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A NEW SPECIES OF PHENACOSAUR ANOLIS FROM PERU

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ABSTRACT: We describe a new species of *Anolis* from a high elevation locality in Department of San Martín, Peru. A single hatchling from this population was described by Ernest Williams and Russel Mittermeier and referred to *Phenacosaurus* (= *Anolis*) *orcesi* in 1991. Our recent collections document consistent differences between this population and *A. orcesi*, including a larger female dewlap and greater number of loreal scales in the new species. The new species may exist in a narrow altitudinal range along the eastern Andean slope of Northern Peru.

Key words: *Anolis*; Lizard; New species; Peru; *Phenacosaurus*

THE *ANOLIS* formerly placed in the genus *Phenacosaurus* are medium to large-sized anoles with very large head scales, short limbs and tail, and apparently cryptic coloration and behavior. The group currently is known from 10 species and is distributed at high elevations of the Andes of Peru, Ecuador and Colombia and the tepuis of Venezuela. *Phenacosaurus* was identified as a lineage within *Anolis* by Etheridge (1959) and formally synonymized with *Anolis* by Poe (1998). However, with some recent exceptions (e.g., Nicholson et al., 2005) the genus name has enjoyed continued use since then (e.g., Jackman et al., 1999), probably due to the unusual morphologies of some phenacosaurus, including, for example, the serrate middorsal crest, casqued skull, and heterogeneous lateral scalation of *Anolis heterodermus* (see e.g., Lazell, 1969: Fig. 2).

In 1991, Williams and Mittermeier described a juvenile specimen of *Anolis* from Venceremos, Peru that they referred to *Phenacosaurus orcesi*. This specimen merited detailed description because it was the first phenacosaur anole found in Peru—a range extension of approximately 500 km south for the phenacosaur lineage. Although they referred this individual to *P. orcesi*, they suspected that it actually represented an undescribed species:

“...it is a possibility that *P. orcesi* is a complex [of distinct species] also, and that the Peruvian juvenile is a distinct

species. Provisionally we assign the Peruvian specimen (Fig. 10) to the species *P. orcesi*, but new material and much more careful collecting in the montane areas of Peru and Ecuador are clearly much to be desired.”

Williams and Mittermeier (1991:15)

We collected additional material of this form and indeed find it to be new. We name this *Anolis* in honor of its original describers.

MATERIALS AND METHODS

We consider species to be evolutionary lineages (Simpson, 1961; Wiley, 1978) and operationalize this concept by identifying species based on consistent differences between populations (see Frost and Kluge, 1994). That is, we hypothesize that populations that are diagnosable by major differences in the frequencies of traits are distinct evolutionary lineages, or species (see Wiens and Servedio, 2000).

Measurements were made with digital calipers on preserved specimens and are given in millimeters (mm), usually to the nearest 0.1 mm. Snout-to-vent length (SVL) was measured from tip of snout to anterior of cloaca. Head length was measured from the tip of the snout to the anterior edge of the ear. Femoral length was measured from the midline of the venter to the knee, with the limb bent at a 90-degree angle. Head width was measured at the broadest part of the head, between the posterolateral corners of the orbits. Comparisons were made with preserved material of the

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FIG. 1.—*Anolis williamsmittermeierorum*, male.

putative closest relatives of the new species, and with published species descriptions and/or preserved material of more distant relatives (Appendix 1). Scale terminology and characters used mainly follow standards established by Williams (e.g., Williams et al., 1996) for species descriptions of anoline lizards. One specimen was dissected to enable description of the skeleton. Skeletal description is given in terms of Poe's (1998, 2004) and Etheridge's (1959) characters. See those papers for more detailed descriptions of skeletal conditions and alternative conditions in *Anolis*.

SPECIES DESCRIPTION

Anolis williamsmittermeierorum *sp. nov.*

Figs. 1, 2

Holotype.—MZUNAP 02.000181, an adult male from Venceremos, approximately 94 km west of Rioja, Department of San Martín, Peru (between old km markers 390-1, near new km marker 380), S 05' 40.405 W 77' 45.310, 1739 m, collected 20 April 2005 by Steven Poe, Christian Yañez-Miranda, and Jenny Hollis.

Paratypes.—MZUNAP 02.000180, MSB 72521-2, same locality, date, and collectors as holotype; MZUNAP 02.000189-90, MSB 72523, same locality and collectors as holotype, 24 April 2005; MCZ 165211, same locality as holotype, collected by Russel Mittermeier, 14 December 1983.

Diagnosis.—Phenacosaur- and *tigrinus*-group (Williams, 1992) *Anolis* are the only South American alpha anoles (sensu Etheridge, 1959) that approach the conditions of very large head scales and very short limbs

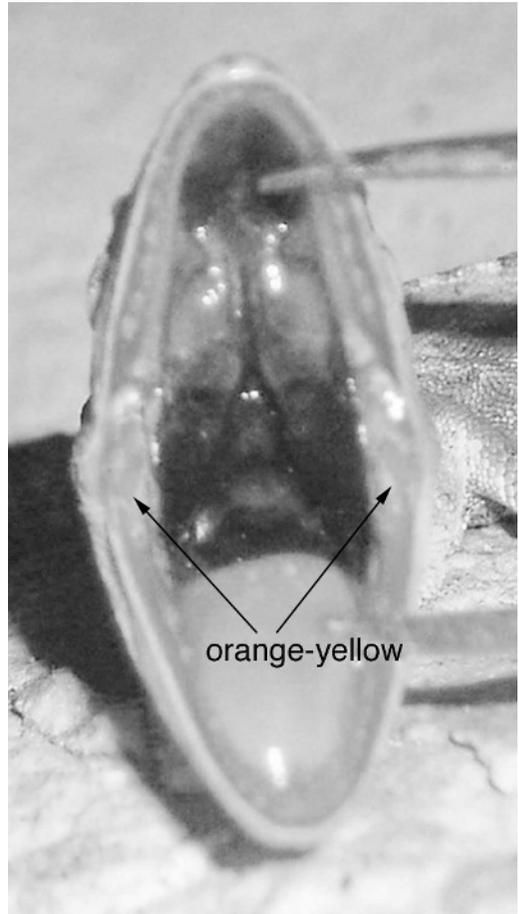


FIG. 2.—Mouth of *Anolis williamsmittermeierorum*, showing distinctive contrasting color pattern.

and tail seen in the new species. *Anolis williamsmittermeierorum* differs from most of the *tigrinus*-group species (*A. lamari*, *A. solitarius*, *A. tigrinus*, *A. menta*, *A. umbrivagus*, *A. paravertebralis*) in lacking a posterior spur on the parietal, from *A. ruizi* in male dewlap color (yellow in *A. ruizi*, brown and orange-peach in *A. williamsmittermeierorum*), from *A. pseudotigrinus* in the presence of a large dewlap in the female, and from *A. nasofrontalis* in number of lamellae under phalanges two and three of the fourth toe of the hind foot (17–19 in *A. williamsmittermeierorum*; 22–25 in *A. nasofrontalis*). Furthermore, the southernmost limit of the *tigrinus*-group is over 1000 km from the only known locality of *A. williamsmittermeierorum*. Among phenacosaur anoles, the new species

appears to be a member of the *orcesi* group (sensu Williams et al., 1996) due to its homogeneous lateral scalation and fully lamellar toe pads (Williams and Mittermeier, 1991). Within the *orcesi* group, *Anolis williamsmittermeierorum* differs from *A. orcesi* in the lack of enlarged middorsal crest scales (raised enlarged keeled middorsal scales in *A. orcesi*), presence of a large dewlap in the female (length of dewlap fold/SVL = 0.23 in *A. orcesi* holotype; mean = 0.29, range = 0.27–0.31 in *A. williamsmittermeierorum*), and greater number of loreal scales (6 or 7 in *A. orcesi*; mean = 15.1, range 10–21 in *A. williamsmittermeierorum*). The new species differs from *A. euskalerruari* in possessing a larger interparietal (interparietal barely evident in *A. euskalerruari*; large and in contact with supraorbital semicircles in *A. williamsmittermeierorum*), tan dewlap with peach-orange distal edge in male (blue in *A. euskalerruari*), and greater number of loreals (6–8 in *A. euskalerruari*). A striking feature of the new species, unscored in most *Anolis* but likely to be unique or rare (S. Poe, personal observations), is its mouth coloration: black throat with bright yellow-orange at the hinges of the mouth (Fig. 2).

External Description of Holotype (paratype variation in parentheses; the MCZ hatchling is excluded from this description).—SVL 60.0 (48.0–65.5); head length 16.1 (11.7–16.9), width 9.9 (6.8–10.1); ear height 1.6 (1.0–1.7); femoral length 12.3 (8.9–11.9); tail broken at tip (length 51–80).

Dorsal head scales smooth; no (or weak) frontal depression; rostral slightly overlaps mental anteriorly; five (3–6) scales across snout between second canthals; supraorbital semicircles in contact; no elongate supraciliary scales, only one or two slightly enlarged scales anteriorly; three (2–4) loreal rows, 14 total loreals on left side (10–21); circumnasal in contact with rostral (or separated from rostral by one scale); interparietal length 2.1 (1.9–2.7); supraorbital semicircles in contact with each other and interparietal; six (6–7) supralabials to center of eye; four postmentals; five (4–7) postrostrals; some enlarged scales present in supraocular disc, decreasing gradually in size laterally, bordered medially by a partial row of small scales (or 3 abruptly enlarged

scales, with or without a complete row of small scales); mental extends deep posteriorly, indented slightly (or greatly) posteromedially, divided posteriorly, extending posterolaterally beyond rostral; sublabial rows strongly enlarged, with first three (3–5) scales in contact with infralabials, gradually decreasing in size; dewlap reaches posterior to axillae in males (length of dewlap fold = 20.4 [17.6–22.0 for male paratypes, excluding subadult MZUNAP 02.000180]), with moderate scales in single rows separated by naked skin, smaller in females (to axillae; length of dewlap fold 15.6–17.4 in female paratypes); no axillary pocket; pair of enlarged postcloacal scales in contact in males; nuchal and dorsal crests not evident in preserved specimens, but apparently distendable in life (Fig. 1); dorsal scales smooth, with no enlarged middorsal rows, 8 (7–9) longitudinal rows in 5% of SVL; ventral scales slightly imbricate, smooth, 6 (6–8) scales in 5% of SVL, in transverse and diagonal rows; dorsal limb scales smooth, largest anteriorly; supradigitals smooth; toe pads expanded; seventeen (17–19) lamellae under second and third phalanges of fourth toe; tail with a single middorsal row of scales.

Skeletal description (based on MSB 72522).—Parietal roof slightly convex, with trapezoidal crests and convex lateral edges, with slight lateral casquing (but not nearly to the degree seen in *A. heterodermus*), lacking crementation on edges, not extending far posteriorly (supraoccipital is exposed above), with anterolateral corners flush with edges of frontal; pineal foramen at parietal-frontal suture; some wrinkling on dorsal skull bones, especially parietal; postfrontal present; prefrontal separated from nasal by anterior extension of frontal; frontal sutures anteriorly with nasals; no parallel crests on nasals; external nares bordered posteriorly by nasals; dorsal aspect of jugal terminates on posterior surface of postorbital; jugal not in contact with squamosal; posterodorsal ramus of squamosal larger than posteroventral ramus, separated from parietal by supratemporal; posterior aspect of jugal straight to weakly concave; epipterygoid short, does not contact parietal; pterygoid and palatine teeth absent; lateral edge of vomer smooth, without posteriorly directed lateral processes; maxilla does not

extend posteriorly beyond ectopterygoid on ventral surface of skull; no crest between basiptyergoid processes of basisphenoid; no lateral shelf of quadrate; black pigment is present on most dorsal skull bones, only weakly present on frontal; nasals do not overlap premaxilla dorsally; posterior of skull approximately even with level of parietal-frontal suture; mandibular toothline extends posterior to anterior mylohyoid foramen; large splenial present; ventral aspect of anteromedial process of coronoid extends posteriorly; external opening of surangular foramen entirely within surangular, but overlain by posterior extension of coronoid; posterior suture of dentary pronged; anteriormost aspect of posterior border of dentary is anterior to mandibular fossa; labial process of coronoid is present; coronoid extends posterolaterally beyond surangular foramen on one side, into foramen on other side; no jaw sculpturing; angular appears absent (angular area is difficult to score in both mandibles because of extraneous tissue); angular process of articular greatly reduced, barely present; mandibular and maxillary teeth unicuspid anteriorly, tricuspid posteriorly; six premaxillary teeth.

Three sternal and two xiphisternal ribs; four postxiphisternal ribs attached to dorsal ribs, followed posteriorly by one unattached "floating" rib; transverse processes on anterior caudal vertebrae, gradually lost in posterior caudal vertebrae (Alpha condition); distal portions of interclavicle are not in contact with clavicle (arrow-shaped condition); 23 presacral vertebrae; three lumbar vertebrae; autotomy septa not evident.

Color in life (adapted from field notes and color photos of male).—Dorsum changed from (1) brown dorsally, rust anterolaterally, all parts with some green as well, to (2) greenish-grey-white-brown dorsum (lichenous appearance) with four dark bands shoulder to sacrum alternating with broad light bands; with reticulating green and brown lines.

Seven dark bands on tail, including tip; top of head dark, light yellow-white around ear and anterior to ear; venter cream with dark flecks laterally, becoming reticulations on flanks; flecks also at base of tail and under limbs and chin.



FIG. 3.—Vegetation at the type locality of *Anolis williamsmittermeierorum*.

Dewlap in males pale brown, orange-peach at edge, with sharp demarcation between central and edge colors or gradual color difference; scales white; female dewlap skin dirty white with elongate black blotches, appearing tiger-striped; scales white.

Throat lining black; bright yellow-orange around edge of mouth, especially at hinges of jaws (Fig. 2); tongue tan.

Habitat.—The type locality has been accurately described by Williams and Mittermeier (1991:8) as "cloud forest with moss-covered trees and a springy, mossy floor." The road here is cut out of the side of a steep slope. The downhill side, where Mittermeier collected the original juvenile specimen, is now almost completely razed of trees; only thorny bushes remain in a grassy field. The uphill side is too steep for cultivation, and includes ferns, trees, and vines overhanging the road. We observed workers trimming back vegetation to within about 2 m of the road. Figure 3 shows habitat along the uphill side of the road.

Distribution.—*Anolis williamsmittermeierorum* is known only from the type locality (see map in Williams and Mittermeier, 1991: Fig. 8). It may be parapatric with another undescribed phenacosaur anole to the west (see below). The road drops down the steep Andean slope out of cloud forest habitat to the east; brief collecting forays along this road produced no additional specimens of *A. williamsmittermeierorum*. More collecting in this and adjacent areas is needed to establish the distribution of *A. williamsmittermeier-*

orum, but it is possible that this species exists in a relatively narrow altitudinal band along the eastern Andean slope.

Ecology.—All specimens were collected sleeping at night on vegetation. Specimens were taken from 2 to 8 m up (measured from road level) on twigs or other narrow vegetation ($n = 5$) or on leaves ($n = 2$) with limbs flexed. Disturbed specimens did not drop from their perches but rather held on more tightly, as in 'twig' *Anolis* of the Caribbean (see Thomas, 1965).

Associated species.—The only other herpetological material we collected at the type locality were nine specimens of a new green species of *Anolis* that we are describing elsewhere. We collected specimens of an *Anolis* similar to *A. fuscoauratus* approximately 5 km east of the type locality at a slightly lower elevation, and specimens of another undescribed phenacosaur *Anolis* approximately 34 km west of the type locality at approximately 100 m higher elevation. The fact that we collected three undescribed species of *Anolis* within 34 km of road suggests that this area may be a fruitful one for additional herpetological investigation.

Status and relationships.—It is unlikely that *A. williamsmittermeierorum* is simply a geographic variant of *A. orcesi*, as originally considered by Williams and Mittermeier (1991). One of the characters that distinguishes these species (size of female dewlap) is usually invariant within anole species, and the range of variation among these two species in another diagnosing character (number of loreals) has not, to our knowledge, been observed in any single species of anole.

Anolis williamsmittermeierorum appears to be a member of the phenacosaur lineage of *Anolis*, which may also include *A. proboscis* and *tigrinus*-group species (Poe, 2004; and S. Poe, unpublished data). Geography and similarity of characters suggest that an undescribed phenacosaur species also from Peru (to be described elsewhere) may be the closest relative of *A. williamsmittermeierorum*. We are analyzing these species in ongoing phylogenetic studies of *Anolis*.

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APPENDIX 1

Comparative Material Examined

MCZ = Museum of Comparative Zoology, Harvard. **A. euskalerrriari** MCZ 176475: Venezuela, Estado Zulia, Sierra de Perija, Campamento La Gran Depression de Mesa Turik. **A. orcesi** MCZ 38937 (Holotype): Ecuador, Mt. Sumaco.