

TWO NEW SPECIES OF *Apostolepis* Cope, 1862 (SERPENTES: ELAPOMORPHINI) FROM BREJOS DE ALTITUDE IN NORTHEASTERN BRAZIL

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Diva Maria Borges-Nojosa^{1,2}, Daniel Cassiano Lima^{1,3}, Castiele Holanda Bezerra¹, David James Harris^{1,2,4}

¹ Universidade Federal do Ceará, Depto. Biologia, Núcleo Regional de Ofiologia da UFC (NUROF-UFC), Campus do Pici, Bloco 905, CEP 60.440-554, Fortaleza-CE, Brasil. dmbnojosa@gmail.com

² CIBIO Research Centre in Biodiversity and Genetic Resources, InBIO, Universidade do Porto, Campus Agrário de Vairão, Rua Padre Armando Quintas, No 7, 4485-661, Vairão, Vila do Conde, Portugal

³ Universidade Estadual do Ceará, FACEDI, Av Mons. Tabosa s/n, CEP 62500-000, Itapipoca-CE, Brasil.

⁴ Departamento de Biologia, Faculdade de Ciências, Universidade do Porto, R. Campo Alegre s/n, 4169-007 Porto, Portugal

RESUMO

São descritas duas novas espécies de serpentes do gênero *Apostolepis* Cope, 1862, endêmico da América do Sul Cisandina. As novas espécies ocorrem em três áreas no Estado do Ceará, nordeste do Brasil, identificadas como brejos-de-altitude. *Apostolepis mariae* sp. nov. ocorre na Serra de Maranguape e no Maciço de Baturité, e difere das demais do gênero por apresentar o seguinte conjunto de caracteres: 200-255 escamas ventrais e 23-36 pares de subcaudais, coloração dorsal e lateral da cabeça castanho escuro, com colar nugal claro completo (ou parcialmente partido) com 2-3 filas de escamas de largura, posterior colar cervical escuro, com 1-2 escamas de largura, presença de uma mancha clara abaixo do globo ocular (3ª e 4ª supralabiais), coloração corporal dorsal e lateral castanho avermelhado, com cinco listras castanho escuro longitudinais, persistentes nos adultos, 6 supralabiais (quarta e quinta em contato com a parietal) e uma temporal (0 + 1), 6-7 infralabiais (1ª – 4ª em contato com chinshields anteriores, nasal em contato com preocular, ponta da cauda coberta por uma banda negra na face dorsal e face ventral imaculada ou com pequenas manchas, e escama anal dividida. *Apostolepis thalesdelemai* sp. nov. ocorre no Planalto da Ibiapaba, é muito semelhante a espécie anterior, mas difere principalmente por apresentar 212-244 escamas ventrais e 29-38 pares de subcaudais, ausência do colar nugal claro (substituído por uma pequena mancha ou barra clara), colar cervical escuro discreto com ½ – 2 escamas de largura, parcialmente fusionado a coloração escura da cabeça, duas manchas laterais na cabeça, a primeira

ocupando a 3^a e 4^a supralabiais e a segunda sobre a 6^a supralabial, cinco listras dorsais longitudinais castanho escuro, a vertebral mais escura do que as duas paravertebrais, e ponta da cauda com uma banda escura na face dorsal e ventral. Ambas são mais assemelhadas com *A. longicaudata*, *A. nigrolineata* e *A. pyimi*.

Palavras chave: *Apostolepis mariae* sp. nov., *Apostolepis thalesdelemai* sp. nov., Brejos nordestinos, Domínio da Caatinga, Dipsadinae.

ABSTRACT

Two new species of snakes are described of the genus *Apostolepis* Cope, 1862, that is endemic to Cisandean South America. The new species occur in three areas in the State of Ceará, northeastern Brazil, the “brejos-de-altitude”. *Apostolepis mariae* sp. nov. occurs in the Serra de Maranguape and Maciço de Baturité, and differs from the others of the genus by the following characteristics: 200-255 ventral scales and 23-36 pairs of subcaudals, dorsal and lateral coloration of head dark brown, light nuchal collar completely or partially split (wide 2-3 rows of scales), posterior cervical dark collar (1-2 scales wide), presence of a light spot below the eye (third and fourth supralabials), dorsal and lateral body color reddish brown, with five longitudinal dark brown stripes, persistent in adults, 6 supralabials (fourth and fifth linked to parietal) and 6-7 infralabials (first - fourth linked to anterior chinshields), nasal in contact with preocular, tip of the tail covered by a black band on the dorsal surface and immaculate ventral face or with small spots, and divided anal scales. *Apostolepis thalesdelemai* sp. nov. occurs in the Planalto da Ibiapaba, is very similar to the previous species, but differs mainly by the following characteristics: 212-244 ventral scales and 29-38 pairs of subcaudals, absence of the light nuchal collar (replaced by a spot or light band small), discreet dark cervical collar with ½ - 2 scales of width, partially fused to the dark color of the head, two lateral patches on the head: the first occupying the third and fourth supralabials and the second on the sixth supralabial, five longitudinal dorsal dark brown stripes, a darker vertebral more dark than two pairs of paravertebrais and first pair lighter, and tip of the tail with a dark band on the dorsal and ventral faces. Both are more similar to *Apostolepis longicaudata*, *A. nigrolineata* and *A. pyimi*.

Key-words: *Apostolepis mariae* sp. nov., *Apostolepis thalesdelemai* sp. nov., “Brejos nordestinos”, Domain of the Caatinga, Dipsadinae.

INTRODUCTION

Apostolepis Cope, 1862 is a genus of snakes endemic to Cisandean South America, occurring from the Guianas to northern Argentina, with fossorial habits. Until now, it is composed of 32 species, of which 26 occur in Brazil, in various phytogeographies such as Amazon, Atlantic Forest, Cerrado, Caatinga and Chaco (Costa & Bérnils, 2014, Uetz et al., 2016).

Cope (1862) described the genus considering *Apostolepis flavotorquata* (described as *Elapomorphus flavo-torquatus* Duméril, Bibron & Duméril, 1854) as the type species, and also included *A. lepida* (*E. lepidus* Reinhardt, 1861, now *Coronelaps lepidus*) and *A. dorbignyi* (*Calamaria d'Orbigny* Schlegel, 1837). Soon after, Boulenger (1869), already recognizing the description of this new genus, also included the species *A. ambinigra* (described as *Rhynchonyx ambiniger* Peters, 1869), *A. coronata* (*E. coronatus* Sauvage, 1886, now junior synonym of *A. nigrolineata*), *A. assimilis* (*E. assimilis* Reinhardt, 1869), *A. lineata* (described as *E. erythronotus* Peters, 1880, and subsequently cited as *A. erythronotus lineatus* Cope, 1887), *A. nigrolineata* (*E. nigrolineatus* Peters, 1869), and described two new species: *A. nigroterminata* and *A. quinquelineata* (sometimes

considered synonymous with *A. nigrolineata*).

The genus, together with *Coronelaps*, *Elapomorphus* and *Phalotris*, has classically been considered part of the Elapomorphini tribe, which is characterized by the absence of internasal scales and presence of a dark band at the tip of the tail (Cope, 1862; Boulenger, 1869; 1903). However, higher level snake systematics are in a state of flux following recent estimates of phylogeny based on molecular data (e.g. Pyron et al., 2010; 2013). Within *Apostolepis* taxonomic status of various forms are also confused, probably due to various cases of descriptions based on only one specimen (e.g. *A. longicaudata* Gomes, 1921, *A. gaboi* Rodrigues, 1993 and *A. christineae* Lema, 2002), as well as due to many cases of presumed synonyms (*A. quinquelineata* Boulenger, 1869, *A. freitasi* Lema 2004 and *A. parassimilis* Lema & Renner, 2012) and later revalidations (e.g. *A. nigrolineata* (Peters, 1869), *A. pyymi* Boulenger, 1903 and *A. albicollaris* Lema, 2002), and few studies that incorporate phylogenetic approaches.

Some subgroups have been identified in this genus, although some may be artificial: *assimilis* group (Lema, 2001; Ferrarezzi et al., 2005); *ambinigra* group (Lema & Martins, 2016); *dimidiata* group

(Ferrarezzi, 1993; Lema, 2001; Nogueira et al., 2012; Lema & Martins, 2016); *flavotorquata*, *lineata*, *polylepis*, *tenius*, and *quinquelineata* group (Lema, 2001), this similar to *pymi* group (Lema & Albuquerque, 2010), including *A. nigrolineata* and *A. pymi*. However, except for the *assimilis* group (Ferrarezzi et al., 2005), which includes *A. assimilis*, *A. ammodites*, *A. cearensis*, *A. quirogai*, *A. arenaria* and *A. gaboi*, the others are not the result of systematic phylogenetic studies, that is, phylogenetic relationships were not evaluated. Moreover, the genus presents important interspecific variations in morphology and coloring, and even ontogenetic (Lema & Albuquerque, 2010; Cúrcio et al., 2011; Nogueira et al., 2012), which make it difficult to understand the relations and correct identifications, especially in the case of species with reduced series-types.

As with many of the other groups, the *pymi* group has been the subject of regular taxonomic modifications: *Apostolepis pymi* and *A. coronata* were synonymized by Amaral (1930a) with *A. quinquelineata*, considering mainly that the holotype of *A. pymi* is a juvenile specimen and the dorsal stripes may disappear in adult specimens of this species. Subsequently, Amaral (1930b) also considered *A. nigrolineata* the junior synonym of *A.*

flavotorquatus. However, the first species was revalidated and considered a senior synonym of *A. pymi* by Lema (1997), who examined the holotypes and considered that the *A. nigrolineata* holotype was a juvenile specimen of *A. pymi*. Hoge (1958) becomes valid *A. quinquelineata* again, but posteriorly, Cunha & Nascimento (1993) considered *A. pymi* and *A. quinquelineata* synonyms. Currently, *A. nigrolineata* and *A. pymi* are considered valid species, while *A. quinquelineata* and *A. coronata* remain recognized as junior synonyms of *A. nigrolineata* (Lema & Albuquerque, 2010).

In this work, two new species are described coming from relict forest areas located in the Northeast of Brazil, known as the “brejos de altitude”. Both were previously considered as *A. nigrolineata* by Nascimento & Lima-Verde (1989) or *A. gr. nigrolineata* by Borges-Nojosa et al. (2016) and Roberto & Loebmann (2016), *A. quinquelineata* by Lima-Verde & Cascon (1990), and still as *Apostolepis gr. pymi* by Borges-Nojosa (2006). Therefore here we add more species for the *pymi* group.

MATERIAL AND METHODS

All the material was fixed with 10% formalin and preserved in 70% alcohol, following routine herpetological procedures (Vanzolini & Papavero, 1967; Auricchio &

Salomão, 2002), with collection permits from ICMBio / SISBIO No. 10893-1, Reg. 472138. All measurements were performed with a rule with an accuracy 0,1 cm and a conventional caliper with an accuracy of 0.01 mm. For the pholidosis data, a stereoscopic magnifying glass was used, following the terminology suggested by Peters (1964) (Table 1). The type series were deposited in the herpetological collections of the Universidade Federal do Ceará (CHUFC) and Museu de Universidade Pontifícia Católica do Rio Grande do Sul (MCP).

Species Descriptions

Apostolepis mariae spec. nov.

(Figures 1 and 2)

Holotype: CHUFC 3131, adult female, November 23, 1997, col. D.M. Borges-Nojosa, Maciço de Baturité, Sítio Olho d'água dos Tangarás, Pacoti Municipality, State of Ceará, Brazil (04°14'13,7"S/ 38°54'58,6"W; Datum WGS 84).

Paratypes: **Brazil: Ceará State: Serra de Maranguape: Maranguape Municipality** (03°54'–04°03' S/ 38°32'–38°40' W; Datum WGS 84): CHUFC 2085, Jun 11, 1997, cols. D.M. Borges-Nojosa, D.C. Lima and B.M. Barguil, Trilha do Pirapora, Castelinho locality; CHUFC 2102, Aug 30, 1997, col. D.C. Lima, Trilha da Rajada locality; CHUFC 2339, Jul 14, 1997, and CHUFC 2347, Jan 29, 1998, col.

D.C. Lima, Linha da Serra locality; CHUFC 2208, Feb 19, 1998, CHUFC 2212-13, Aug 27, 1998, and CHUFC 2218, Apr 29, 1998, col. D.C. Lima; CHUFC 2563, Feb 29, 2004, col. J.C.L. Melo. **Maciço de Baturité: Guaramiranga Municipality** (04°15'41,47"S/ 38°55'59,11"W; Datum WGS 84): CHUFC 1950, Apr 11, 1986, col. J.J. da Silva, Sítio Água Boa; CHUFC 2067, Mar-Jul 1989, col. D.M. Borges-Nojosa; CHUFC 2345, Aug 15, 1999, and MCP 19503 (=CHUFC 2371), Jan 28, 2000, col. D.M. Borges-Nojosa, Linha da Serra locality. **Mulungu Municipality** (04°18'13,62"S/ 38°59'40,85"W; Datum WGS 84): CHUFC 3645, Apr 01, 2011, col. A.J.G. Araújo. **Pacoti Municipality** (04°13'29,97"S/ 38°55'15,65"W; Datum WGS 84): CHUFC 2344, Apr 11, 1998, col. D.M. Borges-Nojosa, Santana locality; CHUFC 2338, Dez 15-18, 1997, CHUFC 2346, Jan 11, 1998, and CHUFC 2463, Jan 03, 1999, CHUFC 3132, Nov 23, 1997, col. D.M. Borges-Nojosa, Sítio Olho d'água dos Tangarás; CHUFC 2732, Dec 2005, and CHUFC 2841, Jun 27, 2006, col. W.C.M. Luz, Sítio Xangrilá; CHUFC 3504, Mar, 1997, col. P.A. Nojosa, Cidade de Pacoti.

Diagnosis:

Apostolepis mariae sp. nov. is closer to *A. nigrolineata* and *A. pyimi*, differing from these (characters in parentheses), and of the other

species of the genus, by the following characteristics: (1) snout rounded or slightly acuminate, but not prominent; (2) dorsal coloration of head dark brown (black color in *A. nigrolineata*); (3) Six supralabials (fourth and fifth in contact with the parietal) and 6-7 infralabials (first to fourth in contact with anterior chinshield); (4) one temporal (0 + 1) separating the sixth supralabial from the parietal (variable in *A. pymi*); (5) nasal scale in contact with preocular; (6) light lateral spot below the eye, usually occupying the third and fourth supralabials; (7) yellow nuchal collar completely or partially split by a thin stripe, with depth of 2-3 rows of dorsal scales (no collar in *A. nigrolineata* and collar disrupted in *A. pymi*); (8) posterior cervical collar with 1-2 scales (present in both); (9) reddish-brown body color on the back and sides (brown in *A. pymi*), with five longitudinal dorsal dark brown stripes (without in *A. flavotorquatus*), persistent in the juvenile and adult phases (may be unnoticed in the adult phase of both); (10) dorsal dark brown stripes (one vertebral and two pairs of paravertebrals) with similar wider (second paravertebral stripe wider than other stripes in *A. pymi*); (11) tip of the tail covered in the dorsal face by a terminal black band, and ventral face clean or with small dark spots (complete in *A. pymi*); (12) anal divided (anal entire in *A. nigrolineata* and divided in *A. pymi*);

and (13) 200-255 ventral scales and 23-36 pairs of subcaudals.

Description of Holotype:

Measurements (mm): snout-vent length 563; head length 12.8 (2.1% of total length); tail length 39.5 (6.6% of TL); body width 9.3; tail width 6.5; Female.

Cylindrical body (mid-body width / SVL = 0.017), covered by smooth scales, 15 rows of scales (no reduction), ventral scales 255, much wider than the dorsal, and 23 pairs of subcaudal. Snout rounded or slightly acuminate, rostral muzzle visible from above, with posterior triangular apex, separating the nasals. A pair of large prefrontals, in close contact with each other, lateral to nasal and preocular, posterior to supraocular and frontal. Frontal lanceolate, twice as long as wide, lateral contact with supraocular (rectangular) and posterior with parietal. Large parietals, with rounded lateral borders, in anterior contact with frontal, supraocular and postocular, lateral with fourth and fifth supralabials and temporal, and posterior with post-parietal and inter-postparietal. A pair of postparietal scales (or occipital scales), separated by an inter-postparietal (or interoccipitals), clearly differentiated in size and shape from the first dorsal scales. Pointed first dorsal scales. Eye visible and minute, circled by supraocular, preocular, second and third

supralabials, and postocular. Supralabials 6/6, being the fifth largest. Nasal triangular, with central rostril, whole, in contact above with prefrontal, below with first supralabial and lateral with preocular and second supralabial. Parietal in contact with the fourth (punctual) and fifth supralabials, and temporal (broadly). Temporal single, between the parietal and the sixth supralabial. Symphysial triangular, small, followed laterally by the first infralabials, which make medium contact behind the symphysial. Infralabiais 7/7, the fourth and fifth being the largest. Two pairs of chinshields, an anterior in contact with the first-fourth infralabials, followed by the posterior pair, in contact with fourth and fifth infralabials and gular scales. Accented symphysial groove. Dorsal and lateral head face (to postparietal scales and first dorsal ones) dark brown. Rostral, nasal and

prefrontals stained, with slightly lighter shades. Light yellow round spot below the eyeball, occupying the third and fourth supralabial. Complete light yellow nuchal collar with depth of 2-3 rows of dorsal scales, and laterally to the lower margin of the last longitudinal stripe and dark cervical collar positioned behind the nuchal collar, with 2-3 scales deep, joining the five longitudinal stripes; Back and lateral reddish-brown body color, with five longitudinal dorsal dark brown stripes, one central vertebral and two pairs of paravertebral. Clear ventral face, no stains, except on the edges of the symphysial, first-third supralabial and middle of the fourth supralabial. Tail tip covered in dorsal face by a terminal black band, with 10 rows of scales, cream ventral face, with small dark spots in the womb and light final scale and. Anal scale divided.

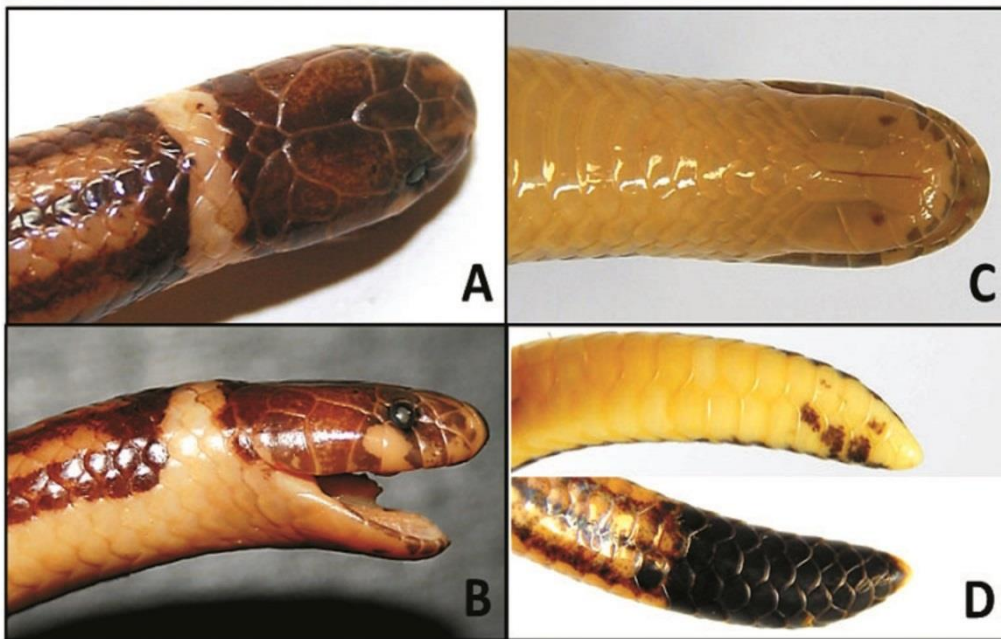


Figure 1 – *Apostolepis mariae* sp. nov. – Holotype (CHUFC 3131): Head (A) dorsal view, (B) lateral, (C) and ventral; Tip of tail (D) ventral and dorsal views. (Photos: D.C. Lima and C.H. Bezerra)



Figure 2: Color in life of paratype (CHUFC 2563) of *Apostolepis mariae* sp. nov., adult male. (Photo: D.M.Borges-Nojosa).

Etymology:

The species is a tribute to Mrs. Maria Diva Borges, a good human example and mother of the first author (DMBN). It is also a tribute to all "Marias", a term intended for women who struggle for survival on a daily basis, but without losing their tenderness.

Coloring and Variation:

The holotype shows the coloration that corresponds to most of the specimens (Figure 1 and 2). However in some specimens the following variations can be observed: (1) light nuchal collar partially or completely divided by the dark brown vertebral stripe; (2) the dorsal stripes may have the following patterns: stripes with ($\frac{1}{2} + \frac{1}{2}$) scales of thickness, all being equal (holotype pattern), all thin stripes with very intense staining (pattern of juvenile specimens) or vertebral stripe thinner than paravertebral; (3) tail terminal band also present on the ventral face, being much narrower (CHUFC 2208, CHUFC 2212 and CHUFC 2732); And (4) the presence of small dark spots in the gular region only observed in the holotype. Other variations in morphometry and pholidosis are given in Table 1.

Distribution and Natural history:

Until now, the species has been recorded only for two "brejos de altitude", Maciço de Baturité (Pacoti,

Guaramiranga and Mulungu municipality) and Serra de Maranguape (Maranguape municipality), both in the state of Ceará (Figure 4). All specimens were captured in areas covered by rain forest, classified as "Floresta Tropical Plúvio-Nebular Perenifólia" and "Floresta Tropical Plúvio-Nebular Sub-Perenifólia" (Andrade-Lima, 1966; 1982) or "Matas Secas do Cristalino" and "Matas Úmidas do Cristalino" by Moro et al. (2015), or in clearings near this type of vegetation, at altitudes above 600m altitude. It is a terrestrial animal, with fossorial habits, and when captured, presents non-aggressive behavior. Lema (2001) cites nocturnal habits for the genus, however, at least one specimen of this species was collected active during the day (CHUFC 2563)(Figure 2).

***Apostolepis thalesdelemai* spec. nov.**

(Figure 3)

Holotype: CHUFC 2341, adult female, June 04, 1999, cols. D.M. Borges-Nojosa, Planalto da Ibiapaba, Murimbeca locality, Ubajara Municipality, State of Ceará, Brazil (03°49'14,3"S/40°54'16,8"W; Datum WGS 84).

Paratypes: **Brazil: Ceará State: Planalto da Ibiapaba: Ibiapina Municipality:** MCP 19504 (=CHUFC 2337), CHUFC 2340 and CHUFC 2351, Oct 07, 1999, and

CHUFC 2342-43, Aug 2, 1998, col. D.M. Borges-Nojosa, Boa Vista locality (03°55'33,2"S/ 40°50'59,7"W; Datum WGS 84); CHUFC 2437, Dec 19, 1998, col. D.M. Borges-Nojosa, Ladeira do Mucambo (03°54'37,5"S/ 40°53'0,2"W; Datum WGS 84). **São Benedito Municipality:** CHUFC 2768-69, Oct 07, 1999, col. D.M. Borges-Nojosa, Sítio Buriti-apuá, Inhuçu locality (04°07'51,8"S/ 40°50'13,8"W; Datum WGS 84). **Ubajara Municipality** (3°51'03,06"S/ 40°55'10,92"W; Datum WGS 84): CHUFC 1349, Nov 1987, col. H. Klein, Sítio Santana; CHUFC 2110, Sep 8, 1997, and CHUFC 2137, Mar 7, 1998, col. F.T. Araújo, Fazenda Buriti (03°49'56,03"S/ 40°56'10,0"W; Datum WGS 84); CHUFC 2154, Mar 7, 1998, and CHUFC 2350, Jun 4, 1999, col. D.M. Borges-Nojosa, Sítio Murimbeca; CHUFC 2954, Apr 03, 2008, col. D.M. Borges-Nojosa.

Diagnosis:

Apostolepis thalesdelemai sp. nov. is very similar to *A. mariae*, being also closer to *A. nigrolineata*, *A. pyimi* and *A. longicaudata*. It differs from these and other species of the genus, by the following characteristics: (1) 212-244 ventral scales and 29-38 pairs of subcaudals; (2) without yellow nuchal collar, replaced by a dark brown band covering the first 4 rows of dorsal scales between the

paravertebral longitudinal stripes. On the lateral, the presence of a light band with 2-3 scales length or light spot between the first and second paravertebral longitudinal stripes, with depth of $\frac{1}{2}$, 1 or 2 scales; (3) the presence of a discreet dark cervical collar with $\frac{1}{2}$, 1 or 2 scales; (4) light lateral spot below the eye, usually occupying the third and fourth supralabial, and other spots in sixth supralabial (absent in *A. longicaudata*); (5) with five longitudinal dorsal dark brown stripes, a darker vertebral more dark than two pairs of paravertebrals (first pair lighter); (6) fourth and fifth supralabial and temporal in contact with parietal; (7) tip of the tail covered in the dorsal and ventral faces by a terminal black band, but with the last light scale; (8) Anal scale divided.

Description of Holotype:

Measurements (mm): snout-vent length 577; head length 11.5 (1.8% of total length); tail length 70 (10.8% of TL); body width 10.9; tail width 6.7; Female.

Cylindrical body (mid-body width / SVL = 0.019), covered by smooth scales, 15 rows of scales (no reduction), ventral scales 221, much wider than the dorsal, and 37 pairs of subcaudal. Snout rounded, rostral muzzle visible from above, with posterior apex between prefrontals, separating the nasals, and with a small concavity at the anterior

border. A pair of large prefrontals, in close contact with each other, lateral to nasal and preocular, posterior to supraocular and frontal. Frontal hexagonal, longer than wide, lateral contact with supraocular (rectangular) and posterior with parietal. Large parietals, twice as long as wide, in anterior contact with frontal, supraocular and postocular, lateral with fourth and fifth supralabials and temporal, and posterior with post-parietal and inter-postparietal. A pair of postparietal scales, separated by an inter-postparietal, differentiated in size and shape from the first dorsal scales. Pointed first dorsal scales. First dorsal scales with rounded vertices. Eye visible and minute, circled by supraocular, preocular, second and third supralabial and postocular. Supralabials 6/6, being the fifth largest. Nasal triangular, with central rostril, in contact with prefrontal, rostral, first and second supralabial and preocular. Parietal in contact with the fourth and fifth supralabials, and temporal. Temporal single, between the parietal and the sixth supralabial. Symphysial triangular, small, followed laterally by the first infralabials, which make medium contact behind the symphysial. Infralabials 7/8, the fourth and fifth being the largest. Two pairs of chinshields, an anterior in contact

with the first-fourth infralabials, followed by the posterior pair, smaller than anterior, in contact with fourth and fifth infralabial and gular scales. Accented symphysial groove.

Dorsal and lateral head face (to postparietal scales and first dorsal ones) dark brown. Rostral, nasal and second supralabial stained. Light round spot below the eyeball, occupying the third and fourth supralabial, followed by another spot on the sixth supralabial. Without nuchal collar, replaced by a dark brown band covering the first 4 rows of dorsal scales between the paravertebral longitudinal stripes. On the lateral, the presence of a light band with 2-3 scales length and 1 scales width. Very discreet and thin cervical collar with 1 dorsal scale width, joining the five longitudinal stripes; Back and lateral reddish-brown body color, with five longitudinal dorsal dark brown stripes, a darker vertebral more dark than paravertebrals (first pair lighter). Body ventral region clear, no stains. Head ventral cream, with small spots on the edges of the symphysial and second infralabials. Tail tip covered in dorsal and ventral faces by a terminal black band, with 9 and 6 rows of scales respectively, and final light scale. Anal scale divided.

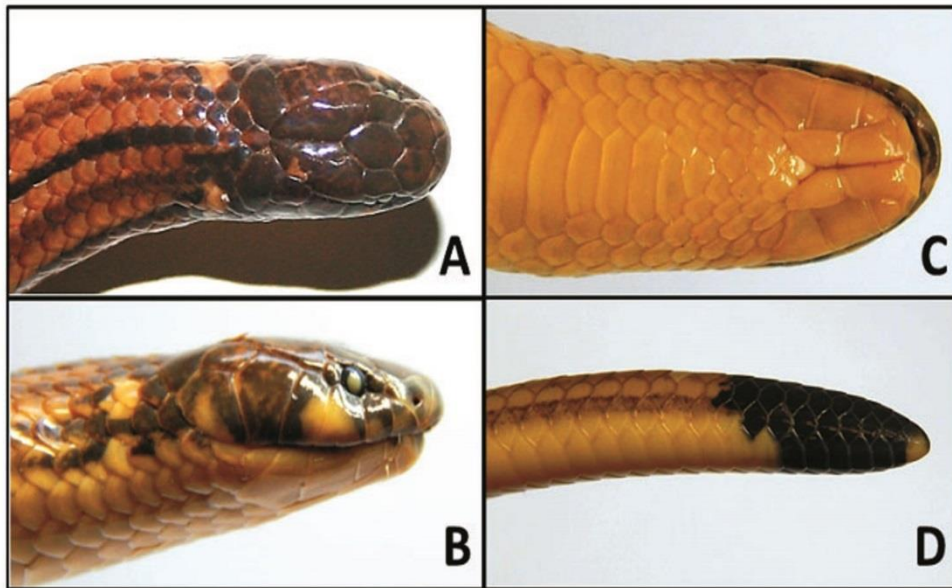


Figure 3 – *Apostolepis thalesdelemai* sp. nov. – Holotype (CHUFC 2341): Head (A) dorsal view, (B) lateral, (C) and ventral; Tip of tail (D) lateral view. (Photos: D.C. Lima and C.H. Bezerra)

Etymology:

This species is a tribute to the herpetologist Prof. Dr. Thales de Lema, for his important contribution to the study of the genus *Apostolepis*, which resulted in the publication of seven of the currently accepted species.

Coloring and Variations:

The color of the holotype corresponds to the most frequent pattern, varying only in the nuchal region, which may have spots or small bands more elongated than the spots, with $\frac{1}{2}$, 1 or 2 scales in width, and 3-4 scales length. This pattern is more visible in the juvenile specimen (CHUFC 2137), as reported by Lema (2001) and Cúrcio et al. (2011). Normally, the vertebral stripe is darker and thinner than

paravertebral stripes. Other variations in morphometry and pholidosis are given in Table 1.

Distribution and Natural History

This species was recorded only in the Planalto da Ibiapaba, collected in the Ubajara, Ibiapina and São Benedito municipality, and observed, but not collected, in a locality of Tianguá municipality, Gameleira (Figure 4). All localities are at altitudes above 600-700 meters, in areas covered by rain forest, classified as “Floresta Tropical Plúvio-Nebular Perenífólia” and “Floresta Tropical Plúvio-Nebular Sub-Perenífólia” (Andrade-Lima, 1966; 1982) or “Matas Secas do Sedimentar” and “Matas Úmidas do Sedimentar” by Moro et al. (2015), or close to this type of vegetation. Unfortunately, there is no information on the biology of the species.

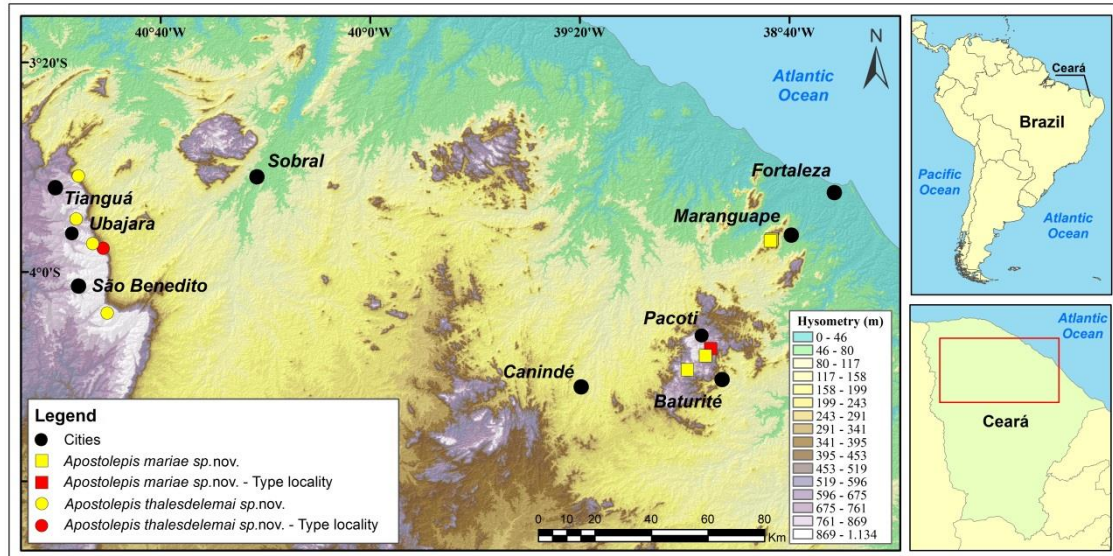


Figure 4: Distributions of *Apostolepis mariae* sp. nov. (yellow squares; red square – type locality) and *A. thalesdelemai* sp. nov. (yellow circles; red circle – type locality) in the state of Ceará, Brazil.

DISCUSSION

According to Lema & Renner (1998), *A. pymi* occurs mainly in the eastern Amazonia and *A. nigrolineata* (including the distributions of the junior synonyms *A. quinquelineata* and *A. rondoni*) in western Amazonia. However, both also occur in sympatry in the eastern Amazon region. Therefore, if *Apostolepis mariae* and *A. thalesdelemai* group with these two Amazonian species, they may be represent two new cases of speciation by isolation of the relictual rain forest that remained in the “brejos de altitude”, that probably occurred when the Amazonia was much larger, occupying part of the Northeast of Brazil, during periods with dry and

humid climate of the Quaternary (Haffer, 1977; 1979; Santos et al., 2007; Batalha-Filho et al., 2013). Other cases, such as the gymnophiona *Cecaelia tentaculata* (Borges-Nojosa et al., 2017), the snakes *Imantodes cenchoa*, *Sibon nebulata*, *Lachesis muta* and *Drymoluber dichrous* (Nascimento e Lima-Verde, 1989; Borges-Nojosa & Lima-Verde, 1999; Borges-Nojosa & Lima, 2001; Borges-Nojosa, 2007), the lizards *Kentropyx calcarata* and *Cercosaura ocellata* (Borges-Nojosa & Caramaschi, 2003), in addition to invertebrate animals (e.g. *Hadrurochactas brejo* Lourenço 1988) and vegetative examples show similar distributions (Santos et al., 2007). The “brejos de altitude” are located

in the Caatingas Domain, but do not share the same vegetation and fauna with this dry environment, particularly in their higher areas (Vanzolini, 1981; Vanzolini & Williams, 1981; Borges-Nojosa & Caramaschi, 2003). These two new species occur over 600 meters, and to date, they have not been recorded at lower altitudes, probably because they have low tolerance to the dry environment. On the contrary, *A. cearensis*, a species typical of the Caatingas, can be found in the highest areas of the “brejos de altitude”. In addition, *A. arenaria* (1), *A. gaboi* (2) and *A. longicaudata* (3) also occur in open and dry environments in northeastern Brazil, and although they share similarities in dorsal coloration composed of longitudinal stripes, they are distinguishable from these three species by respective suites of characters: (1) low number of ventral, nasal without contact with preocular and fifth and sixth supralabial in contact with parietal; (2); Also due to absence of contact between nasal and preocular, parietal in contact with fifth and sixth supralabial and 7 dorsal stripes (Rodrigues, 1993); and (3) condition of the white nuchal collar entirely lacking, temporal formulae with (0 + 0) and the present of lateral spot on the sixth supralabial (Cúrcio et al., 2011). *Apostolepis mariae* and *A. thalesdelemai* present distributions

restricted to the “brejos de altitude”, similar to the other endemic and threatened species, such as the anuran *Adelophryne maranguapensis* Hoogmoed, Borges & Cascon, 1994 (VU), the lizard *Leposoma baturitensis* Rodrigues & Borges, 1997 (EN), and the snake *Atractus ronnie* Passos, Fernandes & Borges-Nojosa, 2007 (EN) (BRASIL, 2014), and additionally, with others endemic species including *Adelophryne baturitensis* Hoogmoed, Borges & Cascon, 1994, *Rhinella casconi* Roberto Brito & Thomé, 2014 and *Placosoma limaverdorum* Borges-Nojosa, Caramaschi & Rodrigues, 2016 (the latter two have not yet been evaluated). Therefore, considering the restricted size of the areas of occurrence, the degree of maximum importance of the areas due to the rainforest isolation and the existence of other species already demonstrated to be threatened by deforestation and other anthropic activities, these two new species must also be evaluated and indicated as endangered species.

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Table 1 – Morphometric (mm) and meristic data (mean ± standard deviation) of type series of *Apostolepis mariae* sp. nov. and *Apostolepis thalesdelemai* sp. nov.

Characters	<i>Apostolepis mariae</i> sp. nov.				<i>Apostolepis thalesdelemai</i> sp. nov.			
	Holotype	Paratypes		Total (n=23)	Holotype	Paratypes		Total (n=15)
		Males (n=13)	Females (n=8)			Males (n=6)	Females (n=7)	
Snout-vent Length (SVL)	563	272 – 613 470.5 ± 93.9	257 – 611 454.8 ± 130.4	201 – 613 443.5 ± 123.2	577	282 - 602 466.5 ±109	285 – 673 436 ±145.4	169 – 673 419.1 ± 143.6
Head Length	12.8	7.3 – 12.2 10.3 ± 1.6	7.1 – 12.8 10.5 ± 2.0	6.0 – 12.8 10.0 ± 2.0	11.5	7.2 – 12.4 10.6 ± 1.9	7.3 – 12.4 9.5 ± 2.1	6.1 – 12.4 9.3 ± 1.4
Head Length /Total Length (%)	2.1%	1.6 – 2.4% 2.0 ± 0.2	1.9 – 2.9% 2.3 ± 0.3	1.6 – 2.9% 2.2 ± 0.3	1.8%	1.8 – 2.4% 2.1 ± 0.2	1.7 – 2.3% 2.0 ± 0.3	1.7 – 3.2% 2.2 ± 0.4
Tail Length	39.5	28-59.1 46.4 ± 8.2	24.8 – 43.1 37.1 ± 7.1	21 – 59.1 41.0 ± 10.6	70	26 – 66 49.2 ± 13.8	26.7 – 70 42.9 ± 16.7	21 – 70 42.9 ± 16.1
Tail Length/Total Length (%)	6.6%	6.8 – 10.8% 9.1 ± 1.4	6.1 – 9.7% 7.8 ± 1.4	6.1 – 10.8% 8.6 ± 1.5	10.8%	7.4 – 11.6% 9.5 ± 1.6	7.6 – 10.8 % 8.9 ± 1.3	7.4 – 11.6% 9.3 ± 1.4
Mid-body Width	9.3	4.8 – 10.9 8.0 ± 1.6	6.2 – 9.5 8.0 ± 1.3	3.8 – 10.9 7.7 ± 1.8	10.9	7.1 – 11.3 10.1 ± 1.5	5.4 – 13.3 8.9 ± 3.1	3.2 – 13.3 8.7 ± 3.1
Mid-body Width/ SVL	0.017	0.013 – 0.022 0.017 ± 0.002	0.014 – 0.024 0.018 ± 0.004	0.013 – 0.024 0.018 ± 0.003	0.019	0.019- 0.025 0.022±0.00 2	0.018–0.028 0.020±0.003	0.016-0.028 0.021±0.003
Tail Width	6.5	2.9 – 6.3 4.9 ± 1.1	3.4 – 8.8 5.2 ± 1.8	2.1 – 8.8 4.8 ± 1.5	6.7	3.5 – 6.7 5.4 ± 1.2	3.1 – 6.9 4.5 ± 1.7	2 – 6.9 4.6 ± 1.6
Tail width / SVL	0.012	0.006 – 0.12 0.010 ± 0.002	0.009 – 0.019 0.012 ± 0.003	0.006 – 0.019 0.011 ± 0.002	0.012	0.010- 0.014 0.012±0.00 2	0.009-0.012 0.010±0.001	0.009-0.014 0.011±0.001
Ventral scales	255	200 – 249 228.8 ± 13.9	222 - 255 241.5 ± 12.3	200 – 255 233.7 ± 13.8	221	212 – 244 226.8 ± 13.7	220 – 241 229.0 ± 8.1	212 – 244 227.6 ± 10.9



Subcaudais scales	23	23 – 38 32.3 ± 4.5	23 – 35 28.3 ± 4.2	23 – 38 31.0 ± 4.6	37	29 – 36 33.2 ± 3.1	29 – 38 31.9 ± 3.9	29 – 38 32.5 ± 3.3
Supralabials contact Parietal	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a	4 ^a e 5 ^a
Nucal collar row scales	3	2-3 2.6 ± 0.5	2 – 3 2.9 ± 0.4	2 – 3 2.7 ± 0.5	Absent	Absent	Absent	Absent
Cervical collar row scales	2	1 – 3 2.5 ± 0.7	1 – 2 1.8 ± 0.5	0.5 – 3 2.1 ± 0.7	1	1 – 2	0 – 2	0 – 2
Tail dorsal scales with black band	10	5 – 11 7.5 ± 2.1	6 – 10 7.4 ± 1.8	5 – 11 7.6 ± 1.9	9	8 – 9 8.7 ± 0.5	7 – 10 8.3 ± 1.0	7 – 10 8.5 ± 0.9
Tail subcaudal scales with black band	Absent	Absent or with black spots	Absent or with black spots	Absent or with black spots	6	4 – 6 5.3 ± 1.0	4 – 6 5.0 ± 1.3	4 – 6 5.1 ± 1.0

Note: Type serie of *A. mariae*: 23 specimens (8 females (=7 + Holotype) + 13 males + 2 juveniles); Type serie *A. thalesdelemai*: 15 specimens (7 females (=6 + Holotype) + 6 males + 2 juveniles).