

***Anolis sierramaestrae* sp. nov. (Squamata: Polychrotidae) of the “chamaeleolis” species group from Eastern Cuba**

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Abstract. A new species of anole, *Anolis sierramaestrae* sp. nov., belonging to the “chamaeleolis” species group of the family Polychrotidae, is described from the mountain region in the vicinity of La Mula village, Santiago de Cuba province, Cuba. The species represents the sixth so far known species of the “chamaeleolis” species group. It resembles *Anolis chamaeleonides* Duméril et Bibron, 1837, but differs markedly in larger body size, long and narrow head shape, higher number of barb-like scales on dewlap, small number of large lateral scales on the body and dark-blue coloration of the eyes.

Key words. Taxonomy, new species, herpetofauna, Polychrotidae, *Chamaeleolis*, *Anolis*, Great Antilles, Caribbean, Neotropical region.

INTRODUCTION

False chameleons of the genus *Anolis* Daudin, 1802 represent a highly ecologically specialized and morphologically distinct and unique clade endemic to Cuba Island (Cocteau 1838, Beuttell & Losos 1999, Schettino 2003, Losos 2009). This group has been traditionally recognized as a distinct genus *Chamaeleolis* Cocteau, 1838 due to its multiple derived morphological, ecological and behavioural characters. Recent studies discovering the cladogenesis of anoles have placed this group within the main body of the tree of Antillean anoles as a sister group of a small clade consisting of the Puerto Rican species *Anolis cuvieri* Merrem, 1820 and Hispaniolan *A. barahonae* Williams, 1962 and *A. christophei* Williams 1960 (e.g., Haas et al. 1993, Poe 2004, Nicholson et al. 2005). Consequently, the former genus *Chamaeleolis* is currently considered to be a derived internal clade of the genus *Anolis* sensu lato, and thus, it is treated as a late synonym of *Anolis* (e.g., Losos 2009). The content of the former genus *Chamaeleolis* is obviously monophyletic (see Losos 2009 and the phylogenetic studies cited above) and it is further referred to as “chamaeleolis” species group.

To this date, the following five species of the “chamaeleolis” group are recognized:

- (1) *Anolis chamaeleonides* Duméril et Bibron, 1837. Type locality: vicinity of La Habana, La Habana province (cf. Schettino 1999).
- (2) *Anolis porcus* (Cope, 1864). Type locality: vicinity of Guantánamo city, Guantánamo (former Oriente) province (cf. Schettino 1999).
- (3) *Anolis barbatus* (Garrido, 1982). Type locality: Ojo de Agua, Cinco Pesos, 9 km NW of San Cristóbal, Pinar del Río province (cf. Garrido 1982).

- (4) *Anolis guamuhaya* (Garrido, Pérez-Beato et Moreno, 1991). Type locality: between Jibacoa and Topes de Collantes, Sierra de Trinidad (Sierra del Escambray or Macizo de Guamuhaya, Sancti Spiritus province; Garrido et al. 1991).
- (5) *Anolis agueroi* Díaz, Navarro et Garrido, 1998. Type locality: La Juba, Bosque Castillo, Meseta de Cabo Cruz, Niquero, Granma province (cf. Díaz et al. 1998).

In this study, we describe a new species from Santiago de Cuba province of Eastern Cuba.

MATERIAL AND METHODS

Besides the designated type specimen (see below under the Results section), we examined 120 adult anoles of the “*chamaeleolis*” species group of which 77 were live animals or preserved specimens provided by European private breeders (18 *Anolis barbatus*, 23 *A. chamaeleonides*, 19 *A. guamuhaya* and 17 *A. porcus*) and 43 were museum specimens from the herpetological collection of the National Museum in Prague (NMP), Czech Republic (29 specimens of *A. barbatus*: NMP6V 34504, NMP6V 34520/1–11, NMP6V 71872/1–3, NMP6V 71873, NMP6V 73148/1–4, NMP6d 279/03, NMP6j 25/1992, NMP6p; 10 spec. of *A. guamuhaya*: NMP6V 34517, NMP6V 71870/1–8, NMP6V 71871; 3 spec. of *A. chamaeleonides*: NMP6V 34505, NMP6V 34518, NMP6d 81/06; and 1 spec. of *A. porcus*: NMP6V 34519).

The following meristic characters of scalation were counted: the number of (1) barb-like scales on the dewlap, (2) supralabials, (3) infralabials, (4) large lateral scales on the left side in the line leading between front and hind legs, (5) subdigital lamellae on the longest finger of a hind leg, (6) femoral scales in the line oriented from a knee to the base of a hind leg. The scalation patterns of the designated holotype were compared with those counted in the following specimens: *A. barbatus* – 6 females and 4 males from the type locality Ojo de Agua, Pinar del Río province; *A. guamuhaya* – 5 females and 5 males from Topes de Collantes, Sancti Spiritus province; *A. chamaeleonides* – 6 females and 4 males from Viñales, Pinar del Río province; *A. porcus* – 5 females and 5 males from Baracoa, Guantánamo province. These animals were reared in captivity and the localities refer to the origin of the ancestral breeding stocks.

The following measurements of the designated holotype were made with digital calliper to the nearest 0.1 mm: snout-to-vent length (SVL: measured from the tip of the snout to the vent); body length (LIE: longitudo interextremitatis – the

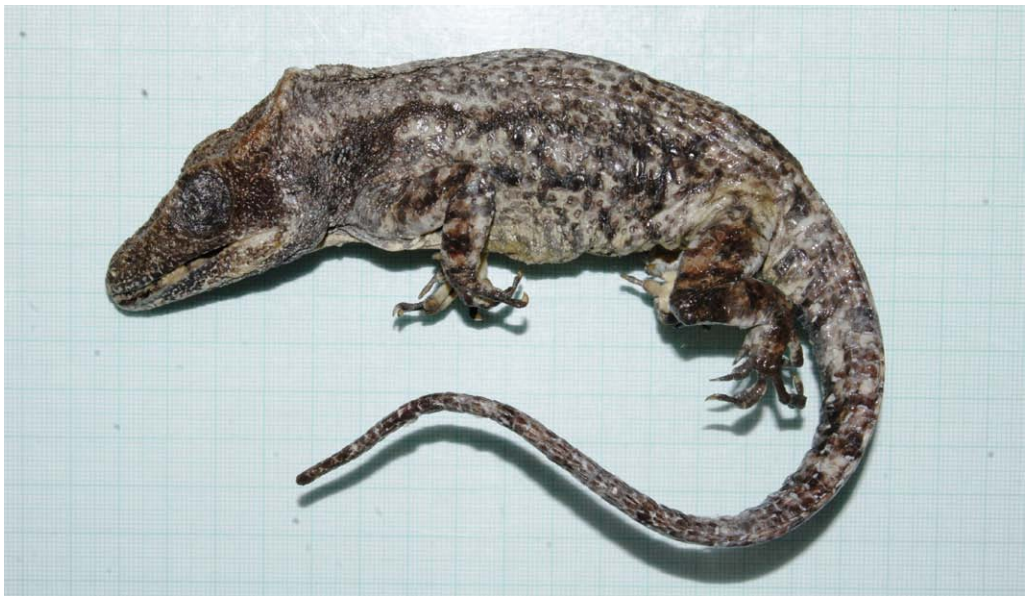


Fig. 1. Holotype of *Anolis sierramaestrae* sp. nov.

distance between front and hind legs); tail length (TL: measured from the vent to the tip of a non-regenerated tail); body height (BH: the greatest height of the body); jaw out-lever distance (JOL: the distance between the jaw articulation and the tip of the jaw); head length (HL: measured from the edge of the head casque to tip of the snout); head width (HW: measured at the intersection with the angle of the jaws); head height (HH: measured just posterior to the orbits); snout-orbit distance (SO: the distance between the tip of the snout to the nearest point of the orbit); snout-nostril distance (SN: the distance between the tip of the snout to the edge of the left nostril); snout-mouth end (SME: the distance from the tip of the snout to the corner of the mouth); lower jaw length (LJL: the distance from the back of the retroarticular process to the tip of the lower jaw); snout length (SL: the length of the snout measured from the back of the jugal bone to the tip of the upper jaw); closing in-lever (CL: the distance between the jaw articulation and the back of the jugal bone; this distance was calculated by subtracting the snout length from the distance measured from the jaw articulation to the tip of the jaw = QT); opening in-lever (OL: the distance from the jaw articulation to the back of the retroarticular process; this distance was calculated by subtracting QT from lower jaw length); internasal distance (IN: the distance between the nostrils); orbit-casque distance (OC: the distance between the posterior-most point of the orbit and the highest point of the casque); interorbital distance (IO: the shortest distance between the orbits); ear opening (EO: the maximum vertical length of an ear opening); tibia (TB: the length of the left tibia); femur (FEM: the length of the left femur); hind metatarsus (HM: the length of the left hind metatarsus); hind finger (HF: the length of the longest – the fourth- hind finger excluding the claw); humerus (HU: the length of the left humerus); radius (RA: the length of the left radius); front metatarsus (FM: the length of the left front metatarsus); barb scales (BS: the maximum length of the barb-like scales on a dewlap).

TAXONOMY

Anolis sierramaestrae sp. nov.

(Figs 1, 4 and 6)

TYPE LOCALITY. Vicinity of La Mula village, 19° 57' 45" N, 76° 45' 24" W, Santiago de Cuba province, Cuba (Figs 2, 3).

TYPE MATERIAL. **Holotype.** An adult male, catalogue number NMP6V 74453, deposited in the zoological collection of the National Museum in Prague (Fig. 1). Label: "adult male collected by local people in the Vicinity of La Mula village, Sierra Maestra Mts, Santiago de Cuba province, Cuba".

DIAGNOSIS. *Anolis sierramaestrae* sp. nov. is differentiated from all other anoles of the "chamaeleolis" species group by having the following combination of characters: large body size, a long and narrow head shape, a high number of barb-like scales of tiny size, a low number of large lateral scales in between the front and hind legs, and dark-blue coloration of the eyes (Fig. 4).

DESCRIPTION OF THE HOLOTYPE. An adult male with the total length of 335 mm and SVL 163 mm; LIE 73.1 mm; tail longer than body TL 172 mm; BH 40.7 mm; JOL 50.0 mm; extremely long head HL 62.2 mm; HW 29.4 mm; HH 23 mm; SO 26.7 mm; SN 6.8 mm; SME 44.8 mm; LJL 53.3 mm; SL 40.8 mm; CL 9.1 mm; OL 5.5 mm; IN 6.4 mm; OC 27.4 mm; IO 18.6 mm; EO 4.3 mm; TB 27.5 mm; FEM 31.8 mm; HM 15.2 mm; HF 22.8 mm; HU 28.5 mm; RA 19.7 mm; FM 6.2 mm; BS 0.9 mm (for definitions of measurements and abbreviations see under the Material and Methods chapter). For scalation patterns, see Table 1; for shape and coloration, see Figs 4 and 5.

ETYMOLOGY. The specific epithet *sierramaestrae* refers to the mountain area where the type locality is situated.

COLLECTING CIRCUMSTANCES. According to the museum record, the holotype was provided by local people and no further information about its behaviour is available. Another adult male was observed by the first author on a branch of tree about 6 meters above the ground level during a day at the type locality on 14 February 2003. This male was further photographed (see Figs 4 and 5).

COMPARISONS. *Anolis sierramaestrae* sp. nov. differs from all other species of *Chamaeleolis* group in its large body size (SVL of the designated type specimen is the longest of all examined specimens of the "chamaeleolis" species group), a longer and narrower head, highest number of barb-like scales (70 compared to 60 representing maximum value recorded in a pooled material

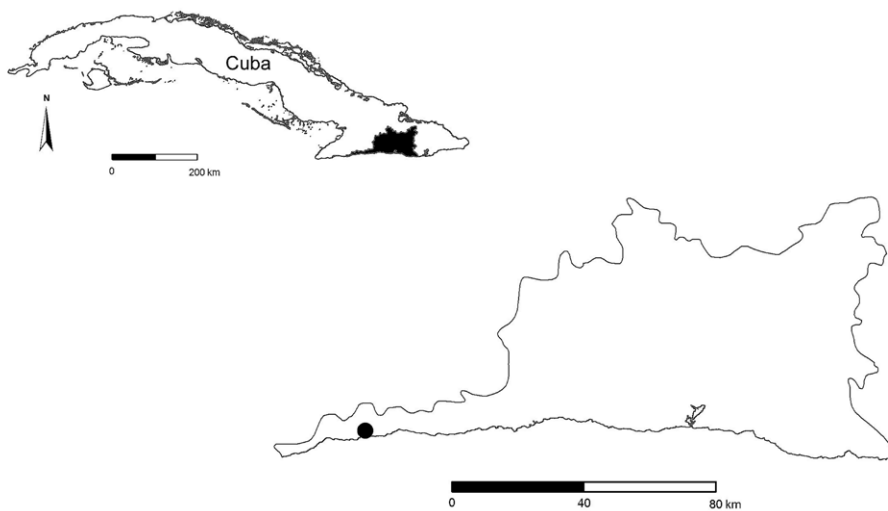


Fig. 2. Sketch map of Cuba showing type locality of *Anolis sierramaestrae* sp. nov.



Fig. 3. Type locality of *Anolis sierramaestrae* sp. nov. in Sierra Maestra Mts (photo by VH on 14 February 2003).

Table 1. Means \pm standard errors, range and sample sizes for scale counts in six species of Cuban anoles belonging to the “chamaeleolis” species group. Barbs = number of barb-like scales on dewlap, Lateral scales = number of the large lateral scales in line between front and hind legs, Infralabials = number of infralabial scales, Supralabials = number of supralabial scales, Lamellae = number of subdigital lamellae on the longest (fourth) finger of a hind leg, Femoral scales = femoral scales in the line oriented from a knee to the base of a hind leg, Mandibular teeth = number of teeth on half of the mandibula. The data concerning *Anolis agueroi* were adopted from Diaz et al. (1998), in this case counts of labial scales refer to the type specimen only.

<i>Anolis</i> species	<i>barbatus</i>	<i>porcus</i>	<i>guamuhaya</i>	<i>chamaeleonides</i>	<i>agueroi</i>	<i>sierramaestrae</i> sp. nov.
sample size	10	10	10	10	17	1
barbs	42.80 \pm 1.15 37–50	41.20 \pm 1.24 34–45	48.80 \pm 1.37 41–55	54.90 \pm 0.81 52–60	– 48–50	70 –
lateral scales	23.90 \pm 0.38 22–25	23.00 \pm 0.21 22–24	20.90 \pm 0.35 19–22	20.90 \pm 0.41 19–22	– –	17 –
infralabials	11.40 \pm 0.31 10–13	12.90 \pm 0.23 12–14	11.70 \pm 0.26 11–13	12.70 \pm 0.26 12–14	11 –	14 –
supralabials	10.00 \pm 0.21 10–13	12.00 \pm 0.30 12–14	10.10 \pm 0.23 11–13	13.30 \pm 0.33 12–14	10 –	15 –
lamellae	42.10 \pm 0.57 10–13	47.70 \pm 0.37 12–14	45.30 \pm 0.58 11–13	44.70 \pm 0.47 12–14	– –	46 –
femoral scales	12.20 \pm 0.20 11–13	18.40 \pm 0.40 16–20	11.60 \pm 0.16 11–12	11.50 \pm 0.17 11–12	– –	11 –



Fig. 4. Wild adult male of *Anolis sierramaestrae* sp. nov. (photo by VH at the type locality on 14 February 2003).




















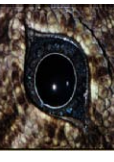










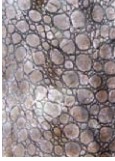




Species	Lateral view of the head	Head – view from the top	Lateral scales of the body	Barb-like scales on the dewlap	Tongue coloration	Eye (iris) coloration	Lower jaw with molariform teeth
<i>barbatus</i>							
<i>porcus</i>							
<i>guamuhaya</i>							
<i>chamaeleonides</i>							
<i>sierramaestrae</i>							

Fig. 5. Comparison of distinguishing characters in *Anolis barbatus* (Garrido), *A. porcus* (Cope), *A. guamuhaya* (Garrido, Pérez-Beato et Moreno), *A. chamaeleonides* Duméril et Bibron and *A. sierramaestrae* sp. nov.

of the remaining species), lowest number of the large lateral scales in line between front and hind legs (17 compared to the minimum value of 19 recorded in the pooled materials).

A. sierramaestrae sp. nov. resembles *A. chamaeleonides* the most, but, moreover to the differences mentioned above, its tail is longer than the body and the iris of the eye is dark-blue (somewhat resembling that of *A. guamuhaya*). In a sharp contrast, all examined specimens of *A. chamaeleonides* had reddish eyes. *A. sierramaestrae* also lacks yellowish spots on jawline which are the specific sign of *A. chamaeleonides* (see Fig. 5).

Anolis sierramaestrae sp. nov. shares whitish tongue with both *A. chamaeleonides* and *A. agueiroi*, while dark coloration of the tongue is shared by *A. barbatus*, *A. porcus* and *A. guamuhaya*.

All anoles of the “chamaeleolis” species group are specialized to malacophagy (molluscivory, cf. Herrel & Holáňová 2008) and their dentition includes enlarged molariform teeth (Estes & Williams 1984) used to crush snail shells. The degree of morphological specialization of the dentition assessed in a designated holotype of *Anolis sierramaestrae* sp. nov. (Fig. 6) is fairly intermediate when compared with that in other species of the “chamaeleolis” species group (cf. Fig. 5). Its dental row consists of 25 teeth like in *A. guamuhaya*, the species with least specialized dentition of the “chamaeleolis” species group.. This fairly conforms to the value 23 reported for *Anolis chamaeleonides*, but sharply contrasts with low teeth counts in *A. barbatus* and *A. porcus* (20 and 16, respectively; teeth counts: Holáňová et al. unpubl. results, see also Holáňová 2009, Zahradníček 2011). Comparisons of *A. sierramaestrae* sp. nov. with the remaining species of the “chamaeleolis” species group are summarized at the Table 1 and Fig. 5.

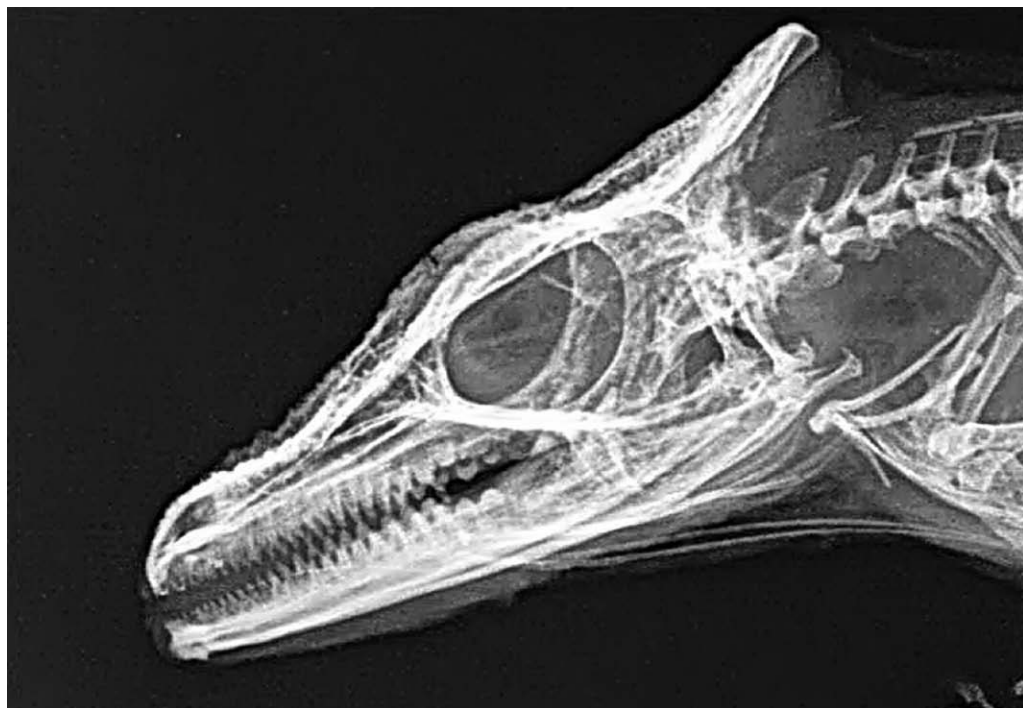


Fig. 6. X-ray picture showing dentition of the holotype (NMP6V 74453) of *Anolis sierramaestrae* sp. nov.

DISCUSSION

The records of *Anolis chamaeleonides* reported by previous authors (Garrido et al. 1991, Díaz et al. 1998, Schettino 1999) from Sierra Maestra mountains come from localities distributed within the range of about 30 km from the type locality of *A. sierramaestrae* sp. nov. Obviously, these records refer to this species. Thus, *A. chamaeleonides* is most probably restricted to the western part of Cuba. The older records from the central part of the island require a revision.

The geographic ranges of the anole species belonging to the “chamaeleolis” species group are apparently mutually exclusive and no case of sympatric occurrence of multiple species has been reported (Garrido et al. 1991, Díaz et al. 1998), for distribution patterns see Schettino (1999). Each species is typically restricted to a local mountainous area and its surroundings. Such distribution pattern provides efficient geographic barriers among the populations/species. The isolation of relatively small areas may explain a considerable degree of morphological divergence we observed. Considering the structural diversity and complex geological history of Cuba as well as the reports of morphologically suspect individuals from other localities (e.g., Rancho Velaz, Villa Clara province, Sierra de Banao, Sancti Spiritus province, Garrido 1982, Garrido et al. 1991), discoveries of additional species of the chamaeleolis group can be expected in the near future.

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REFERENCES

- BEUTTELL K. & LOSOS J. B. 1999: Ecological morphology of Caribbean anoles. *Herpetological Monographs* **13**: 1–28.
- COCTEAU J. T. 1838: Reptiles. *Historia Física, Política y Natural de la Isla de Cuba*. Paris: Bertrand, 90 pp.
- DÍAZ L. M., NAVARRO N. & GARRIDO O. H. 1998: Nueva especie de Chamaeleolis (Sauria: Iguanidae) de la Meseta de Cabo Cruz, Granma, Cuba. *Avicennia* **8–9**: 27–34.
- ESTES R. & WILLIAMS E. E. 1984: Ontogenetic variation in the molariform teeth in lizards. *Journal of Vertebrate Paleontology* **4**: 96–107.
- GARRIDO O. H. 1982: Descripción de una nueva especie cubana de Chamaeleolis (Lacertilia: Iguanidae), con notas sobre su comportamiento. *Poeyana* **236**: 1–25.
- GARRIDO O. H., PÉREZ-BEATO O. & MORENO L. V. 1991: Nueva especie de Chamaeleolis (Lacertilia: Iguanidae) para Cuba. *Caribbean Journal of Science* **27**: 162–168.
- HASS C. A., HEDGES S. B. & MAXSON L. R. 1993: Molecular insights into the relationships and biogeography of West Indian Anoline lizards. *Biochemical Systematics and Ecology* **21**: 97–114.
- HERREL A. & HOLÁNOVÁ V. 2008: Cranial morphology and bite force in Chamaeleolis lizards – Adaptations to molluscivory? *Zoology* **111**: 467–475.
- HOLÁNOVÁ V. 2009: *Comparative Morphology and Reproduction Strategies of Cuban Genus Chamaeleolis*. Unpubl. MSc. Thesis. Praha: Charles University in Prague, 88 pp (in Czech).
- LOSOS J. B. 2009: *Lizards in an Evolutionary Tree. Ecology and Adaptive Radiation of Anoles*. Berkeley: University of California Press, 507 pp.
- NICHOLSON K. E., GLOR R. E., KOLBE J. J., LARSON A., HEDGES S. B. & LOSOS J. B. 2005: Mainland colonization by island lizards. *Journal of Biogeography* **32**: 929–938.
- POE S. 2004: Phylogeny of anoles. *Herpetological Monographs* **18**: 37–89.
- SCHETTINO L. R. 1999: *The Iguanid Lizards of Cuba*. Gainesville: University Press of Florida, 428 pp.
- SCHETTINO L. R. 2003: *Anfibios y Reptiles de Cuba*. Vaasa, Finlandia: UPC Print, 169 pp.
- ZAHRADNÍČEK O. 2011: *Evolutionary and Developmental Aspects of Dentition of Squamate Reptiles*. Unpubl. Ph.D. Thesis. Praha: Charles University in Prague, 136 pp (in Czech).