline lizards. Biothem. Syst. Ecol. 21:97-114.

Ruibal, R. 1964. An annotated checklist and key to the anoline lizards of Cuba, Bull. Mus. Comp. Zool. 130(8):476-520.

Schwartz, A., and R. Thomas. 1968. A review of *Anolis angusticeps* in the West Indies. Quart, J, Florida Acad. Sci. 31(1):52-69.

Williams, E. E. 1976. West Indian anoles: a taxonomic and evolutionary summary. 1. Introduction and a species list. Breviora, Museum of Comparative zoology 440:1-21.

——. 1983. Ecomorphs, faunas, island size, and diverse end points in islands radiations of *Anolis*. In R. B. Huey, E. R. Pianka, and T. W. Schoener (eds.), Lizard ecology, pp. 326-370, Harvard University Press, Cambridge.

Appendix

Specimens Examined

Anolis angusticeps (25).—CUBA: Bosque de La Habana, Ciudad de La Habana, CARE 60814- 17; Ciénaga de Zapata, Matanzas, CZACC 7420-21 (IZ 273-74); San Miguel de los Baños, Jovellanos, Matanzas, MNHNCU 1259, 1261-62; Cayo Cantiles, Archipiélago de los Canarreos, CZACC 7335 (IZ864), Cayo Juan Garcia, Cayería de San Felipe, CZACC 7336 (IZ865), Río Calabazas, Placetas, Villa Clara, MNHNCU 3238; Bajada al Pesquero de la Alegría, Niquero, Granma, CARE 60536; La Mula, 4 km W de Uvero, Guamá, Santiago de Cuba, CZACC 6120, Santiago de Cuba, CZACC 7263; Playa Siboney, Santiago de Cuba, CZACC 7445; Sardinero, Santiago de Cuba, CZACC 7428; San Ramon, Campechuela, Granma, MCZ 59248-50 (skeleton); Finca La Bahia, 32 km SW de Victoria de las Tunas, La Tunas, MCZ 59251-52; 9 km SE of Mea, Holguín, MCZ 59253; Río Ovando Arriba, Maisí, Guantánamo, MCZ 42469, 42526; Cuchillas de Guajimero, 23.37N, 75.04W, near Guayabal de Yateras, Guantánamo, MCZ 42558; Pico Turquino, Guamá, Santiago de Cuba, MCZ 50154; Playa Jaraguá, Santiago de Cuba, AMNH 96500.