

ON THE TAXONOMIC STATUS OF *APOSTOLEPIS RONCADORI* LEMA, 2016 AND *APOSTOLEPIS VITTATA* (COPE, 1887) (SERPENTES: DIPSIDAE)

SOBRE EL ESTATUS TAXONÓMICO DE *APOSTOLEPIS RONCADORI* LEMA, 2016 Y *APOSTOLEPIS VITTATA* (COPE, 1887) (SERPENTES: DIPSIDAE)

OMAR MACHADO ENTIAUSPE-NETO^{1*} & ARTHUR TIUTENKO²

¹Laboratório de Vertebrados, Instituto de Ciências Biológicas, Universidade Federal do Rio Grande, Rio Grande, 96203-900, Brazil.

²Friedrich-Alexander-Universität Erlangen-Nürnberg, Schlossplatz 4, 91054 Erlangen, Germany.

*Correspondence: omarentiauspe@hotmail.com

Resumen.— *Apostolepis* Cope, 1862 es un género de serpientes dipsadideas especioso. Entre su más de 30 especies, muchas son únicamente conocidas por una pequeña serie de individuos. La falta de información básica sobre las variaciones morfológicas y la historia natural ha dado como consecuencia una historia taxonómica difícil del grupo. Revisamos el estado taxonómico de la recientemente descrita *Apostolepis roncadori* Lema, 2016 y discutimos sobre su posible sinonimia con una especie previamente conocida, *Apostolepis vittata* Cope, 1887, considerando que sus caracteres de diagnóstico no difieren, o la diferencia puede atribuirse a la variación intraespecífica.

Palabras clave.— Elapomorphini, Neotropical, Sinónimo, Sistemática.

Abstract.— *Apostolepis* Cope, 1862 is a speciose dipsadid snake genus. Among its more than 30 taxa, several species are known only from small series of specimens. The lack of basic information about morphological variations and natural history has resulted in a difficult taxonomic history of the group. We revisit the taxonomic status of the recently described *Apostolepis roncadori* Lema, 2016 and argue about its synonymy with a previously long-known species *Apostolepis vittata* Cope, 1887, considering their diagnostic characters either do not differ or the difference can be attributed to intraspecific variation.

Keywords.— Elapomorphini, Neotropical, Synonym, Systematics.

Apostolepis Cope, 1862 is a large genus of Neotropical dipsadid snakes, encompassing over 30 small to medium sized species, that together with other three genera (*Coronelaps* Lema & Deiques, 2010; *Elapomorphus* Wiegmann, 1843; *Phalotris* Cope, 1862) constitute a monophyletic tribe of the Elapomorphini Jan, 1862 (Ferrarezzi, 1993; Zaher, 1999; Zaher et al., 2009; Grazziotin et al. 2012; Colli et al., 2019; Entiauspe-Neto et al., 2019). These snakes are characterized by a short dentigerous dentary teeth process, U-shaped fronto-parietal suture, two or less pterygoid palatine teeth, six or less supralabial scales, and an entire nasal plate (Ferrarezzi, 1993; Zaher, 1999; Zaher et al., 2009). From other Elapomorphini genera, *Apostolepis* can be distinguished by its characteristic fusion of prefrontals and internasals (Ferrarezzi, 1993).

Quite a few species of the genus have been described a century or longer ago from a single specimen or a small series of specimens and quite often in a usual for that historical

period manner, when color rather than distinct morphological characters were playing a role. This often resulted in taxonomic confusion and uncertain status of some taxa described according to modern standards later if such inaccurate historical descriptions had been ignored or overlooked.

Cope (1887) described *Rhynchonyx ambiniger vittatus* based on an adult male individual (Fig. 1, ANSP 11293) from “Chapada” (Chapada dos Guimarães), Mato Grosso state, that he distinguished from the nominal *Apostolepis ambiniger* (Peters, 1869) by the presence of longitudinal colors bands. The description is brief, and contains only information about color and pattern. Later, Boulenger (1896) provided a redescription for *Rhynchonyx ambiniger*. He suggested its inclusion in *Apostolepis* and a modification of its epithet (from *ambiniger* to *ambinigra*), while considering *A. ambinigra vittatus* to be a synonym. Amaral (1930:224) reanalyzed both, *Apostolepis ambinigra vittatus* and *Apostolepis tenuis*, and considered these taxa as conspecific with



Figura 1. Vista comparativa de las cabezas de *Apostolepis roncadori* (BMNH 1972.429, izquierda) and *Apostolepis vittata* (ANSP 11293, derecha). Crédito fotográfico: Ned Gilmore (*A. vittata*) y Patrick Campbell (*A. roncadori*).

Figure 1. Head view comparison of *Apostolepis roncadori* (BMNH 1972.429, left) and *Apostolepis vittata* (ANSP 11293, right). Photograph credits: Ned Gilmore (*A. vittata*) and Patrick Campbell (*A. roncadori*).

Apostolepis ambinigra, without further discussion, but after brief arguing that both species were “close” and “did not merit taxonomic recognition”. Peters and Orejas-Miranda (1972) carefully re-examined the type series of both *A. ambinigra vittatus* and *A. tenuis*, redescribed both taxa and considered them as full species, distinct from *A. ambiniger*. *Apostolepis vittata* remained known only from its holotype, until Harvey (1999) reported two individuals from Bolivia (CM 2824 from Río San Julian, Provincia Nuflo de Chaves; BMNH 1907.10.31.62, from Puerto Suarez, Provincia German Busch), although remarking that these specimens differed greatly from the holotype, and the status of Bolivian populations should be reassessed upon availability of more material. Lema and Renner (2004) later reported the discovery of new specimens from Mato Grosso, Brazil.

Lema (2002) described *Apostolepis christineae* on basis of an adult female (MCP 12515) from Estação Ecológica Serra das Araras, Barra dos Bugres, Mato Grosso, Brazil, separating it from *Apostolepis vittata* by presence of wide dark dorsal stripes (thin and incomplete, in *A. vittata*), absence of black gular collar, as well as absence of occipital scales. Lema (2002) also suggested that the specimens reported by Harvey (1999) should be considered as *Apostolepis* cf. *christineae*, giving as a reason that

these have more morphological similarity with *A. christineae* rather than with *A. vittata*. Unfortunately, the specimen CM 2824 had been lost during a loan (T.D.L. pers. comm.). Entiauspe-Neto and Lema (2015) reanalyzed the remaining specimen BMNH 1907.10.31.62 and identified it as the first confirmed record of *Apostolepis christineae* for Bolivia.

Recently, Lema (2016) described *Apostolepis roncadori* from a single adult male individual (Fig. 1, BMNH 1972.429) collected at Serra do Roncador (municipality of Ribeirão Cascalheira), Mato Grosso, at western Brazil. The author only noted that this species is “conspicuously different” from *A. vittata* and provided a direct comparison only with *A. christineae*. A closer look at the specimens and their comparison with similar *Apostolepis* have brought us to a revision of taxonomic relationship of *A. vittata* and *A. roncadori* that we present here.

MATERIALS AND METHODS

We examined a total of 33 specimens of *Apostolepis* from the following collections: Academy of Natural Sciences, ANSP, USA; The Natural History Museum, BMNH, England; Instituto Butantan, IBSP, Brazil; Instituto de Ciencias Naturales, Universidad Nacional de Colombia, ICN, Colombia; Coleção Herpetológica, Instituto de Pesquisas Amazônicas, INPA, Brazil; Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, MCP, Brazil; Muséum National d’Histoire Naturelle, MNHN, France; Museo de Historia Natural Para la Tierra, MHNP, Paraguay; Museu de Zoologia da Universidade de São Paulo, MZUSP, Brazil; Coleção Herpetológica da Universidade Federal do Mato Grosso, UFMT-R, Brazil; Coleção Herpetológica da Universidade Federal de Rondônia, UFRO-H, Brazil; University of Michigan Museum of Zoology, Herpetology collection, UMMZ, USA; Zoologisches Forschungsmuseum Alexander Koenig, ZFMK, Germany; Zoologisches Museum für Naturkunde Berlin, ZMB, Germany. A list of examined material is provided in Appendix 1.

An emended diagnosis, as well as meristic and morphometric characters were selected based on the nomenclature used by Entiauspe-Neto et al. (2020), as follows: head length, measured from center of rostral to the corner of mouth; head width, measured at the corner of mouth; snout-vent length, ventrally measured from center of rostral to the posterior margin of cloacal scale; tail length, measured from posterior margin of cloacal scale to terminal scale. Head and tail measurements were taken with a dial caliper to the nearest 0.01 mm; for others, a flexible ruler was used. Scale counts follow Dowling (1951).

RESULTS

The holotype of *A. roncadori* shares several striking similarities with the holotype of *A. vittata*. The description only contains brief sections about morphology, measurements, pholidosis, coloration fit on a single page, as well as a dichotomous key and a conclusion section. Both individuals present similar total body size (305 mm in *A. vittata*, 252 mm in *A. roncadori*), head length (6.5 mm in *A. vittata*, 8.4 mm in *A. roncadori*), tail length (25 mm in *A. vittata*, 16 mm in *A. roncadori*), labial scales count (5 infralabials and 6 infralabials in both *A. vittata* and *A. roncadori*), ventrals (238 in *A. vittata*, 239 in *A. roncadori*), and subcaudals (27 in *A. vittata*, 24 in *A. roncadori*). Both type localities (Chapada dos Guimarães and Serra do Roncador, Ribeirão Cascalheira) are situated at similar elevation, within the Cerrado biome. The only difference that remains between both individuals is the dorsal pattern (consisting of thin dorsal stripes in *A. vittata*, five vestigial stripes in *A. roncadori*, Figure 2, Tabla 1).

However, in some topotypical specimens of *A. vittata* (UFMT-R 12259, CHUNB 30656) the dorsal stripes are vestigial or absent in life, and the snakes had a uniform dorsal pattern, identical

to that of the holotype of *A. roncadori*. Exposure to light or poor conservation might also have contributed to their discoloration. Considering the lack of diagnostic characters and a significant overlap in morphology, combined with a close geographic distribution, we regard *A. roncadori* as a junior synonym of *A. vittata*.

Apostolepis vittata can be distinguished from all its congeners by the following combination of characters: (1) 15/15/15 smooth dorsals, without apical pits; (2) preocular single, contacting nasal; (3) postocular single; (4) loreal absent; (5) temporals 1+0 or absent; (6) supralabials 5, with 2nd and 3rd in contact with orbit; (7) infralabials 6, with first three or four in contact with anterior chinshields; (8) ventrals 227–239 in males; (9) subcaudals 24–28 pairs in males; (10) in life, dorsal background coloration orange or red, with five thin black stripes present or absent, supralabial blotch reaching five supralabials, nuchal collars absent, tail blotch black, up to 12 dorsals wide (white, orange, and red colorations may become indistinct in preservative); (11) in life, ventral pattern similar to dorsal, uniformly light orange, black gular collar absent or present, terminal caudal spine black or white.



Figura 2. Comparación de patrones de *Apostolepis vittata* (ANSP 11293, holotipo, arriba) y *Apostolepis roncadori* (BMNH 1972.429, holotipo, abajo).

Figure 2. Pattern comparison of *Apostolepis vittata* (ANSP 11293, holotype, top) and *Apostolepis roncadori* (BMNH 1972.429, holotype, bottom).

Tabla 1. Datos comparativos de los ejemplares analizados de *Apostolepis vittata*. Las medidas están en mm.

Table 1. Comparative dataset between analyzed specimens of *Apostolepis vittata*. Measurements are given in mm.

Characters	ANSP 11293 (Holotype of <i>A. vittata</i>)	MCP 13283	BMNH 1972.429 (Holotype of <i>A. roncadori</i>)	CHUNB 30656
Age, sex	Adult male	Adult male	Adult male	Adult, missing middle of body
Head length	6.5	7.24	8.4	8.1
Head width	2.7	2.96	3.1	3.40
Tail length	25	29	16	—
Total length	305	308.24	252.04	—
Snout-vent length	280	279.2	235	—
Ventrals	238	227	239	—
Subcaudals	27	28	24	—
Supralabials	5, 2-3 in contact with orbit	5, 2-3 in contact with orbit	5, 2-3 in contact with orbit	5, 2-3 in contact with orbit
Infralabials	6, 1-3 in contact with chinshields	6, 1-3 in contact with chinshields	6, 1-3 in contact with chinshields	6, 1-3 in contact with chinshields
Dorsal pattern	Five brown dorsal stripes	Five brown dorsal stripes	Five vestigial brown dorsal stripes	Five vestigial brown dorsal stripes
Ventral color	Uniformly cream	Uniformly cream	Uniformly cream	Uniformly cream

DISCUSSION AND CONCLUSIONS

Apostolepis vittata remains known from less than 10 specimens, restricted to four locations in the heart of the Cerrado ecoregion at western Brazil, and nothing is known about its ecology, distribution, or population trends. The diagnostic separation from its close congener, *A. christineae*, is also poorly supported. Notably, the specimen MCP 9192 of *A. vittata*, mentioned by Lema (2016), could not be found in its collection; a specimen of *Apostolepis goiasensis* has the same accession number.

The diagnosis of these two species refers to largely variable characters of external morphology. In *Apostolepis* coloration pattern and cephalic scalation can be particularly variable among and between populations (e.g. Harvey, 1999). With its restricted range (Fig. 3), *A. vittata* may be considered regionally endemic. Integrated study in genetics, osteology, hemipenial morphology, external morphological variability should clarify its taxonomic validity.

Acknowledgements.— We are grateful to the curators Patrick Campbell (BMNH) and Ned Gilmore (ANSP) for kindly allowing access and photographing specimens under their care. OME-N thanks Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for a PIBIC Grant (136628/2016-8). Our special thanks are due to Weverton Azevedo (Instituto Butantan) for assistance in making our plates and maps.

LITERATURA CITADA

- Cope, E.D. 1887. Synopsis of the Batrachia and Reptilia obtained by H. H. Smith in the Province of Mato Grosso, Brazil. *Proceedings of the American Philosophical Society* 24:44-60.
- Entiauspe-Neto, O.M., T.B. Guedes, D. Loebmann & T. Lema. 2020. Taxonomic status of two simultaneously described *Apostolepis* Cope, 1862 species (Dipsadidae: Elapomorhini) from Caatinga Enclaves Moist Forests, Brazil. *Journal of Herpetology* 54:225-234.
- Entiauspe-Neto, O.M., A. Sena, A. Tiutenko & D. Loebmann. 2019. Taxonomic status of *Apostolepis barrioi* Lema, 1978, with comments on the taxonomic instability of *Apostolepis* Cope, 1862 (Serpentes, Dipsadidae). *ZooKeys* 841:71-78.
- Entiauspe-Neto, O.M. & T. Lema. 2015. *Apostolepis christineae* Lema, 2002 (Serpentes: Xenodontinae: Elapomorhini): first record for Bolivia. *Check List* 11:1814.
- Ferrarezzi, H. 1993. Sistemática Filogenética de *Elapomorphus*, *Phalotris* e *Apostolepis* (Serpentes: Colubridae: Xenodontinae). Master of Science Dissertation, Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo. Brazil.
- Ferrarezzi, H., F.E. Barbo & C.E. Albuquerque. 2005. Phylogenetic relationship of a new species of *Apostolepis* from Brazilian Cerrado with notes on the *assimilis* group (Serpentes: Colubridae: Xenodontinae: Elapomorhini). *Papéis Avulsos de Zoologia* 45:215-229.

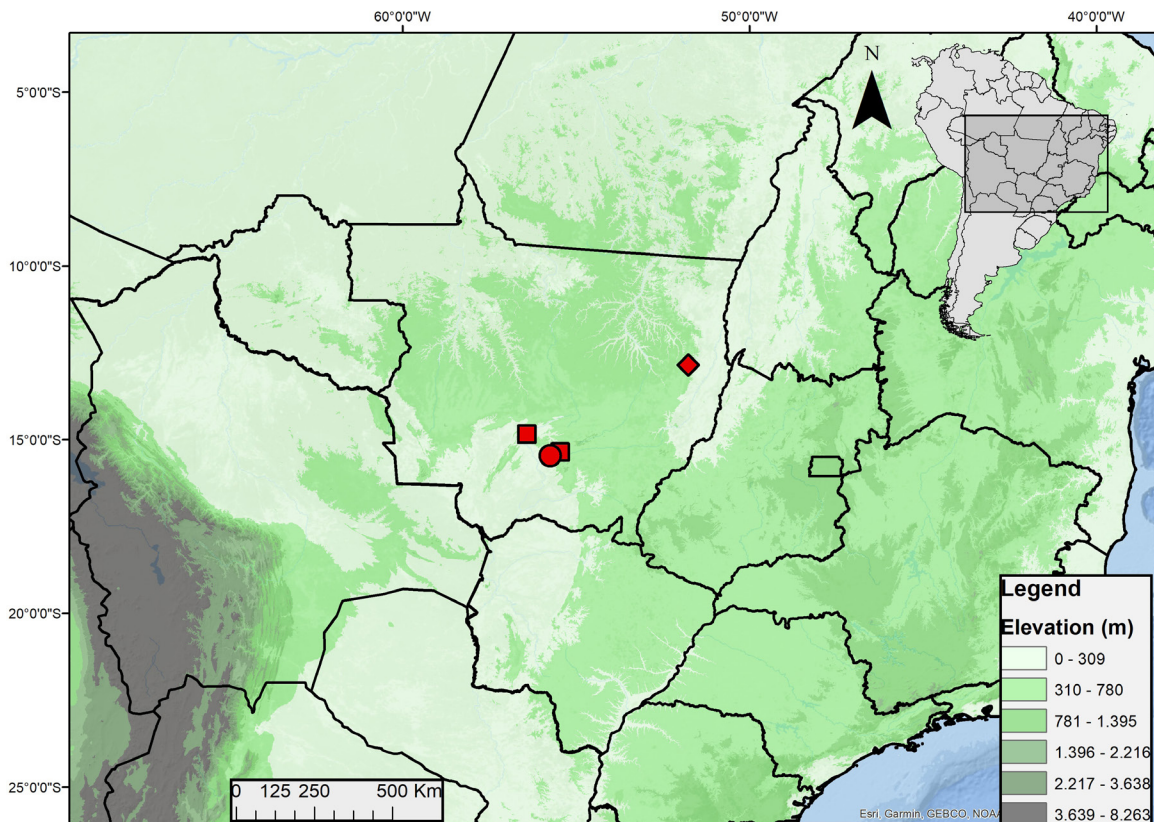


Figura 3. Distribución geográfica de *Apostolepis vittata*. Diamante: Localidad tipo para *A. roncadori*; Círculo: Localidad Tipo para *A. vittata*; Cuadros: Otros especímenes.

Figure 3. Geographic distribution of *Apostolepis vittata*. Diamond: Type locality for *A. roncadori*; Circle: Type locality for *A. vittata*; Squares: Other specimens.

- Golli, G.R., A.F. Barreto-Lima, P.T. Dantas, C.J.S. Morais, D.L. Pantoja, A. Sena & H.C. Sousa. 2019. On the occurrence of *Apostolepis phillipsi* (Serpentes, Elapomorphini) in Brazil, with the description of a new specimen from Mato Grosso. *Zootaxa*, 4619:580-588.
- Grazziotin, F.G., H. Zaher, R.W. Murphy, G. Schrocchi, M.A. Benavides, Y.P. Zhang & S.L. Bonatto. 2012. Molecular phylogeny of the New World Dipsadidae (Serpentes: Colubroidea): a rephrasial. *Cladistics* 1:1-23.
- Guedes, T.B., F.E. Barbo, D. França & H. Zaher. 2018. Morphological variation of the rare psammophilous species *Apostolepis gaboi* (Serpentes, Dipsadidae, Elapomorphini). *Zootaxa* 4418:469-480.
- Harvey, M.B. 1999. Revision of Bolivian *Apostolepis* (Squamata: Colubridae). *Copeia* 1999:388-409.
- Lema, T. & M.F. Renner. 2004. New specimens of *Apostolepis vittata* (Cope, 1887) (Serpentes, Elapomorphinae). *Caderno de Pesquisa* 16:51-56.
- Lema, T. 2002. Nova espécie de *Apostolepis* do grupo *lineata* do sudoeste do Brasil (Serpentes, Elapomorphinae). *Facena* 18:41-52.
- Lema, T. 2016. Description of new species of *Apostolepis* (Serpentes: Dipsadidae: Xenodontinae: Elapomorphini) from Serra do Roncador, Central Brazil. *Caderno de Pesquisa, série Biologia* 28:1-12.
- Peters, J. & B. Orejas-Miranda. 1972. The taxonomic validity of *Apostolepis tenuis* Ruthven and *Apostolepis vittata* (Cope) (Serpentes: Colubridae). *Copeia* 1972:588-590.

Vanzolini, P.E. 1986. Addenda and corrigenda to the catalogue of Neotropical Squamata. Smithsonian Herpetological Information Service 70:1-26.

Zaher, H. 1999. Hemipenial morphology of the South American xenodontine snakes, with a proposal for a monophyletic Xenodontinae and a reappraisal of Colubrid hemipenes. Bulletin of the American Museum of Natural History 240:1-168.

Zaher, H., F.G. Grazziotin, J.E. Cadle, R.W. Murphy, J.C. Moura-Leite & S.L. Bonatto. 2009. Molecular phylogeny of advanced snakes (Serpentes, Caenophidia) with an emphasis on the South American xenodontines: a revised classification and descriptions of new taxa. Papéis Avulsos de Zoologia 49:115-153.

APPENDIX 1. MATERIAL EXAMINED

[Countries are given in bold capitals, states in plain capitals, municipalities in italics, and localities in plain text.]

Apostolepis aff. *niceforoi* (n= 1). **BRAZIL**: RORAIMA: Caracara, Vila de Caicubi, Rio Jufari (MZUSP 19625).

Apostolepis cerradoensis (n= 1). **BRAZIL**: Goiás: Minaçu (MCP 15219, holotype of *Apostolepis cerradoensis*).

Apostolepis christineae (n= 2). **BOLIVIA**: SANTA CRUZ: Puerto Suarez, German Busch (BMNH 1907.10.31.62). **BRAZIL**: MATO GROSSO: Cáceres (MCP 12515, holotype of *Apostolepis christineae*).

Apostolepis dorbignyi (n= 1). "AMÉRIQUE MÉRIDIONALE": Unknown locality (MNHN 3664, holotype of *Apostolepis dorbignyi*).

Apostolepis goiasensis (n= 1). **BRAZIL**: MINAS GERAIS: Três Lagoas (CHFURG 1344).

Apostolepis intermedia (n= 2). **PARAGUAY**: San Pedro: Laguna Blanca (MHNP 11533, 11636).

Apostolepis kikoi (n= 5). **BRAZIL**: MATO GROSSO: APM Manso, Chapada dos Guimarães (MCP 12096, 14524, 14525, 11372, UFMT-R 1933).

Apostolepis multicincta (n= 3). **BOLIVIA**: SANTA CRUZ: San Juan (ZFMK 66375, paratype of *Apostolepis multicincta*), Florida (ZFMK 75025, 75026).

Apostolepis niceforoi (n = 1). **COLOMBIA**: Caquetá (Voucher withheld at request of collector).

Apostolepis nigrolineata (n= 2). SOUTH AMERICA (ZMB 6447, *A. nigrolineata* holotype). **BRAZIL** (BMNH 1946.1.9.82, *A. pymi* holotype).

Apostolepis nigroterminata (n= 3). **PERU**: Cayaria (BMNH 1946.1.9.77, holotype).

Apostolepis quinquelineata (n= 4). **GUYANA**: Georgetown (BMNH 89.9.30.12 holotype of *Apostolepis quinquelineata*). **BRAZIL**: AMAZONAS: Presidente Figueiredo (INPA-H 31440); RONDÔNIA: Porto Velho (UFRO-H 228, 229).

Apostolepis quirogai (n= 1). **BRAZIL**: RIO GRANDE DO SUL: Santo Ângelo, Campus URI (MCP 12185).

Apostolepis tenuis (n= 1). **BOLIVIA**: SANTA CRUZ: Buena Vista (UMMZ 64436, holotype of *Apostolepis tenuis*).

Apostolepis vittata (n = 5). **BRAZIL**: MATO GROSSO: Chapada dos Guimarães (ANSP 11293, Holotype of *Rhynchonyx ambinger vittatus*; CHUNB 30656), Parque Nacional Chapada dos Guimarães (UFMT-R 12259), Rio da Casca (MCP 13283), Serra do Roncador, Rio Araguaia (BMNH 1972.429, Holotype of *Apostolepis roncadori*).

