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Morphological variation in *Norops capito* (PETERS, 1863), a wide-spread species in southeastern Mexico and Central America

GUNTHER KÖHLER, ARNE SCHULZE & MILAN VESELY

Abstract. Pholidosis, morphometrics, and hemipenis morphology of the Central American anole *Norops capito* (PETERS, 1863) are described. Head scalation and hemipenis illustrations and a distribution map are provided. No individual or geographic variation is evident in hemipenis morphology among the material studied. There is no evidence for cryptic species among the various populations of *Norops capito.*

Key words. Squamata: Iguanidae: *Norops capito*; geographic distribution; morphological variation; hemipenis morphology.

Resumen. Se describe la folidosis, morphometría y la morfología del hemipene del anoli centroamicano *Norops capito* (PETERS, 1863). Se incluye ilustraciones de las escamas de la cabeza y del hemipene. No se evidencia ninguna variación individual o geográfica en la morfología de los hemipenes del material estudiado. No se evidencia ninguna especie críptica en las diversas poblaciones de *Norops capito.*

Introduction

In 1863, PETERS described *Anolis capito* (Fig. 1) on the basis of two specimens (now ZMB 4684, 36298; examined by authors) collected by C. HOFFMANN from an unknown locality in Costa Rica. A year later COPE (1864) described *Anolis carneus* from the "Lower Vera Paz Forest", Guatemala, a taxon considered to be a synonym of *A. capito* by BOULENGER (1885), GÜNTHER (1885-1902) and BOCOURT (1870-1909). In 1893, COPE described *Anolis longipes* from "Palmar" and "Boruca", Costa Rica which was placed in the synonymy of *A. capito* by subsequent authors (BARBOUR 1934, PETERS & DONOSO-BARROS 1970). We follow GUYER & SAVAGE (1987, 1992) in recognizing the genus *Norops* for the beta anoles (sensu ETHERIDGE 1959) and therefore use the combination *Norops capito* for the species in question.

Although *Norops capito* occupies a wide geographic range stretching from Tabasco, Mexico, to eastern Panama, this species has never received much attention from researchers. Its appearance in the literature is mostly limited to checklists (e.g., STUART 1963, VILLA et al. 1988, CAMPBELL & VANNINI 1989, KÖHLER 2003) except for the summaries of description, natural history and distribution in CAMPBELL (1998) and SAVAGE (2002).

In other wide-spread anoles, such as *Norops lemurinus, N. cupreus* and *N. humilis*, analyses of morphological variation have revealed striking differences in hemipenial morphology between populations that led to the assumption that these species actually comprise species complexes (KÖHLER 1999, KÖHLER & KREUTZ 1999, KÖHLER et al. 2003). The present study was done to provide detailed data on the geographic distribution and the morphological variation in *Norops capito* and to evaluate whether there is evidence for cryptic species among the various populations.

Materials and methods

The description of *Norops capito* is based on specimens examined by the authors (see Ap-

Fig. 1. Male of *Norops capito* from Nicaragua.

pendix). The distribution map is based on specimens examined by the authors (closed symbols) and on additional records (open symbols) taken from MEYER & WILSON (1973), LEE (1996), and SAVAGE (2002). Measurements and scalation data were taken from 17 males, 12 females and 10 juveniles. Color descriptions refer to specimens in preservative, if not otherwise specified. Abbreviations for museum collections follow those of LEVITON et al. (1985), except USAC (Universidad de San Carlos de Guatemala, Guatemala City). Data for anoles whose collecting

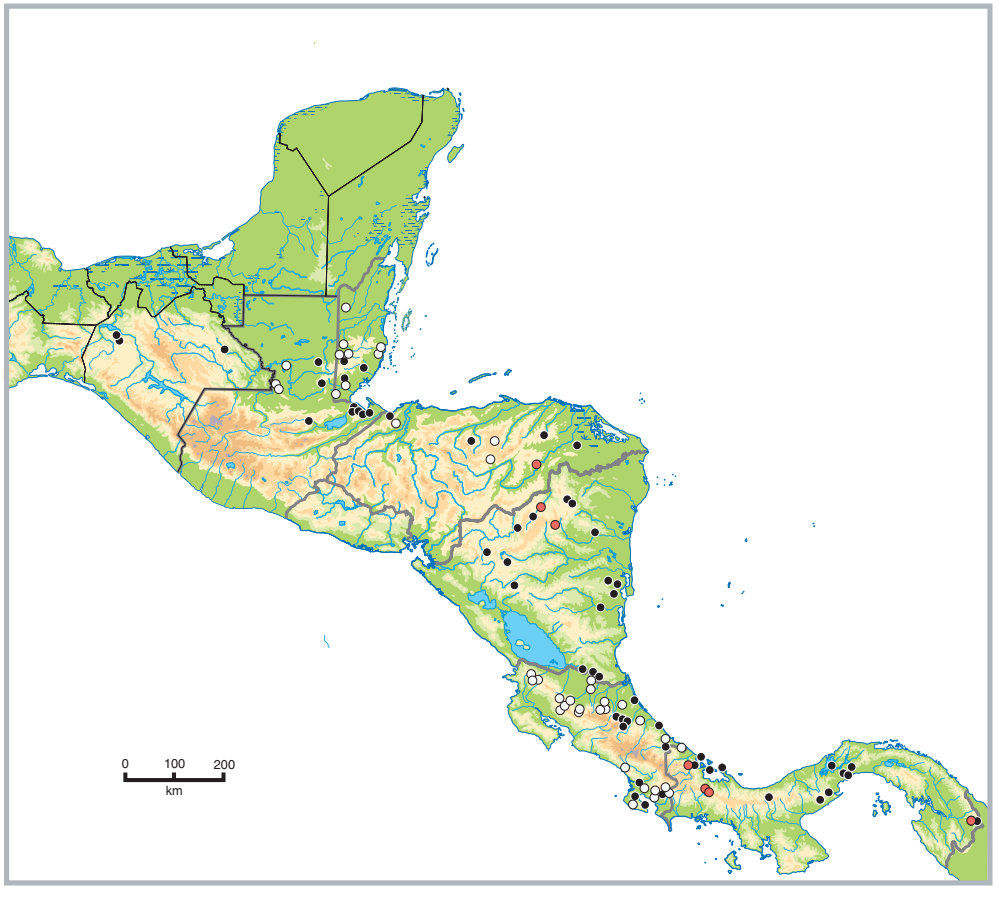

Fig. 2. Distribution of *Norops capito*; solid red symbols represent localities from where we have examined adult males with everted hemipenes; solid black symbols represent localities from where we have examined specimens of the respective species, but not males with everted hemipenes; and open symbols represent literature records. A single symbol can represent two or more nearby localities.

site was recorded using the UK and US systems of linear measure have been converted to metric equivalents. Nomenclature of scale characters follows that of KÖHLER (2003). Terminology for hemipenial morphology follows that of MYERS et al. (1993) and SAVAGE (1997). All measurements were made using precision calipers and were rounded to the nearest 0.1 mm. Head length was measured from the tip of the snout to the anterior margin of the ear opening. Snout length was measured from the tip of the snout to the anterior border of the orbit. Head width was determined as the distance between the oral ricti. Dorsal and ventral scales were counted at midbody along the midline. Tail height and width were measured at the point reached by the heel of the extended hind leg. Subdigital lamellae were counted on phalanges ii to iv of the 4th toe. Abbreviations used are SVL (snout-vent length), HL (head length) and HW (head width).

Results

In *Norops capito* no individual or geographic variation is evident in hemipenis morphology among the material studied. See Table 1 for variation in selected measurements and proportions and scale characters. Ontogenetic variation with respect to scalation is not apparent. There is no evidence for cryptic species among the various populations of *Norops capito.* Thus, *N. carneus* and *N. longipes* remain in the synonymy of *N. capito*.

Norops capito (PETERS, 1863)

Anolis capito PETERS, 1863: Monats. Akad. Wiss. Berlin 1863: 142; type locality: Costa Rica.

Anolis carneus COPE, 1864: Proc. Acad. Nat. Sci. Philad. 1864: 171; type locality: Lower Verapaz Forest, Guatemala.

Anolis longipes COPE, 1893: Proc. Am. Phil. Soc. 31: 343; type locality: Palmar and Boruca, Costa Rica.

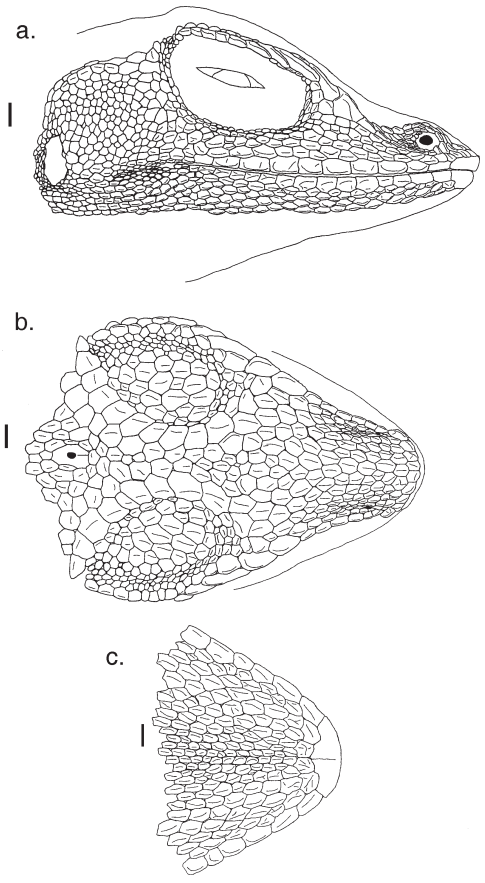

Fig. 3. Head of *Norops capito* (SMF 79894). a) lateral view; b) dorsal view; c) ventral view. Scale bar equals 1.0 mm.

Geographic distribution: From Tabasco, Mexico, along the Caribbean versant of Central America to eastern Panama and probably adjacent regions in Columbia. Fig. 2 shows the distribution of the specimens examined for this study. The existence of *Norops capito* in the Mexican state of Tabasco is poorly documented. SMITH & TAYLOR (1950) recorded this species only from "Tabasco", without a specific locality.

Description: Maximum SVL 83 mm in males, 91 mm in females; tail length/SVL ratio 1.22-2.05; HL/SVL 0.23-0.27 in males, 0.25-0.27

Character	sex	
SVL	males	65-83 (77.69±4.69) 14
	females	69-91 (78.91±9.63) 12
tail length/SVL	males	1.72-2.05 (1.85±0.11) 14
	females	1.61-1.86 (1.70±0.10) 11
tail diameter vertical/horizontal	males	1.13-1.62 (1.35±0.17) 14
	females	1.17-1.48 (1.33±0.13) 12
axilla-groin distance/SVL	males	0.35-0.41 (0.38±0.02) 14
	females	0.35-0.46 (0.38±0.05) 12
HL/SVL	males	0.23-0.27 (0.25±0.01) 14
	females	0.25-0.27 (0.26±0.01) 12
HL/HW	males	1.32-1.54 (1.43±0.07) 14
	females	1.31-1.49 (1.44±0.08) 12
snouth length/SVL	males	0.09-0.13 (0.10±0.01) 14
	females	0.10-1.30 (0.11±0.01) 12
snouth length/HL	males	0.37-0.49 (0.41±0.03) 14
	females	0.38-0.48 (0.41±0.04) 12
shank length/SVL	males	0.31-0.36 (0.34±0.01) 14
	females	0.20-0.35 (0.31±0.06) 12
subdigital lamellae of 4th toe		18-28 (22.30±2.40) 36
number of scales between SS		1-3 (2.22±0.48) 36
number of scales between IP and SS		1-4 (2.89±0.77) 36
number of scales between SO and SPL		1-2 (1.10±0.25) 30
number of SPL to level below center of eye		6-9 (8.00±0.72) 36
number of INL to level below center of eye		7-11 (9.30±0.95) 36
total number of loreals		24-49 (35.40±5.60) 36
number of horizontal loreal scale rows		4-6 (4.90±0.63) 36
number of postmentals		4-7 (5.08±1.29) 36
number of scales between nasals		7-11 (9.80±0.98) 36
number of scales between 2nd canthals		8-12 (10.10±1.24) 36
number of dorsals between level of axilla and groin		32-48 (37.24±4.04) 36
number of ventrals between level of axilla and groin		26-42 (34.16±3.69) 36
number of scales around midbody		73-119 (104.73±8.60) 36

Tab. 1. Selected measurements, proportions and scale characters of *Norops capito.* Range is followed by mean value and one standard deviation in parentheses, and then by sample size. Abbreviations: SVL = snout–vent length; HL = head length; HW = head width; SS = supraorbital semicircles; IP = interparietal plate; SO = subocular scales; SPL = supralabial scales, INL = infralabials. Data from 14 males, 12 females and 10 juveniles. Morphomentric data were only taken from adults.

in females; HL/HW 1.32-1.54 in males, 1.31-1.50 in females; shank length/SVL 0.20-0.36; shank length/HL 0.78-1.54; longest toe of adpressed hind limb usually reaching to a point between mid eye and slightly beyond tip of snouth; scales on snout strongly keeled; tail slightly to distinctly laterally compressed in cross section, tail height / width ratio 1.10-2.17; 5-8 postrostrals (Fig. 3); 7-11 scales between nasals; 2-3 scales

between circumnasal and rostral; considerable variation is apparent in the nasoloreal region (Fig. 4); scales in distinct frontal depression smooth or weakly keeled; supraorbital semicircles well developed, composed of keeled scales and forming weak ridges in adults; 1-3 row of scales separating supraorbital semicircles at narrowest point; 1-4 rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 6-8 distinctly enlarged, faintly to strongly keeled scales; 1-2 enlarged supraorbitals in contact with supraorbital semicircles or all separated by a complete row of small scales; supraorbitals decreasing abruptly in size laterally; 2-3 rows of granular scales between enlarged supraoculars and superciliaries at level of midorbit; 3 elongated superciliaries, the anterior one about two times the length of the following ones, followed by 6-7 smaller squarish scales posteriorly; superciliaries bordered medially by a row of squarish parasuperciliaries, about the size of the posterior superciliaries; interparietal scale not well developed, slightly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge very prominent, composed of 2-4 large scales; 8-13 scales present between second canthals; 8-12 scales present between posterior canthals; loreal region slightly to strongly concave, 24-49 slightly keeled loreal scales in a maximum of 4-6 horizontal rows, in some specimens strongly keeled; mostly keeled subocular scales arranged in a single row; 6-9 supralabials to level below center of eye; 3-4 suboculars in contact with supralabials; mental completely divided medially, bordered posteriorly by 4-7 postmentals; 7-11 infralabials to level below center of eye; 3-4 anterior sublabials greatly enlarged, then gradually decreasing in size posteriorly; keeled granular scales present on chin and throat; lateral head scales anterior to the ear opening larger than those posterior to the ear opening; ear opening usually vertically oval, size (length x width) ratio ear opening / interparietal 0.06-1.10; dorsum of body with small, flattened,

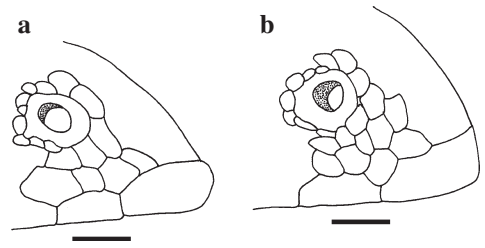

Fig. 4. Variation in the nasoloreal region in *Norops capito*: (a) SMF 82058; (b) SMF 79680. Scale bar equals 1.0 mm.

juxtaposed, scales, 32-48 dorsal scales in one head length; no median rows enlarged, dorsals gradually grading into the slightly smaller, flattened and homogeneous laterals; ventrals at midbody distinctly keeled, slightly mucronate and subimbricate; 26-42 ventral scales in one head length; dorsal, lateral and ventral caudal scales strongly keeled, without whorls of enlarged scales, although an indistinct division in segments is discernible; dorsal medial caudal scales slightly enlarged, not forming a crest; limb scales strongly keeled, imbricate; digital pads dilated, about two times as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 18-28 lamellae under phalanges ii–iv of 4th toe.

The completely everted hemipenis (SMF 78571; Fig. 5) is a large stout organ with well developed lobes; on asulcate side a flap-like processus is present; a slight "lateral" ridge is evident on the lobes and increases on each

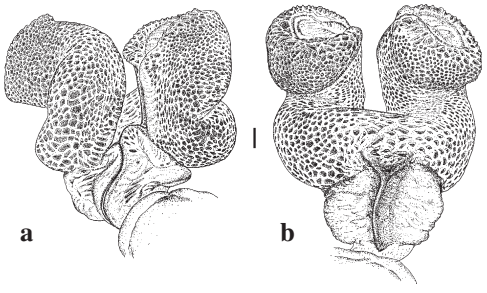

Fig. 5. Hemipenis of *Norops capito* (SMF 78571). a) sulcate view; b) asulcate view. Scale bar equals 1.0 mm.

side of the truncus; sulcus spermaticus bordered by well developed lips, bifurcating at base of apex and continuing to tips of lobes; lobes strongly calyculate; truncus with a few folds.

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Appendix

Specimens examined (^{H} = males with everted hemipenes)

Belize: Cayo: Chiquibul Branch, S Granos de Oro Camp: CM 112127; Toledo: Bladen Nature Reserve, Teakettle Camp on Bladen Branch, 16° 31'01''N, 88°49'48''W, 140 m: USNM 496667; Gloria Camp, Colombia River Forest Reserve, 16°22'N, 89°10'W, 680 m: USNM 319787-88.

Costa Rica: "Costa Rica": AMNH 126044-48, MTKD 34323, USNM 32561-62: 32573-75; San Clement: ZFMK 39476; Alajuela: San Carlos [Ciudad Quesada]: USNM 29857, 29861-63; Cartago: Boruca, Río Concepción: AMNH 16351; Irazú: AMNH 16352; mountains above Turrialba, ca. 6 km NE: CM 64587; Heredia: Río Guácimo, 120 m: SMF 80870; Limón: Sipurio, 9°32'N, 82°55'W: AMNH 16356; La Castilla: ANSP 23041; La Emilia, near Guapiles: ANSP 21412-13; near Tortuguero, Cano Mora: USNM 244865; ca. 50 mi NW Limón, 0.75 mi S of mouth of Río Tortuguero: AMNH 89179; Puerto Limón: ANSP 19527-28; Puntarenas: Puerto Jimenez: ZFMK 52336; 12 mi SSW Palmar Sur: LSUMZ 52361; ca. 2.5 km SW of Rincon de Osa, Osa Tropical Science Center, 8°42'N, 83°31'W, 30 m: USNM 219553-56; 6 km (by road) S of San Vito de Java, Finca las Cruces, OTS Field Station, 8°48'N, 82°58'W, 1250 m: USNM 219721.

Guatemala: "Guatemala": USNM 24757; Alta Verapaz: Senahu: USNM 338343; Izabal: Cayo Piedra, El Golfete: ANSP 22171; Livingston, Río Dulce, Biotopo Universitario "Chocon Machacas": SMF 82708; Cerro San Gil, Torres – Las Escobas, 600 m: UVG 3433; Sta. Tomás de Bastilla, Cerro San Gil: UVG 2641; Puerto Barrios, Cerro San Gil: UVG 2160; Puerto Barrios, Cerro San Gil, 850 m: UVG 2627; Puerto Barrios, 25 m: UVG 3582; El Petén: Dolores, 3 km NE Finca Anaité: UVG 1268; Las Cañas, Municipio de San Luis: CM 58236.

Honduras: Colon: Quebrada Machin, 15°19' 10''N, 85°17'30''W, 540 m: USNM 536489; Cortés: Quebrada Aquabuena, ca. 5 km SSE Tegucigalpita, 15°36.25'N, 88°13.93'W, 250 m: SMF 79136; Gracias A Dios: Bodega de Rio Tapalwas, 14°55'39''N, 84°32'02''W, 190 m: USNM 559595; Olancho: Parque Nacional Patuca, Guasimo, 14°34'38''N, 85°17'54''W, 140 m: SMF 80822-23$^{\text{both H}}$; Parque Nacional La Muralla, Quebrada Las Cantinas, 950 m: SMF 79093; Parque Nacional La Muralla, Las Escaleras, 950 m: SMF 79094; Quebrada El Pinol, 15°07'N, 86°43'W, 1180 m: USNM 342274-78.

Mexico: Chiapas: km 43 carretera Ocozocoautla – Malpaso: IHNHERP 477; km 34 carretera Ocozocoautla – Malpaso (1 km E del camino): IHNHERP 668; Selva Lacandona, Laguna Xalisco, Municipio Ocosingo, región Lacanja-Chansayab: IHNHERP 999.

Nicaragua: "Nicaragua": AMNH 17093, 17095-98, 17100-08, 17110-16, USNM 14203, 14212; Atlántico Norte: Río Waspuc, Musawas: AMNH 75459-61, 75204-05; Eden Mine: ANSP 21139; Parque Nacional Saslaya, Cerro El Toro, Campamento 2004, 13°42'30.6''N, 85°02'17.7'' W, 830 m: SMF 83190^{H}; Parque Nacional Saslaya, between Estación Biologica Salto Labú and Cerro El Toro (Campamento I), 400-500 m: SMF 82058-59; Parque Nacional Saslaya, Campamento Las Pavas, 13°44.5'N, 85°01.5'W, 780 m: SMF 79376, 79894^{H}; Parque Nacional Saslaya, Campamento Los Monos, 13°45.1'N, 85°02.2'W, 800 m: SMF 79586, 79895^{H}; Alamikamba, 13°30.08'N, 84°13.64'W: SMF 77550; Atlántico Sur: Río Pichinga, back of Pearl Lagoon: AMNH 70520; Río Huahuashán, Camp Corozo: AMNH 70521; Río Huahuashán, back of Santa Ana Camp: AMNH 70522-23; Río Escondido, 50 mi from Bluefields: USNM 19875; Estelí: Reserva Natural Miraflores,

Montagues de Congos, Padre de Tayacan, 1205 m: SMF 79680; Jinotega: Cerro Kilambé, 13°33.98' N, 85°41.85'W, 1300 m: SMF 79004; Reserva Biosfera Bosawas, ca. 3 km SE Ayapal at Río Curinwas, 13°46.62'N, 85°23.17'W, 200 m: SMF 78406; Reserva Biosfera Bosawas, ca. 0.5 km SE Pueblo Wiso, 13°59.60'N, 85°19.60'W, 200 m: SMF 78570, 78571[H]; Matagalpa: Selva Negra, 12°59.96'N, 85°54.55'W: SMF 77287-88, 77973, 78282; 2 km N and 6 km E Esquipulas, 960 m: KU 124988; Río San Juan: Bartola, 10°58.37'N, 84° 20.35'W, 30 m: SMF 79831, 80959-60, 81503; El Castillo, Finca Juan Zavala: KU 174047; Río Sarnoso, ca. 1 km above confluence with Río San Juan, 10°55.35'N, 84°17.40'W, 25 m: SMF 79806; Rio San Juan: USNM 24983.

Panama: Bocas del Toro: Almirante: USNM 193451, 532425; Río Changuinola, near Quebrada El Guabo, 16 km airline W Almirante, 200-250 m: AMNH 119023-28, 119029[H]; Isla Popa**,** 1 km SE of Deer Island channel: USNM 298106-10; Isla Colon, La Gruta: USNM 338188, 338200; south end of Isla Popa, 1 km E of Sumwood Channel: USNM 347206-10; Laguna de Tierra Oscura, 3.7 km S of Tiger Key: USNM 348440-41; Chiriquí: Finca Santa Clara, 1300 m: AMNH 147738; upper Chiriquí, Fortuna Dam Site, 1000 m: AMNH 114268-69, 114270[H], 114271-72; Continental divide above upper Quebrada de Arena, 1160-1270 m: AMNH 129812-14, 129815[H]; Cocle: El Valle de Anton: USNM 140667; Darién: Cerro Mali, head of Rio Pucro, 1250 m: USNM 151084; S base Cerro Tacarcuna, Río Pucuro, 8°01'N, 77°30'W, 640 m: AMNH 119347[H]; Panamá: Canal Zone, Hill 65: USNM 102724; Canal Zone, Rio Frijole: USNM 25160; Barro Colorado Island: ANSP 24428; Cerro Campana, 800-900 m: AMNH 106665; Río Sucubti [Sucutí]: AMNH 42908; Madden Forest Preserve [=Parque Nacional Soberana], ca. 100 m: AMNH 107425; Pipeline Road, Limbo Hunt Club, Canal Zone: AMNH 119997-98; Cerro Azul region: AMNH 119866-67; Veraguas: 5-6 mi NW (via road) Santa Fe, ca. 2000 ft: AMNH 147796.

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Authors' addresses: GUNTHER KÖHLER, ARNE SCHULZE, Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, D-60325 Frankfurt a.M., Germany. E-Mail: gkoehler@senckenberg.de; MILAN VESELÝ, Department of Zoology, Faculty of Natural Sciences, Palacký University, tà. Svobody 26, CR-77146 Olomouc, Czech Republic.