

## A new species of *Thamnodynastes* from the open areas of central and northeastern Brazil (Serpentes: Dipsadidae: Tachymenini)

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**Abstract.** The genus *Thamnodynastes* Wagler, 1830 is currently composed by nineteen species of viviparous and opisthoglyphous snakes, largely distributed in South America, from Colombia to Argentina. The analyses of a large data set of specimens from South American collections evidenced one unknown species from the open formations of central and northeastern Brazil, which is described here. The new species is distinguished from all its congeners by a unique combination of characters, including 19 dorsal rows of smooth scales on the midbody, the smallest number of subcaudals in the genus, and a distinct hemipenial morphology and coloration pattern. To define this new species we present robust diagnostic characters and discuss comparisons with other species of this diverse and taxonomically complex genus of Neotropical snakes.

Key words. Neotropical region, Caatinga, Cerrado, Squamata, taxonomy, Xenodontinae.

### Introduction

The tribe Tachymenini was first established by BAILEY (1966a, b, 1967) to encompass the genera *Calamodontophis* AMARAL, 1963, *Gomesophis* HOGE & MERTENS, 1959, *Pseudotomodon* LEYBOLD, 1873, *Ptychophis* GOMES, 1915, *Tachymenis* WIEGMANN, 1835, *Thamnodynastes* WAGLER, 1830, and *Tomodon* DUMÉRIL & BRIBON, 1853. Recent morphological (FERRAREZZI 1994) and molecular works (VIDAL et al. 2000, ZAHER et al. 2009, VIDAL et al. 2010, GRAZZIOTIN et al. 2012) consistently recovered this group as a monophyletic tribe within the subfamily Xenodontinae (VIDAL et al. 2000, ZAHER et al. 2009). However, several taxonomic issues regarding the validity of a number of taxa remain unsolved, especially for the most specious genera *Tachymenis* and *Thamnodynastes*, which support a hidden diversity of undescribed species within the tribe (FRANCO & FERREIRA 2002, FRANCO et al. 2003, HARVEY & MUÑOZ 2004, BAILEY et al. 2005, BAILEY & THOMAS 2007).

Species belonging to the genus *Thamnodynastes* tend to share a suite of external features. They are small to medium size, opisthoglyphous and viviparous snakes, with elliptical pupils, single nasal scales (secondarily semidivided), a blotched dorsal pattern that is predominantly checkered anteriorly and variegated or striped posteriorly, with

two to six longitudinal lines along the venter (secondarily blotched), a distinctive dark postocular stripe and a white cervical dorsal stripe, bordered by a pair of longitudinal dark bands (FRANCO & FERREIRA 2002, FRANCO et al. 2003, BAILEY et al. 2005, BAILEY & THOMAS 2007).

The genus occurs throughout South America and is composed by 19 species (FRANCO & FERREIRA 2002, FRANCO et al. 2003, BAILEY et al. 2005, BAILEY & THOMAS 2007). Ten species are recognized for the Brazilian territory, *Thamnodynastes almae*, *T. chaquensis*, *T. hypoconia*, *T. lanei*, *T. longicaudus*, *T. pallidus*, *T. rutilus*, *T. sertanejo*, *T. strigatus* and *T. ramonriveroi* (FRANCO & FERREIRA 2002, BAILEY & THOMAS 2007). At least four of them can be found in the northeast and the northern portion of central Brazil: *T. almae*, *T. sertanejo*, *T. hypoconia*, and *T. pallidus*; the first three from arid and open formations, and the latter in forested areas (HANDAM & LIRA-DA-SILVA 2012, COELHO et al. 2013, GUEDES et al. 2014, NÓBREGA et al. 2016).

An eleventh species, here referred as *Thamnodynastes cf. nattereri* and previously mentioned as *Thamnodynastes* sp.1 by FRANCO & FERREIRA (2002), is known to occur along most of the Atlantic Domain in Brazil, with an additional record in the Caatinga (GUEDES et al. 2014). This taxon has been cited in several herpetological inventories as *Thamnodynastes cf. nattereri* (BERTOLUCI et al. 2009,

CONDEZ et al. 2009, MARQUES et al. 2009, PONTES et al. 2009, ARAÚJO et al. 2010, HAMDAN & LIRA-DA-SILVA 2012, GUEDES et al. 2014). However, its taxonomic status and distribution records are still controversial and will be addressed properly in an upcoming publication (V. TREVINE et al. in prep.).

Here we describe a new species of *Thamnodynastes* from the dry forested areas of central and northeastern Brazil. This species is readily distinguishable from the five species that occur in the same region, including *T. cf. nattereri*, which is promptly differentiated from the new species by its immaculated gular region.

### Materials and methods

We examined 176 specimens from the following Herpetological Collections (acronyms given in parenthesis): Laboratório Especial de Coleções Zoológicas, Instituto Butantan, São Paulo, Brazil (IBSP), Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP), Museu Nacional da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ), Museu de Zoologia da Universidade Santa Cruz, Ilhéus, Bahia, Brazil (MZUESC), Museu de Zoologia da Universidade Federal da Bahia, Salvador, Bahia, Brazil (MZUFBA), Museu de Zoologia da Universidade Estadual de Feira de Santana, Feira de Santana, Bahia, Brazil (MZFS), Museu de Fauna da Caatinga, Universidade Federal do Vale do Rio São Francisco, Petrolina, Pernambuco, Brazil (MFCH), Coleção Herpetológica da Universidade de Brasília, DF, Brazil (CHUNB), Coleção Herpetológica da Universidade Federal de Paraíba, João Pessoa, Paraíba, Brazil (CHUFPB), Museu de Zoologia, Universidade Estadual de Campinas, São Paulo, Brazil (ZUEC), Fundação Ezequiel Dias, Belo Horizonte, Minas Gerais, Brazil (FUNED), Museu Paraense Emílio Goeldi, Belém, Pará, Brazil (MPEG), Coleção Herpetológica da Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil (UFRGS). Specimens examined are listed in the Appendix.

Snout–vent length (SVL) and tail length (TL) were measured to the nearest 1 mm by stretching the specimen against a metallic ruler. Other measurements were taken to the nearest 0.1 mm with a digital calliper. Measures were taken only in sexually mature specimens. Females were considered to be sexually mature when secondary vitellogenetic follicles or embryos were present. Males were considered sexually mature when their snout–vent length (SVL) were equal or larger than the SVL of the smallest sexually mature female. Scale counts and measurements of head shields and scales followed PETERS (1964) and PETERS & OREJAS-MIRANDA (1970). Ventral counts followed DOWLING (1951), although pre ventral scales were not included here. Counts and measurements of paired structures were scored as right/left.

Hemipenial preparation followed protocols by PESANTES (1994), MANZANI & ABE (1998), ZAHER (1999) and ZAHER & PRUDENTE (2003). After preparation, hemipenes

were stained with alizarin in a 70% alcohol solution to ease the visualization of structures (NUNES et al. 2012). Hemipenial terminology follows ZAHER (1999).

### Nomenclatural Acts

The electronic edition of this article conforms to the requirements of the amended International Code of Zoological Nomenclature, and hence the new names contained herein are available under that Code from the electronic edition of this article. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICBN. The LSID (Life Science Identifier) for this publication is: urn:lsid:zoobank.org:pub:4E8D503B-36F7-4095-B935-74CD2D74A71A. The electronic edition of this work was published in a journal with an ISSN, and has been archived and is available from the following digital repositories: www.salamandra-journal.com.

### Results

#### *Thamnodynastes phoenix* sp. n. (Figs 1, 2, Tables 1, 2)

ZooBank: LSID:urn:lsid:zoobank.org:pub:4E8D503B-36F7-4095-B935-74CD2D74A71A

*Thamnodynastes* sp. 2 – FRANCO & FERREIRA, 2002

*Thamnodynastes* sp. 2 – HAMDAN & LIRA-DA-SILVA, 2012

*Thamnodynastes* sp. 2 – COELHO, SOUZA, WEIDER, PEREIRA & RIBEIRO, 2013

*Thamnodynastes* sp. – GUEDES, NOGUEIRA & SAWAYA, 2014

Holotype: Brazil, Pernambuco, municipality of Petrolina, 09°19'29.00" S, 40°32'50.00" W, 389 m above sea level, Campus Ciências Agrárias, Universidade Federal do Vale do São Francisco (UNIVASF): IBSP 87527, adult male collected by LEONARDO DE BARROS RIBEIRO on 4 November 2011 (Figs 1 and 2).

Paratypes (N = 12): Brazil: Alagoas: UHE Xingó (9°37'25" S, 37°47'54" W): MZUSP 10875 (former CHESF 3455), adult female, no collector information; and MZUSP 10878 (former CHESF 3723), adult male, no collector information; Bahia: municipality of Guanambi (14°12' S, 42°46' W): IBSP 54904, adult male, collected by Guanambi city hall, 17 August 1992; municipality of Queimadas (10°58'40" S, 39°37'26" W): MZUSP 10775, adult female, collected by MIGUEL T. RODRIGUES, October 1991; Ceará: Serra do Baturité (4°23'48.8" S, 39°01'28.3" W): MZUSP 21180, young female, collected by NATÁLIA RIZZO FRIOL et al., 27 October 2012; Pernambuco: municipality of Floresta (7°23'20" S, 38°46'26" W): MFCH 1897 (former LPE 1275), adult female, no collector information, 23 May 2009; municipality of Salgueiro (8°04'00" S, 39°06'00" W): MFCH 1887 (former NCA 822), young male, no collector information, 19 May 2009; UHE Itaparica (9°08'37" S 38°18'43" W):

IBSP 52127, adult female, collected by CHESF Company, 20 August 1988; Piauí: Estação Ecológica Uruçuí-Una ( $8^{\circ}38' S$ ,  $44^{\circ}56' W$ ): MZUSP 18146, adult female, and MZUSP 18147, adult male, collected by HUSSAM ZAHER et al., 17–30 January 2001; municipality of Piracuruca, Parque Nacional das Sete Cidades ( $4^{\circ}5'59'' S$ ,  $41^{\circ}42'50'' W$ ): MPEG 23344, adult male, no collector information, 7 September 2005; Tocantins: municipality of Palmeiras do Tocantins ( $6^{\circ}36'49'' S$ ,  $47^{\circ}32'46'' W$ ): MZUSP 19105 (former EST 14460), adult male, collected on UHE Estreito by Systemae Naturae Consultoria Ambiental, 3 November 2011; municipality of Mateiros, Pares do Jalapão, Posto das Dunas ( $10^{\circ}22'40'' S$ ,  $46^{\circ}40'30'' W$ ): MNRJ 15196, adult female, collected by A. CHAGAS, 14 June 2007.

**Diagnosis:** *Thamnodynastes phoenix* sp. n. differs from all other species of the genus by the following combination of characters: 19/19/15 dorsal rows with smooth scales; maximum SVL 495 mm; maximum TL 136 mm; ventral scales 133 to 159; subcaudals 40 to 66; coloration of the ventral portion of the head extremely spotted with dark-brown dots, infralabials and chin shields with a white centre. Darkening intensifies on the infralabial borders, outlining a clear contrast of lateral and dark margins (Fig. 2). Two pairs of non-continuous longitudinal dark ventral stripes, darker at the transition of the venter and the lateral sides, with a more conspicuous black spot on the apex of each ventral scale; tip of the tail lighter than the overall body coloration without blotches or dots, almost white in juvenile specimens.



Figure 1. Dorsal (A) and ventral (B) pattern of the preserved holotype of *Thamnodynastes phoenix* sp. n. (IBSP 87527). Scale bar: 1 cm.

**Description of the holotype:** An adult male (IBSP 87527), with the right hemipenis everted; SVL 377 mm, TL 86 mm. Dorsals smooth in 19/19/15 rows, with one apical pit; 148 ventral scales; 52 paired subcaudals; cloacal scale divided; eight supralabials on both sides of the head, fourth and fifth contacting the orbit; nine infralabials on both sides, first to fifth contacting first pair of chin shields, fifth contacting second pair of chin shields; two pairs of chin shields; temporals 2+3; nasal undivided/semi-divided; one preocular and two postoculars on both sides of the head; right maxilla with nine pre-diastemal teeth and two grooved and enlarged post-diastemal teeth; 11 dentary teeth. Head length 18.16 mm; head width 10.04 mm; head height 6.34 mm; distance between nostrils 3.13 mm; eye height 2.99 mm; eye width 3.45 mm; distance between eyes 6.22 mm; rostral–orbit distance 4.73 mm; internasal scale (right) longer than wider (length 2 mm, width 1.61 mm); loreal scale longer than larger (length 1.02 mm, width 0.82 mm); prefrontal scale wider than longer (length 1.67 mm, width 2.16 mm); frontal scale longer than wider (length 4.73 mm, width 1.42 mm); parietal scale longer than wider (length 5.44 mm, width 3.31 mm).

In preservative, dorsal background coloration light grey; lighter vertebral region, with approximately 38 white blotches separated by 2–3 darker and speckled vertebral scales which gradually fade toward the tail; dorsal white blotches delimited laterally on both sides by brownish blotches formed by 3–4 scales with black margins; distal half of tail lighter (light brown) and without blotches or dots. A darker lateral longitudinal line on the third and fourth row of dorsal scales, evident on the distal half of



Figure 2. Detail view of the preserved holotype of *Thamnodynastes phoenix* sp. n. (IBSP 87527): (A) dorsal, (B) ventral, and (C) dextral view of the head. Scale bar: 1 cm.

the body. Dorsal portion of the head brownish, with a distinct central brown mark trespassing the supraoculars and extending up to the cervical region, where it forms two distinct brown bands that covers 9 or 10 scales after the temporals, bordering a white band on the cervical region. Background ventral coloration light beige; distal half of the tail immaculate; two pairs of non-continuous longitudinal brown stripes, formed by brownish small spots, darker at the distal end of each ventral scale, which denotes an inconspicuous pattern. External pair of ventral stripes more

accentuated, beginning at the preventrals until half of the tail; ventral scales also intensely speckled with small darker dots. Gular region intensely pigmented; pigmentation entering the chinshields and infralabials margins, forming a speckled pattern, which encloses white small blotches on the centre of the infralabials, chinshields and some gular scales (Figs 1 and 2).

Variation: A considerable degree of colour variation can be found in *T. phoenix*. Some individuals show the gular re-

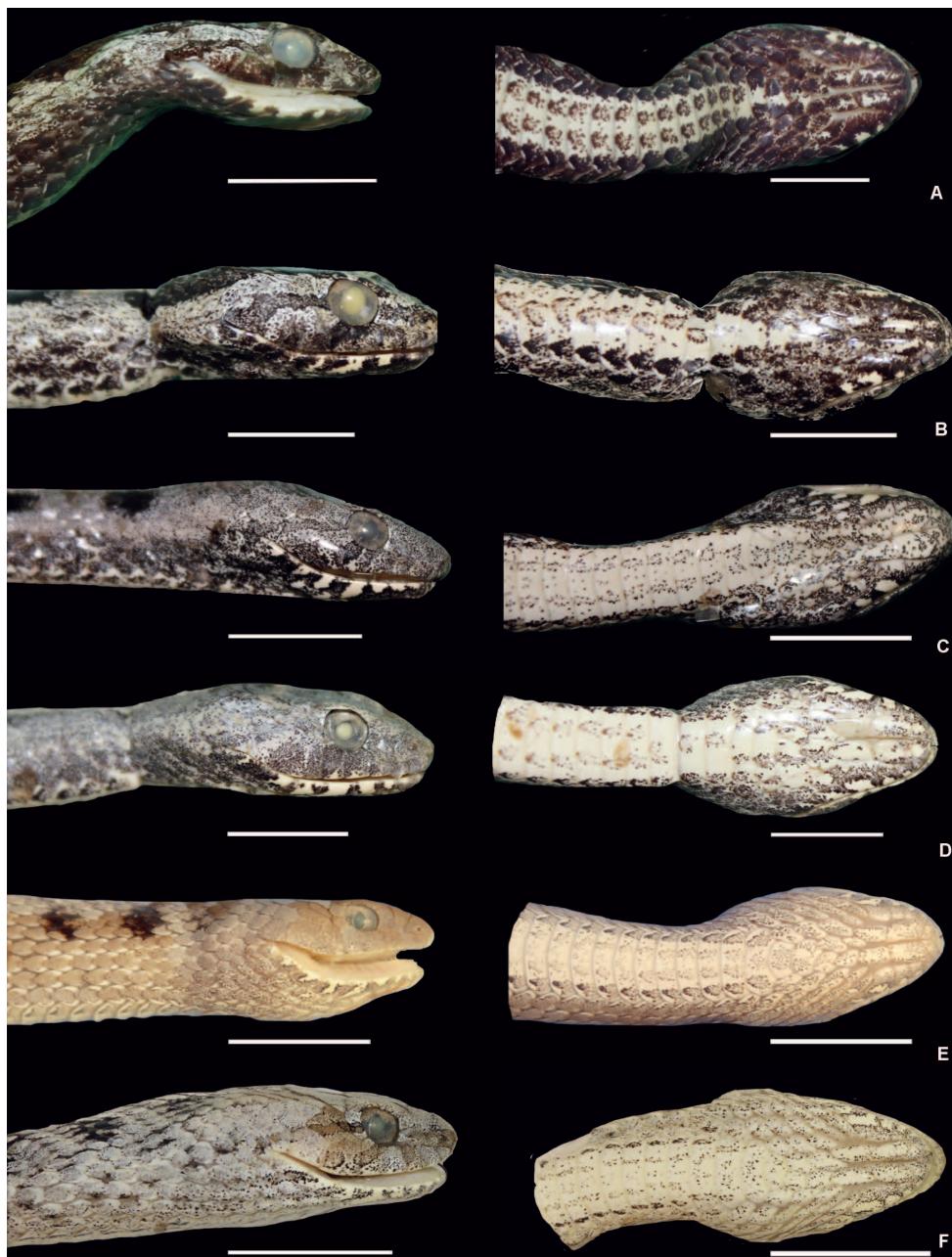


Figure 3. Variation of head colour within preserved *Thamnodynastes phoenix* sp. n., illustrating the supralabials (dextral view, left), gular region, chin shields and infralabials (ventral view, right) on specimens: (A) MZFS 835; (B) MZUSP 10878; (C) MZUSP 19105; (D) MZUSP 10868; (E) MNJR 15196; (F) UFMG 350. Scale bars: 1 cm.

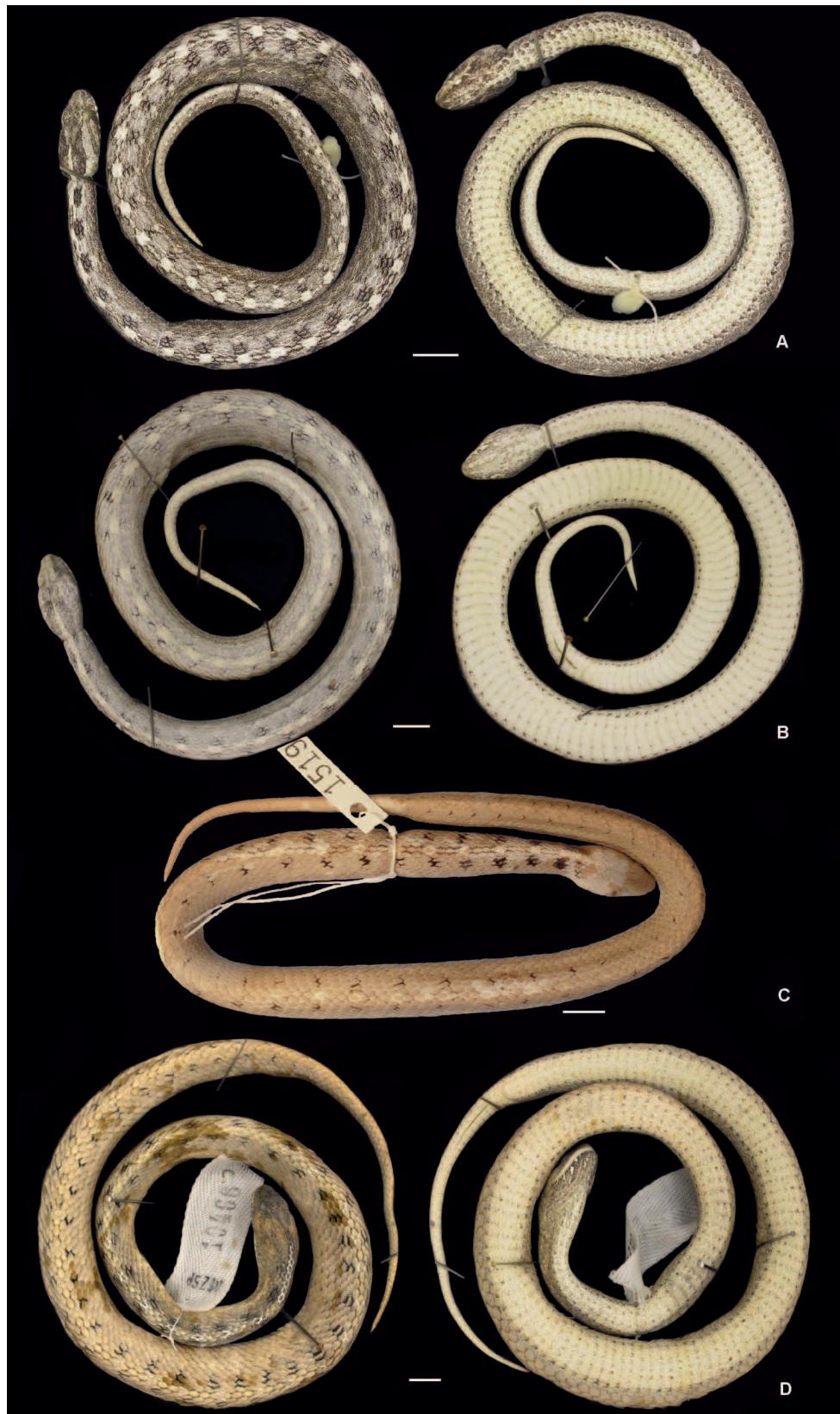


Figure 4. Variation of dorsal and ventral pattern of preserved *Thamnodynastes phoenix* sp. n.: specimens (A) MZUSP 10876; (B) MZUSP 10868; (C) MNRJ 15196; (D) MZUSP 10466. Scale bars: 1 cm.

gion completed pigmented (black or dark brown), with a few small white spots (Fig. 3a, b); others present a more marbled or variegated pattern, with lighter blotches outlined by dark brown dots (Fig. 3c, d); or with a more subtle gular pigmentation, with a thin darker line outlining blotches on the infralabials (Fig. 3e, f). Supralabial coloration can also vary, with a dark blotched pattern and a clear spot on the fifth supralabial (Fig. 3c); or with supralabials homogeneously coloured, without visible blotches (Fig. 3e). Dorsal white blotches vary among individuals, occurring throughout the extension of the body (Fig. 4a); transforming into a white vertebral line (Fig. 4b); present only on the first half of the body (Fig. 4c); or even almost absent on a few specimens (Fig. 4d). The dorsolateral longitudinal lines can be evident only on the distal half of the body, or completely absent. Juveniles have an overall darker coloration, with the gular region intensely pigmented. A few adults also show a more contrasting colour, with a conspicuous pattern of dorsal white and black blotches, and with groups of four to six scales outlined by black pigmentation on each side of the body.

Hemipenis morphology (Holotype IBSP 87527; left organ; Fig. 5a): Slightly bilobed, noncapitated and semicalculated. Capitulum restricted to the distal third of the hemipenis, occupied by spinulated calyces with micro spines on its basal portion; calyces enter the distal portion of the hemipenial body on the asulcated side with papillate calyces on the apex. Hemipenial body completely covered by small to medium spines, first row of spines near the base slightly larger than the distal rows closer to the capitulum. Subtle constriction between the base and the hemipenial body, base of hemipenis with scarcely distributed small spines. Sulcus spermaticus divided at the distal portion of hemipenial body, and each sulcus runs centrolinearly until the distal portion of each lobe, not reaching the apex.

All hemipenes examined (hemipenes analyzed: FUNED 1018; MZUSP 5845, 10460, 10876, 18147, 19105, 20621, 21017; CHUFPB 4334; Fig. 5b-d) exhibited the same typical pattern of slight bilobation, uniculated and noncapitated. Spinulated calyces are evident on the proximal portion of the capitulum, slightly reaching the distal portion of the hemipenial body, without spines or spinules on the apex of lobes (which present papillated calyces). All examined hemipenes appear to have a constriction between base and hemipenial body, and all exhibit the base of the hemipenis with small spines, throughout the superficial area, or scattered and restricted to a portion of the base. Preparation bias is responsible for particular aspects of hemipenial variation, specially on the general shape of the organ.

Concerning meristic and morphometric variation, a total of 176 specimens were examined with the following variation: smooth dorsal scales in 19/19/15 rows ( $N = 156$ ), or 17/19/15 ( $N = 9$ ), 18/19/15 ( $N = 6$ ), 19/17/15 ( $N = 1$ ) and 19/18/15 ( $N = 2$ ); ventral scales 133–159 for males, and 133–155 for females; subcaudals 45–66 for males, and 40–60 for females; supralabials 8/8 ( $N = 170$ ), varying from 8/9 ( $N = 2$ ), 9/9 ( $N = 1$ ) or 9/8 ( $N = 2$ ); infralabials 9/9 ( $N = 163$ ), 8/9

( $N = 4$ ), 8/8 ( $N = 2$ ), 9/8 ( $N = 2$ ), 9/10 ( $N = 2$ ), 10/9 ( $N = 2$ ), or 10/10 ( $N = 1$ ); preoculars 1/1 ( $N = 166$ ), with a slight variation of 2/2 ( $N = 6$ ), 2/1 ( $N = 2$ ) or 1/2 ( $N = 2$ ); postoculars 2/2 ( $N = 175$ ) or 1/2 ( $N = 1$ ) (Table 1). As in several other species of *Thamnodynastes*, the temporal scales exhibit a high degree of variation: 2+3/2+3 ( $N = 52$ ), 2+1/2+1 ( $N = 33$ ), 2+2/2+2 ( $N = 17$ ), 2+1/2+3 ( $N = 13$ ), 2+2/2+3 ( $N = 11$ ), 2+2/2+1 ( $N = 8$ ), 2+3/2+1 ( $N = 8$ ), 2+3/2+2 ( $N = 7$ ), 1+2/1+2 ( $N = 3$ ) or 1+3/1+3 ( $N = 2$ ) (Table 1). Maxillary teeth ranging from 5 to 10, with two enlarged sulcated post-diastema teeth; 7 to 14 dentary teeth. Variation on morphometric data are (adults only): SVL 376–495 mm for males, and 376–451 mm for females; TL 86–136 mm for males, and 66–118 mm for females; head length 16.6–21.4 mm for males, and 18.2–21.6 mm for females (Table 1).

Comparisons with other species of the genus: *Thamnodynastes phoenix* sp. n. differs from *T. chimanta*, *T. duida*, *T. lanei*, *T. marahuaquensis*, *T. pallidus* and *T. sertanejo* by having 19 scale rows at midbody (versus 17 in all others) (ROZE 1958, GORZULA & AYARZAGÜENA 1996, MYERS & DONNELLLY 1996) (Table 2). It further differs from *T. almae*, *T. ceibae*, *T. chaquensis*, *T. dixoni*, *T. hypoconia*, *T. paraguanae* and *T. cf. nattereri* by the general pattern

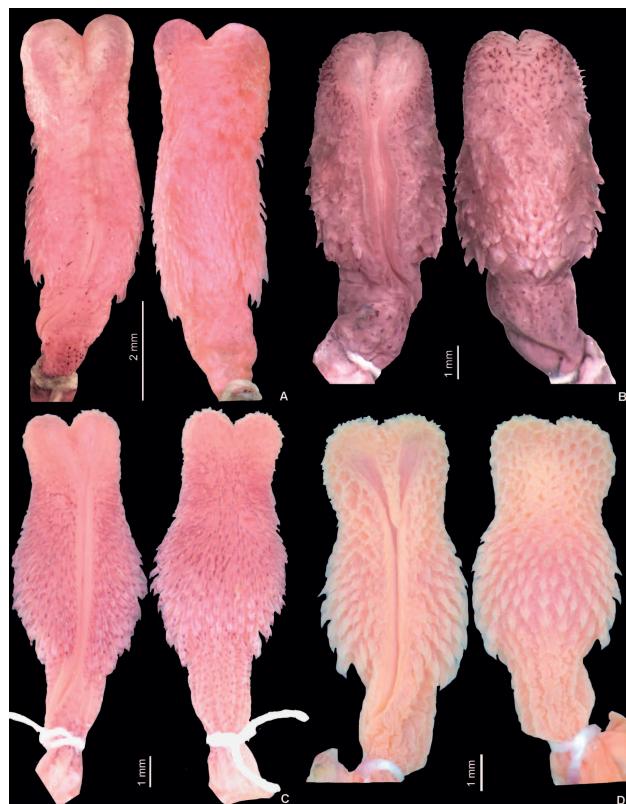


Figure 5. Hemipenial variation within *Thamnodynastes phoenix* sp. n.: sulcate (left) and asulcate (right) sides of the prepared hemipenes of the specimens: (A) IBSP 87527, holotype; (B) IBSP 54904, paratype; (C) MZUSP 5845; and (D) MZUSP 21017. Scale indicated on the figure.

Table 1. Pholidosis and morphometric variation within examined specimens of *Thamnodynastes phoenix* sp. n. M = males; F = females; DO = dorsal scales rows; VE = number of ventral scales; SC = subcaudals; SL = supralabials; IL = infralabials; preoc = postoculars; postoc = preoculars; temp = first + second rows of temporals; SVL = snout-vent length; TL = tail length; HL = head length. Values presented as mean ± standard deviation (minimum-maximum); N = number of examined specimens. Morphometric values presented in millimetres.

DO	M	VE	SC	SL	IL	preoc	postoc	temp	SVL	M	F	M	TL	HL	M	F
19/19/15 (N=156)	145±4.5 (133-159)	142±4.5 (133-155)	53±3.5 (45-66)	49±3.6 (40-60)	8/8 (N=170)	9/9 (N=163)	1/1 (N=166)	2/2 (N=175)	425±35.9 (376-495)	409±19.1 (376-451)	105±12.8 (86-136)	91.8±9.8 (66-118)	19±1.3 (N=24)	19.9±1 (N=18)		
17/19/15 (N=9)					8/9 (N=2)	8/9 (N=4)	2/2 (N=6)	1/2 (N=1)	2+3/2+3 (N=25)	425±35.9 (N=20)	105±12.8 (N=28)	91.8±9.8 (N=24)	19±1.3 (N=24)	19.9±1 (N=18)		
18/19/15 (N=6)					9/8 (N=2)	8/8 (N=2)	2/1 (N=2)	2/1 (N=2)	2+2/2+2 (N=17)							
19/17/15 (N=1)					9/9 (N=1)	9/8 (N=2)	1/2 (N=2)	2+1/2+3 (N=13)	2+1/2+3 (N=13)							
19/18/15 (N=2)					9/10 (N=2)	9/10 (N=2)	2+2/2+3 (N=11)	2+2/2+3 (N=11)	2+2/2+3 (N=11)							
					10/9 (N=2)	10/9 (N=2)	2+2/2+1 (N=9)	2+2/2+1 (N=9)	2+2/2+1 (n=8)							
					10/10 (N=1)	10/10 (N=1)	2+3/2+1 (N=7)	2+3/2+1 (N=7)	2+3/2+1 (N=7)							
							1+2/1+2 (N=3)	1+2/1+2 (N=3)	1+3/1+3 (N=2)							

Table 2. Morphological variation and diagnostic characters for the genus *Thamnodynastes*. Species with no available information are indicated with the symbol ‘-’. DO = Dorsal scales rows; keels = presence or absence of keeled dorsal scales (in parenthesis: number of keeled dorsal scale rows); max. SVL = maximum snout-vent length (in millimetres); VE = number of ventral scales; SC = subcaudals; SL = supralabials; IL = infralabials; ventral stripes = number of longitudinal ventral stripes on the body; M = males; F = females. Species are presented in chronological order.

Species	DO	Keels	max. SVL		VE		SC		SL	IL	Ventral stripes
			M	F	M	F	M	F			
<i>T. phoenix</i> sp. n.	19/19/15	no	459	470	133–159	134–152	45–66	40–57	8	9	2–4
<i>T. almae</i>	19/19/15	yes (9–15)	539	525	146–157	144–151	64–75	55–65	8	9	2–4
<i>T. ceibae</i>	19/19/13	yes	448	–	150	–	67	–	8	9	4
<i>T. chaquensis</i>	19/19/15	yes (11–15)	577	501	136–152	135–155	55–73	48–65	8	9	2–4
<i>T. chimanta</i>	17/17/15	no	327	318	126–134	125–132	51–61	51–61	7 or 8	8 or 9	2
<i>T. corocoroensis</i>	19/19/15	no	–	260	–	132	–	56	8	8	2
<i>T. dixoni</i>	19/19/15	yes (4–11)	438	477	147–162	141–154	53–75	58–69	7 or 8	9	2–4
<i>T. duida</i>	17/17/15	no	455	–	130	–	56	–	8	9	4
<i>T. gambotensis</i>	19/19/15	no	542	499	152–160	136–156	61–75	55–73	7 or 8	9	2–4 (occasionally 5)
<i>T. hypoconia</i>	19/19/15	yes (7–15)	556	522	137–165	134–159	60–87	61–80	8	9	2–6
<i>T. lanei</i>	17/17/15	yes (13–15)	390	431	150–158	135–154	81–86	75–88	8	9	4
<i>T. longicaudus</i>	19/19/13	no	411	–	133–149	–	101–109	–	8 or 9	9 or 10	3–6
<i>T. marahuaquensis</i>	19/19/15	no	–	307	–	135	–	61	8 or 9	9	2
<i>T. cf. nattereri</i>	19/19/15	yes (7–15)	577	495	159–167	142–160	61–80	60–74	8	9	2–4
<i>T. pallidus</i>	17/17/13 or 11	no	520	442	148–164	141–161	88–98	81–93	8	9	4
<i>T. paraguanae</i>	19/19/15	yes (4–11)	485	550	139–157	132–152	55–72	53–65	8	9	2–4
<i>T. ramonriveroi</i>	19/19/15	no	420	411	142–155	138–147	59–77	52–70	8	9	5
<i>T. rutilus</i>	19/19/15	no	477	414	134–135	127–131	74–79	56–69	8	8–10	2
<i>T. sertanejo</i>	17/17/11	no	665	655	152–167	140–151	84–98	74–83	8	9	absent
<i>T. strigatus</i>	19/19/15	no	796	625	133–157	130–147	53–72	47–71	8	9	2–4
<i>T. yavi</i>	19/19/15	no	–	260	–	130–131	–	58–61	8	9 or 10	2

of coloration and smooth dorsal scales (versus slightly or strongly keeled in all the above) (FRANCO & FERREIRA 2002 BAILEY & THOMAS 2007); from *T. chaquensis* (in parenthesis) it also differs by the smaller size, with maximum SVL 495 mm (maximum SVL 577 mm), fewer subcaudals, 45–66 for males and 40–60 for females (55–73 subcaudals for males, 48–65 for females), and infralabials more intensely pigmented, outlining a white centre on each infralabial (dark pigmentation not as conspicuous and not outlining a white centre on each infralabial). *Thamnodynastes phoenix* differs from *T. corocoroensis* by its characteristic colour pattern and by its slightly higher counts of ventral scales, from 133 to 159, and nine infralabials (132 ventrals and eight infralabials in *T. corocoroensis*, GORZULA & AYARZAGÜENA 1996); it differs from *T. gambotensis* and *T. ramonriveroi* by the smaller counts of subcaudals (61–75 for males, and 55–73 for females of *T. gambotensis*; and 59–77 for males, and 52–70 for females of *T. ramonriveroi*) (Table 2), and also by the pattern of ventral coloration, with two to four inconspicuous brown longitudinal ventral stripes that disappear on the first half of the tail (versus two to four well defined and continuous longitudinal ventral stripes in *T. gambotensis*, and five darker conspicuous longitudinal

stripes in *T. ramonriveroi*, evident throughout the tail). It differs from *T. longicaudus* by its darker general coloration and 19/19/15 rows of dorsal scales (versus 19/19/13 and five to six dark anterior dorsal blotches; FRANCO et al. 2003); from *T. rutilus* by the absence of a red mark on the sixth supralabial (versus present); from *T. cf. nattereri* by its smaller size (versus maximum SVL 577 mm), fewer ventral scales (159–167 ventrals for males, and 142–160 for females of *T. cf. nattereri*), and also by its gular region intensely pigmented, forming white blotches on the centre of infralabials and chinshields (slightly pigmented or immaculate); from *T. strigatus* by its immaculate oral mucosa and by the darker background coloration of the labials, without distinct oval blotches on the supra and infralabials (versus with a black stain enclosing tongue sheath and black oral palate, light background colour of labial scales, with distinct darker blotches present on the margin of every supralabial and infralabial); and from *T. yavi* for its bigger size and different pattern of coloration (maximum SVL 260 mm, and darker background colour with brown dorsal coloration with black scales scattered along the body, without white blotches, in *T. yavi* MYERS & DONNELLY, 1996) (Table 2).

*Thamnodynastes phoenix* is very much alike to *T. paraguanae* from northwestern Venezuela (Paraguana Peninsula) and northern Colombia, which shares the intensely pigmented gular, mental and infralabial region, also with infralabials with a lighter centre, contrasting with dark borders. However, the new species can be distinguished from *T. paraguanae* (in parenthesis) by the more robust hemipenis, with evident spines on the hemipenial body that increase slightly in size towards the base (very slender hemipenis with reduced spines on a long hemipenial body); for its slightly smaller size (maximum SVL 550 mm), and lower subcaudal counts (55–72 subcaudals for males and 53–65 for females) (Table 2).

**Distribution:** *Thamnodynastes phoenix* sp. n. occurs on open savannas of Brazil, predominantly the Caatinga formation of northeastern Brazil, in the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe, extending to the Caatinga enclaves of the region of Juába, Minas Gerais. It also encompasses the Cerrado in central Brazil, in the states of Goiás, Tocantins and Minas Gerais (Fig. 6).

**Natural History:** The inspection of a few dissected specimens confirmed the viviparous reproductive mode of this species, as expected for members of the tribe Tachymenini. The specimen MZUSP 10462 (SVL 407 mm) exhibited eight well-developed embryos. The species is predominantly terrestrial and nocturnal, feeds on frogs, and is associated with different types of Caatinga and Cerrado vegetation (GUEDES et al. 2014).

**Etymology:** The specific epithet *phoenix* (Greek: φοῖνιξ phoinix; Latin: phoenix, fenix) refers to the mythological bird that dies in combustion and subsequently rises from ashes in a cycle of life and death. This name acknowledges the fact that the previously selected holotype, used originally for the species description, was lost in the fire that consumed 90% of the Herpetological Collection “Alphonse Richard Hoge” of the Instituto Butantan, on March 15, 2010. Some specimens, including two paratypes, were rescued from the fire, and the data previously collected from the lost specimens were kept and used herein.

## Discussion

Taxonomy of the genus *Thamnodynastes* has always been in a state of flux due to the underestimated diversity of cryptic species present in the genus. Cryptic morphological patterns, intraspecific variation, and the extensive geographical range shown by many species of *Thamnodynastes* represent a challenge. As a result, many taxonomic problems within this genus persist since the nineteenth century due to poor descriptions of the known morphological variation coupled with the lack of clear diagnosable characters to distinguish its species (MIKAN 1820, WAGLER 1824, 1830, GÜNTHER 1858, BOULENGER 1896, LÖNNBERG 1896, ANDERSSON 1899).

Additionally, fourteen new species were described over the last few decades (e.g. PÉREZ-SANTOS & MORENO 1989, BERGNA & ALVAREZ 1993, GORZULA & AYARZAGÜENA 1996, MYERS & DONNELLY 1996, FRANCO & FERREIRA 2002, FRANCO et al. 2003, MANZANILLA & SÁNCHEZ 2005,

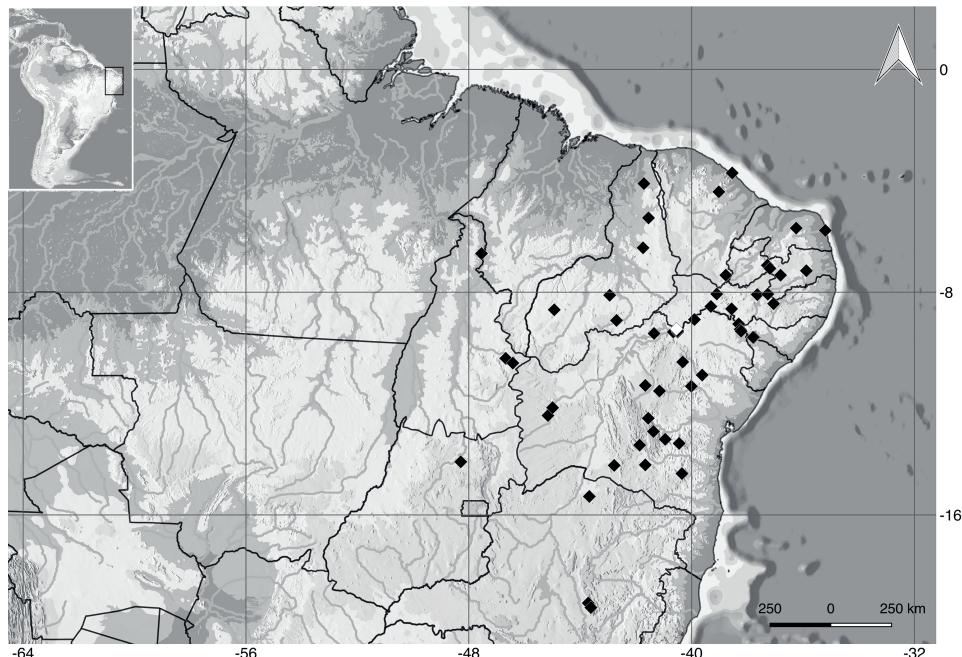


Figure 6. Map of northeastern Brazil showing the geographic distribution of *Thamnodynastes phoenix* sp. n. Black symbols represent analyzed specimens, white symbol represents the type locality.

BAILEY & THOMAS 2007), from which at least five are only known from their type series (*T. ceibae*, *T. corocoroensis*, *T. duida*, *T. marahuaquensis* and *T. yavi*). There is no need to emphasize that a detailed taxonomic revision of the genus *Thamnodynastes* is much needed, since only a few authors (CEI et al. 1992, FRANCO & FERREIRA 2002, BAILEY et al. 2005) provided a more thorough review of the group. Their contribution includes only a few taxonomic modifications, leaving a large gap in our knowledge of the taxonomic status of many available names. A taxonomic review of the genus is now in course (V. C. TREVINE, unpubl. data) and is intended to tackle these problems. However, before the latter is available, we considered that the present new species would not further complicate the taxonomic scenario of the genus since *Thamnodynastes phoenix* sp. n. is promptly distinguished from its congeners by the distinctive pattern of coloration of chinshields and infralabial scales, hemipenial morphology and fewer subcaudals. Likewise, the overall dorsal and ventral body pattern, and the presence of 19 rows of smooth dorsal scales differentiate *T. phoenix* from its geographically close species, *Thamnodynastes almae*, *T. sertanejo*, *T. hypoconia*, *T. cf. nattereri* and *T. pallidus* (HANDAM & LIRA-DA-SILVA 2012, COELHO et al. 2013, GUEDES et al. 2014, NÓBREGA et al. 2016).

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## Appendix

Examined specimens. Numbers marked with an asterisk were lost in the fire at the Butantan Institute on 15 March 2010 (see KUMAR 2010).

*Thamnodynastes phoenix* sp. n. Brazil: Alagoas: Piranhas (UHE Xingó,  $9^{\circ}37'26"S$ ,  $37^{\circ}45'25"W$ ): MZUFBA 841, 844, 846, 1116, 1120; UHE Xingó ( $9^{\circ}37'25"S$   $37^{\circ}47'54"W$ ): MZUSP 10864, 10868, 10875–79, 13342–13362\*; FUNED 857, 860, 862, 866, 871. Bahia: Alagoado ( $9^{\circ}29'S$   $41^{\circ}21'W$ ): MZUSP 10462; Barreiras (Fazenda Acauã Souza),  $12^{\circ}08'54"S$ ,  $44^{\circ}59'33"W$ : MNRJ 1955; Barreiras,  $12^{\circ}08'54"S$ ,  $44^{\circ}59'33"W$ : IBSP 50432, 50706\*; Brumado,  $14^{\circ}12'14"S$ ,  $41^{\circ}39'54"W$ : MZUSP 20621; Brumado (between Brumado and Poções): IBSP 67584\*; Capim Grosso (Fazenda Alegria,  $11^{\circ}22'51"S$ ,  $40^{\circ}0'46"W$ ): MZFS 835; Campo Formoso (Gruta do Salitre,  $10^{\circ}30'32.04"S$ ,  $40^{\circ}19'14.88"W$ ): IBSP 31328; Curaçá (Bairro Brotas,  $08^{\circ}59'S$ ,  $39^{\circ}54'W$ ): IBSP 43055\*, 43061, 43063, 43065, 43106\*, 43191; Guanambi ( $14^{\circ}13'22"S$ ,  $42^{\circ}46'51"W$ ): IBSP 50102\*, 50238, 50618\*, 70458, 70459\*; Guanambi ( $14^{\circ}12'S$ ,  $42^{\circ}46'W$ ): IBSP 54904, 54905\*; Glória ( $9^{\circ}20'20"S$ ,  $38^{\circ}15'25"W$ ): ZUEC 605\*; Iramaia (Fazenda Jacarandá,  $13^{\circ}17'9"S$ ,  $40^{\circ}57'3"W$ ): IBSP 42157; João Dourado ( $11^{\circ}21'0"S$ ,  $41^{\circ}39'50"W$ ): MZUESC 3819\*, 3820\*; Juazeiro (Caraíbas Metais,  $9^{\circ}24'53"S$ ,  $40^{\circ}30'19"W$ ): IBSP 37597; Juazeiro ( $9^{\circ}25'50"S$ ,  $40^{\circ}30'10"W$ ): IBSP 37461, 48692, 48693\*, 48941, 49859\*, 51718\*, 51719, 51834\*; Maracás (Vila-rejo Ilha Grande,  $13^{\circ}26'0"S$ ,  $40^{\circ}27'0"W$ ): IBSP 58370\*;

Morro do Chapéu ( $11^{\circ}33'0''S$ ,  $41^{\circ}9'21''W$ ): MZUSP 8957; Mucujé ( $13^{\circ}0'18''S$ ,  $41^{\circ}22'15''W$ ): MZUSP 8956; Palmeiras (Campo São João,  $12^{\circ}31'44''S$ ,  $41^{\circ}33'32''W$ ): MZFS 1263; Paulo Afonso ( $9^{\circ}24'0''S$ ,  $38^{\circ}13'30''W$ ): IBSP 44444, 44446; Paulo Afonso (UHE Itaparica,  $9^{\circ}8'47''S$ ,  $38^{\circ}18'43''W$ ): MZUFBA S108, S115; Paulo Afonso (UHE Sobradinho,  $9^{\circ}25'49''S$ ,  $40^{\circ}39'37''W$ ): MZUFBA 5366; Poções ( $14^{\circ}31'0''S$ ,  $40^{\circ}21'0''W$ ): MZUFBA 1556; Poções (Mina São Félix do Amianto, Bom Jesus da Serra,  $14^{\circ}31'0''S$ ,  $40^{\circ}21'0''W$ ): IBSP 28190\*, 28192\*, 28193\*, 28194, 28195; São Desidério (PCH Sítio Grande,  $12^{\circ}25'50''S$ ,  $45^{\circ}09'33''W$ ): MZUFBA 2315; Território Itaparica (between Bahia and Pernambuco states): IBSP 53763\*, 53766\*, 53767\*; Queimadas ( $10^{\circ}58'40''S$ ,  $39^{\circ}37'26''W$ ): MZUSP 10460, 10775. Ceará: Mauriti ( $7^{\circ}23'20''S$ ,  $38^{\circ}46'26''W$ ): MFCH 1890, 1898; Fortaleza (Universidade Federal do Ceará,  $3^{\circ}44'38.1''S$ ,  $38^{\circ}32'08.9''W$ ): FUNED 1018; Serra do Baturité ( $4^{\circ}23'48.8''S$ ,  $39^{\circ}01'28.3''W$ ): MZUSP 21180. Goiás: UHE Serra da Mesa ( $14^{\circ}5'42''S$ ,  $48^{\circ}17'23''W$ ): MZUSP 21009–21020. Minas Gerais: Jaíba ( $15^{\circ}20'18''S$ ,  $43^{\circ}40'28''W$ ): FUNED 906; Santana do Riacho (before Capão da Mata stream,  $19^{\circ}10'08''S$ ,  $43^{\circ}42'50''W$ ): UFMG 350; Santana do Riacho, Serra do Cipó ( $19^{\circ}10'08''S$ ,  $43^{\circ}42'50''W$ ): ZUEC 870\*, ZUEC 1780\*; Serra do Cipó ( $19^{\circ}19'41''S$ ,  $43^{\circ}37'05''W$ ): IBSP 40521, UFMG 355; Minas Gerais, unknown locality: UFMG 353. Paraíba: Cacimba de Areia ( $7^{\circ}8'55''S$ ,  $37^{\circ}11'24''W$ ): IBSP 33401; Campina Grande ( $7^{\circ}13'50''S$ ,  $35^{\circ}52'52''W$ ): IBSP 51658\*; Patos (Jardim Guanabara,  $7^{\circ}2'02''S$ ,  $37^{\circ}17'44''W$ ): IBSP 33399, 33400\*; Patos (Fazenda Senata,  $7^{\circ}1'53''S$ ,  $37^{\circ}16'43''W$ ): 33751\*, 33752\*; São José dos Cordeiros (Fazenda Alma,  $7^{\circ}23'27''S$ ,  $36^{\circ}48'28''W$ ): CHUFPB 5894. Pernambuco: Arcoverde (Povoado Caraíbas,  $8^{\circ}24'55''S$ ,  $37^{\circ}3'29''W$ ): IBSP 52350\*; Cabrobó ( $8^{\circ}30'51''S$ ,  $39^{\circ}18'56''W$ ): MFCH 1872, 1873, 1875, 1876, 1877, 1882, 1883; Custódia ( $8^{\circ}5'15''S$ ,  $37^{\circ}38'35''W$ ): MFCH 1901; Floresta ( $7^{\circ}23'20''S$ ,  $38^{\circ}46'26''W$ ): MFCH 1880, 1881, 1884, 1885, 1888, 1896, 1897, 1899; Petrolina ( $9^{\circ}23'24''S$ ,  $40^{\circ}30'28''W$ ): MFCH 1902, 1903, IBSP 48317, 48318\*, 48319\*, 48320, 48321\*, 48322; Petrolina (Campus Ciências Agrárias, Universidade Federal do Vale do São Francisco,  $09^{\circ}19'29.00''S$ ,  $40^{\circ}32'50.00''W$ ): IBSP 87527; Salgueiro ( $8^{\circ}04'00''S$ ,  $39^{\circ}06'00''W$ ): MFCH 1887; Sertânia ( $8^{\circ}04'14''S$ ,  $37^{\circ}15'57''W$ ): MFCH 1889, 1895; UHE Itaparica ( $9^{\circ}08'37''S$ ,  $38^{\circ}18'43''W$ ): IBSP 52113\*, 52114\*, 52115\*, 52116\*, 52117\*, 52118\*, 52127; Pernambuco, unknown locality: IBSP 41893. Piauí: Castelo do Piauí (ECB,  $5^{\circ}20'0''S$ ,  $41^{\circ}33'0''W$ ): MPEG 22766; Canhoto do Buriti ( $8^{\circ}6'36''S$ ,  $42^{\circ}56'38''W$ ): ZUEC 650\*; Estação Ecológica Uruçuí-Una ( $8^{\circ}38'S$ ,  $44^{\circ}56'W$ ): MZUSP 18146, 18147; Pirarucá (Parque Nacional de Sete Cidades,  $4^{\circ}5'59''S$ ,  $41^{\circ}42'50''W$ ): MPEG 23344; São Raimundo Nonato ( $9^{\circ}0'54''S$ ,  $42^{\circ}41'56''W$ ): IBSP 41291\*; Valença do Piauí ( $6^{\circ}24'28''S$ ,  $41^{\circ}44'45''W$ ): MZUSP 5845. Rio Grande do Norte: Lajes (Fazenda Azevedo, former Itaretama,  $5^{\circ}42'0''S$ ,  $36^{\circ}14'42''W$ ): IBSP 30587\*; Natal, Guamaré RIV ( $5^{\circ}47'0''S$ ,  $35^{\circ}12'0''W$ ): IBSP 44508. Sergipe: Canindé de São Francisco ( $9^{\circ}38'31''S$ ,  $37^{\circ}47'16''W$ ): IBSP 67952, 67953. Tocantins: Mateiros (Posto das Dunas, Pares do Jalapão,  $10^{\circ}22'40''S$ ,  $46^{\circ}40'30''W$ ): MNRJ 15196; Mateiros ( $10^{\circ}32'52''S$ ,  $46^{\circ}25'15''W$ ): CHUNB 28898, 41315; Palmeiras do Tocantins, UHE Estreito ( $6^{\circ}36'49''S$ ,  $47^{\circ}32'46''W$ ): MZUSP 19105.

*Thamnodynastes almae*. Brazil: Alagoas: (UHE Xingó,  $9^{\circ}37'26''S$ ,  $37^{\circ}45'25''W$ ): MZUSP 20985, 20987–21003. Bahia: Feira de Santana: MZFS 801. Paraíba: Cabaceiras (Fazenda Bravo): CHUFPB 4527; São José do Cariri: CHUFPB 5918. Pernambuco: Custódia: MFCH 1848, 1863; Floresta: MFCH 1849–52, 1855, 1857; Sertânia: MFCH 1866.

*Thamnodynastes chaquensis*. Argentina: Departamento Pilcomayo: Bouvier: MNRJ 13419–13420. Brazil: Mato Grosso: Barão de Melgaço: MNRJ 7651. Mato Grosso do Sul: Corumbá: MNRJ

21001–21003; unknown locality (Pantanal): ZUEC 2870. Paraguay: Assunção: MNRJ 664, 666.

*Thamnodynastes cf. nattereri*. Brazil: Bahia: Miguel Calmon: MZUFBA 1798. Paraíba: Maturéia (Pico do Jabre): MZUSP 20312, 20313. Rio de Janeiro: Rio de Janeiro (Floresta da Tijuca): MNRJ 4813.

*Thamnodynastes hypoconia*. Argentina: Província Chaco: Colônia Las Mercedes: MNRJ 13423; Departamento de Corrientes: Capital: MNRJ 13424. Brazil: Minas Gerais: Betim: FUNED 247; Brumadinho: UFMG 356, 525; Cardeal Mota: UFMG 249; Contagem: FUNED 250; Corinto: FUNED 243; Florestal: FUNED 1200; Itaguara: FUNED 681; Nova Ponte: FUNED 762, 780; Ouro Preto: FUNED 744; Santana do Riacho (Serra do Cipó): FUNED 1603; Tocantins: Goiatins: UFMG 357; UHE Luis Eduardo Magalhães: MZUSP 15656–15659; UHE Peixe Angelical: MZUSP 15425. Paraguay: Província Itapúa: Isla Yasyretá: MNRJ 13422.

*Thamnodynastes lanei*. Brazil: Amapá: Mazagão (Vilanova): IBSP 80714. Mato Grosso: Lagoa Gahyba: MNRJ 370. Pará: Monte Alegre (Serra da Partuma): MNRJ 662; São Luiz de Cáceres: MNRJ 660, 661; Porto de Moz (LT Xingú): MZUSP 17760. Rondônia: UHE Jirau: MZUSP 19716, 19717, 19719, 19977.

*Thamnodynastes pallidus*. Brazil: Alagoas: Maceió (Mangabeiras): MZUSP 3499. Amazônia: Beruri: MZUSP 5771; Mucuripe: MZUSP 5760. Bahia: Elísio Medrado (APA Municipal Serra da Jibóia): MZFS 1173; Mata de São João (Reserva de Camurujipe): MZUFBA 1744; Salvador (Jardim Botânico, Pau da Lima): MZUFBA 1534. Rondônia: Porto Velho (UHE Jirau): MZUSP 19460.

*Thamnodynastes paraguanae*. Venezuela: Zulia state: Cabimas: Sector la Pica Pica, consejo de Ziruma, Costa Oriental del lago: MZUSP 22305.

*Thamnodynastes ramonriveroi*. Venezuela: Anzoátegui: Freites: Cerro La Laguna, Maciço de Turimique: MNRJ 8128.

*Thamnodynastes rutilus*. Brazil: Minas Gerais: Belo Horizonte: FUNED 1452; Belo Horizonte (Nova Pampulha): FUNED 1102; Esmeraldas (Fazenda Porteira da Brama): FUNED 249; Nova Ponte (UHE Nova Ponte): FUNED 809, 1231; unknown locality: MNRJ 7508.

*Thamnodynastes sertanejo*. Brazil: Bahia: Paulo Afonso (UHE Itaparica): MZUFBA 39, 41, 43, 45–49, 102, 104, 141; Poções: MZUFBA 1568. Minas Gerais: Manga (Lagoa do Sossego, Mocambinho): MNRJ 8583. Pernambuco: Cabrobó: MZUFBA 1907; Custódia: MFCH 1912; Sertânia: MFCH 1917, 1919, 1920, 1922.

*Thamnodynastes strigatus*. Brazil: Rio de Janeiro: Itatiaia (Parque Nacional do Itatiaia): MNRJ 14887; Rio Grande do Sul: Barracão: UFRGS 5786.