Zootaxa 3915 (1): 111–122
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3915.1.5
http://zoobank.org/urn:lsid:zoobank.org:pub:63D397DA-5E70-412F-B8ED-70B853593E4E

Anolis marsupialis Taylor 1956, a valid species from southern Pacific Costa Rica (Reptilia, Squamata, Dactyloidae)

JOHANNES J. KÖHLER[1,2], STEVEN POE[3], MASON J. RYAN[3] & GUNTHER KÖHLER[1,4]

[1]*Forschungsinstitut und Naturmuseum Senckenberg, Senckenberganlage 25, 60325 Frankfurt a.M., Germany*
[2]*Johann Wolfgang Goethe-University, Institute for Ecology, Evolution and Diversity, Max-von-Laue-Str.9, 60438 Frankfurt am Main, Germany*
[3]*Department of Biology and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, USA*
[4]*Corresponding author. E-mail, gkoehler@senckenberg.de*

Abstract

The examination of the holotype of *Anolis marsupialis* Taylor 1956 along with recently collected specimens reveals that *A. marsupialis* is a valid species. It differs from its closest congeners *A. humilis* Peters 1863 and *A. quaggulus* Cope 1885, in male dewlap coloration, scalation, body size, and hemipenial morphology. These findings are supported by preliminary molecular genetic analysis.

Key words: *Anolis humilis, A. marsupialis*, *A. quaggulus*, synonymy, taxonomy

Introduction

In 1956, Edward H. Taylor described *Anolis humilis marsupialis* based on a male holotype (KU 40893) and seven paratypes (KU 40889–92, 40894–96) from "about 15 km. WSW of San Isidro del General along the Dominical Road.", a collecting site situated in the Fila Costeña. Savage (1974) provided the following comments on the type locality of *A. marsupialis*: "1.5 km NW Alfombra, Cantón de Pérez Zeledón, Provincia de San José: 970 m. E.H. Taylor collected in this vicinity on several occasions. The swamp and meadow that he mentions at 15 km (by road) WSW of San Isidro de El General drains into the Río Pacurito and lies east of the road to Dominical. Premontane Pluvial bioclimate."

This taxon was treated as a subspecies of *A. humilis* Peters 1863 by Peters & Donoso-Barros (1970) but was placed in synonymy of the latter species by Savage & Villa (1986), Savage (2002), and Köhler *et al.* (2003, 2006). Wilson & Johnson (2010) briefly discussed this issue, and, just as Sasa *et al.* (2010), retained *A. marsupialis* in the synonymy of *A. humilis*. Bolaños & Savage (2009) and Bolaños et al. (2011) treated this form as a full species, pointing to Taylor (1956) for a diagnosis.

Recent field work in the area of the type locality of *Anolis humilis marsupialis* produced additional specimens that allow for reconsideration of this taxonomic issue.

Material and methods

Before preservation, the dewlap of male individuals was extended with small forceps, and the extended dewlap was photographed in life. Sampled specimens were euthanized by injection of T61 (Intervet Deutschland GmbH, Unterschleißheim, Germany). Tissue samples were taken from the forearm, tail tip, or liver and stored in Eppendorf tubes filled with 96% ethanol. Samples were stored at -20 °C after return from the field. In males, hemipenes were everted by manually applying gentle pressure to the base of the tail. This, however, results only in partial eversion of the organs. In order to reach full eversion, 70% ethanol was injected into the hemipenis pockets just posterior to

Accepted by S. Carranza: 19 Dec. 2014; published: 2 Feb. 2015

History (USNM), Washington, D.C.; W. Böhme, Zoologisches Forschungsmuseum A. Koenig (ZFMK), Bonn; R. Günther, Museum für Naturkunde der Humboldt-Universität zu Berlin (ZMB), Berlin; and F. Glaw and D. Fuchs, Zoologische Staatssammlung München (ZSM), Munich. We thank Sebastian Lotzkat and Larry David Wilson for their helpful comments on an early draft of this paper. Support for POE was provided by NSF DEB 0844624.

References

Bolaños, F. & Savage, J.M. (2009) A checklist of the amphibians and reptiles of Costa Rica. Additions and nomenclatural revisions. *Zootaxa*, 2005, 1–23

Bolaños, F., Savage, J.M. & Chaves, G. (2011) Amphibians and Reptiles of Costa Rica. *Listas Zoológica Actualizadas UCR*, Museo de Zoologia UCR. San Pedro, Costa Rica. Available from: http://museo.biologia.ucr.ac.cr/listas/LZAPublicaciones.htm (accessed 20 December 2013)

Cope, E.D. (1885) A contribution to the herpetology of Mexico. *Proceedings of the American Philosophical Society*, 22, 379–404.

Köhler, G. (2001) *Anfibios y reptiles de Nicaragua*. Herpeton Verlag, Offenbach, 208 pp. [Germany]

Köhler, G. (2008) *Reptiles of Central America. 2nd Edition*. Herpeton Verlag, Offenbach, 400 pp. [Germany]

Köhler, G., Alt, S., Grünfelder, C., Dehling, M. & Sunyer, J. (2006) Morphological variation in Central American leaf-litter anoles: *Norops humilis, N. quaggulus* and *N. uniformis*. *Salamandra*, 42, 239–254.

Köhler, G., McCranie, J.R., Nicholson, K.E. & Kreutz, J. (2003) Geographic variation in hemipenial morphology in *Norops humilis* (Peters 1863), and the systematic status of *Norops quaggulus* (Cope 1885) (Reptilia, Squamata: Polychrotidae). *Senckenbergiana biologica*, 82, 213–222.

Larkin, M.A., Blackshields, G., Brown, N.P., Chenna, R., McGettigan, P.A., McWilliam, H., Valentin, F., Wallace, I.M., Wilm, A., Lopez, R., Thompson, J.D., Gibson, T.J. & Higgins, D.G. (2007) ClustalW and ClustalX version 2. *Bioinformatics*, 23, 2947–2948.
http://dx.doi.org/10.1093/bioinformatics/btm404

Peters, J.A. & Donoso-Barros, R. (1970) Catalogue of the Neotropical Squamata. Part II. Lizards and Amphisbaenians. *Smithsonian Institution United Stated National Museum Bulletin*, 297, 1–293.
http://dx.doi.org/10.5479/si.03629236.297.1

Peters, W.C.H. (1863) Über einige neue Arten der Saurier-Gattung *Anolis*. *Monatsberichte der Königlich Preußischen Akademie der Wissenschaften zu Berlin*, 1863, 135–149.

Ratnasingham, S. & Herbert, P.D.N. (2007) BOLD: The Barcode of Life Data System (http://www.barcodinglife.org). *Molecular Ecology Notes*, 7, 355–364.
http://dx.doi.org/10.1111/j.1471-8286.2007.01678.x

Sabaj Pérez, M.H. (2010) Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Version 1.5 (4 Oct 2010). Available from http://www.asih.org/ (accessed 10 December 2010)

Savage, J.M (1974) Type localities for species of amphibians and reptiles described from Costa Rica. *Revista de Biologia Tropical*, 22, 71–122.

Savage, J.M. (2002) *The amphibians and reptiles of Costa Rica. A herpetofauna between two continents, between two seas*. Univ. Chicago Press, Chicago and London, 934 pp.

Savage, J.M. & Villa, J. (1986) Introduction to the herpetofauna of Costa Rica. Introducción a la herpetofauna de Costa Rica. *Contributions to Herpetology*, 3, 1–207.

Silvestro, D. & Michalak, I. (2012) raxmlGUI: a graphical front-end for RAxML. *Organisms Diversity & Evolution*, 12, 335–337.
http://dx.doi.org/10.1007/s13127-011-0056-0

Tamura, K., Peterson, D., Peterson, N., Stecher, G., Nei, M. & Kumar, S. (2011) MEGA5: Molecular Evolutionary Genetics Analysis using Maximum Likelihood, Evolutionary Distance, and Maximum Parsimony Methods. *Molecular Biology and Evolution*, 28, 2731–2739.
http://dx.doi.org/10.1093/molbev/msr121

Taylor, E.H. (1956) A review of the lizards of Costa Rica. *University of Kansas Science Bulletin*, 38, 3–322.

Vences, M., Thomas, M., Bonett, R.M. & Vieites, D.R. (2005) Deciphering amphibian diversity through DNA barcoding: chances and challenges. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 360, 1859–1868.
http://dx.doi.org/10.1098/rstb.2005.1717

Wilson, L.D. & Johnson, J.D. (2010) Distributional patterns of the herpetofauna of Mesoamerica, a biodiversity hotspot. *In*: Wilson, L.D., Townsend, J.H. & Johnson, J.D. (Eds.), *Conservation of Mesoamerican Amphibians and Reptiles.* Eagle Mountain Press, Eagle Mountain, Utah, pp. 30–235.

Sasa, J.D., Chaves, G. & Porras, L.W. (2010) The Costa Rican herpetofauna: Conservation status and future perspectives. *In*: Wilson, L.D., Townsend, J.H. & Johnson, J.D. (Eds.), *Conservation of Mesoamerican Amphibians and Reptiles.* Eagle Mountain Press, Eagle Mountain, Utah, pp. 510–603.