

Overview of the distribution of snakes of the genus *Thamnodynastes* (Dipsadidae) in northeastern Brazil, with new records and remarks on their morphometry and pholidosis

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The genus *Thamnodynastes* (Serpentes: Dipsadidae) currently comprises 19 valid species, eleven of which occur in Brazil (Bérnils and Costa, 2012): *T. almae* (Franco and Ferreira, 2002), *T. chaquensis* (Bergna and Alvarez, 1993), *T. hypoconia* (Cope, 1860), *T. lanei* (Bailey, Thomas and Silva-Jr., 2005), *T. longicaudus* (Franco et al., 2003), *T. naterleri* (Mikan, 1828), *T. pallidus* (Linnaeus, 1758), *T. sertanejo* (Bailey, Thomas and Silva-Jr., 2005), *T. strigatus* (Gunther, 1858), *T. ramonriveroi* (Manzanilla and Sánchez, 2005) and *T. rutilus* (Prado, 1942). There are new species currently in the description phase, previously denominated as *T. sp. 1*, *T. sp. 2* and *T. sp. 3* (Franco and Ferreira, 2002). Snakes of the genus *Thamnodynastes* are small to medium-sized, viviparous, with opisthognath dentition and vertically elliptical pupil, suggesting nocturnal and crepuscular habits. They feed primarily on amphibians, and occasionally on fish, lizards and small mammals (Ruffato, Di-Bernardo and Fabiano, 2003; Manzanilla and Sánchez, 2005). Species of *Thamnodynastes* are distributed in South America from approximately 10° N in Colombia (Pérez-Santos and Moreno, 1989) to 37° S in Argentina (Bellagamba and Vega, 1996). Here we provide new data on the geographic distribution of *T. almae*, *T. sertanejo* and *T. sp. 2* in northeastern Brazil. We also present data on their morphology, size, and pholidosis.

The literature reports 14 records of *T. almae* and *T. sertanejo* for the states of Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Bahia, and Minas Gerais (Figure 1). We collected specimens of *T. almae* (N=24), *T. sertanejo* (N=14) and *T. sp. 2* (N=35) from July 2008 to November 2012 in additional municipalities in the states of Ceará, Paraíba, and Pernambuco (Figure 2). The specimens were gathered during faunal rescues and monitoring plans for water dams in the São Francisco river diversion project (designed to supply water to about 12 million people in 390 municipalities in the states of Ceará, Rio Grande do Norte, Paraíba and Pernambuco by 2025). All collection sites lie in the Caatinga biome. Voucher specimens are deposited in the Coleção de Herpetologia of the Museu de Fauna da Caatinga at the Centro de Conservação e Manejo de Fauna da Caatinga (CEMAFAUNA-CAATINGA/UNIVASF), in Petrolina, Pernambuco, Brazil

Thamnodynastes almae (Figure 3) is large (mean SLV of females was 349.3 ± 102.5 mm, range = 177.0-492.0 mm, mean tail length was 84.8 ± 27.4 mm, range = 43.0-126.2 mm; mean SVL of males was 318.9 ± 96.5 mm, range = 171.0-462.0 mm, mean tail length was 86.1 ± 28.1 mm, range = 42.0-134.0 mm), normally yellowish clear-brown, exhibiting immaculate mental and gular regions, with a pattern of ventral lines (normally 6) reducing to 4 after the cloaca on the subcaudal scales. The rows of dorsal scales follow the formula 19-19-15, displaying keels mainly in the vertebral region of the posterior third of the body. The type locality is the municipality of Rodelas, Bahia. This species has additional records for the following states: Ceará, Rio Grande do Norte, Paraíba and Alagoas. We present here a compilation of known geographic distribution data for this species, based on eight records in the literature (Appendix I).

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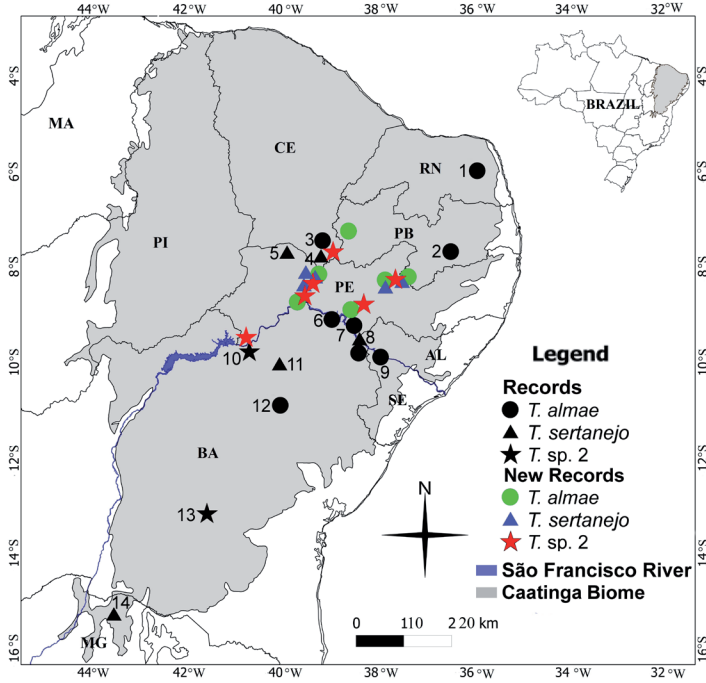


Figure 1. Published geographic distribution of *Thamnodynastes almae* (black circles), *T. sertanejo* (black triangles) and *T. sp. 2* (black stars) in Brazil: Ceará (CE), Rio Grande do Norte (RN), Paraíba (PB), Pernambuco (PE), Alagoas (AL), Sergipe (SE), Bahia (BA), Minas Gerais (MG). Colour symbols are new records. See Appendices I, II and III for explanation of the numbers.

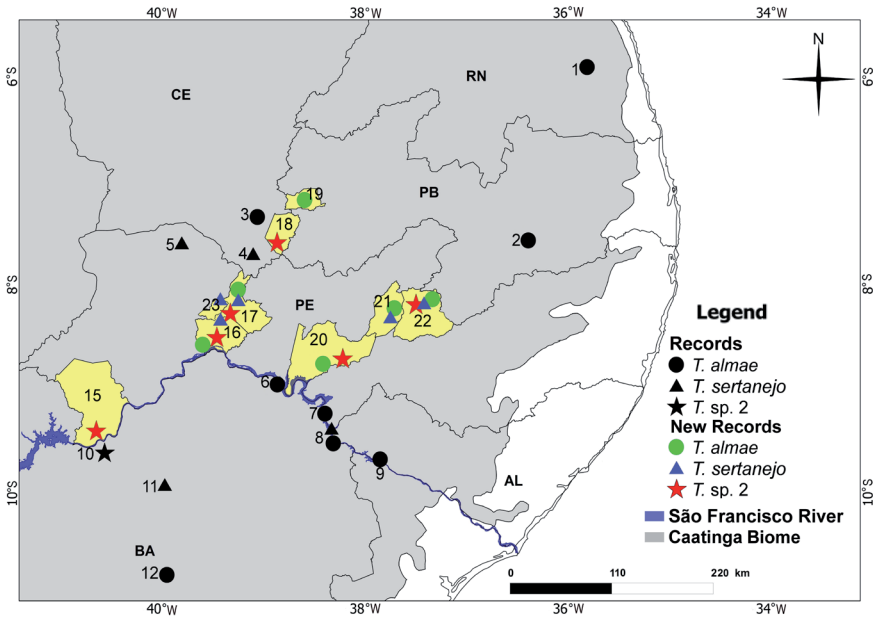


Figure 2. New records for *T. almae* (green circles), *T. sertanejo* (blue triangles) and *T. sp. 2* (red stars) collected in the municipalities of north-eastern Brazil for this study: Ceará (CE), Paraíba (PB), and Pernambuco (PE). Black symbols are records from literature. See Appendices I, II and III for explanation of the numbers.



Figure 3. *Thamnodynastes almae*: A- Ventral pattern with two pairs of lines, plus one or two additional lines, reducing to two pairs in the tail; B- Immaculate mental and gular regions; C- Lateral view of head, D- Keeled dorsal scales.

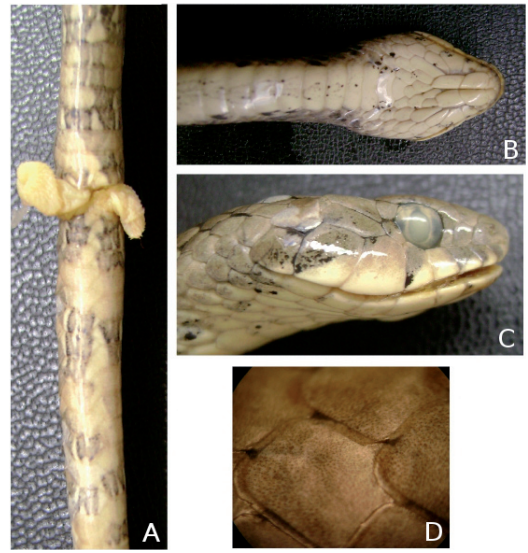


Figure 4. *Thamnodynastes sertanejo*: A- Ventral pattern without lines; B- Mental and gular regions with a few dark spots; C- Lateral view of head; D- Smooth dorsal scales.

Thamnodynastes sertanejo (Figure 4) is also a large species (mean SLV of females was 575.0 ± 66.8 mm, range = 462.0-661.0 mm and tail length of 205.5 ± 25.9 mm, range = 159.0-244.0 mm; mean SVL of males

was 530.6 ± 47.2 mm, range = 426.0-590.0 mm and tail length of 194.5 ± 18.0 mm, range = 151.0-213.0), greyish, with the gular region sometimes yellowish. It exhibits a checkerboard pattern in the dorsal region near the head, which it reveals when it flattens itself dorsoventrally in a hood display similar to that of *T. longicaudus* (Franco et al., 2003). The rows of dorsal scales follow the formula 17-17-11. Despite similar formulae, *T. sertanejo* differs from *T. pallidus* by a divided cloacal scale. It is also distinguished by a large number of subcaudal scales (females: 74-88 and males: 76-96) and for not displaying a pattern of lines on its venter, but rather a mixed pattern. The type locality is Jaguarari, Bahia. This species also has records for the states of Ceará, Pernambuco and Minas Gerais. We present here a compilation of known geographic distribution data for the species, based on six records in the literature (Appendix II).

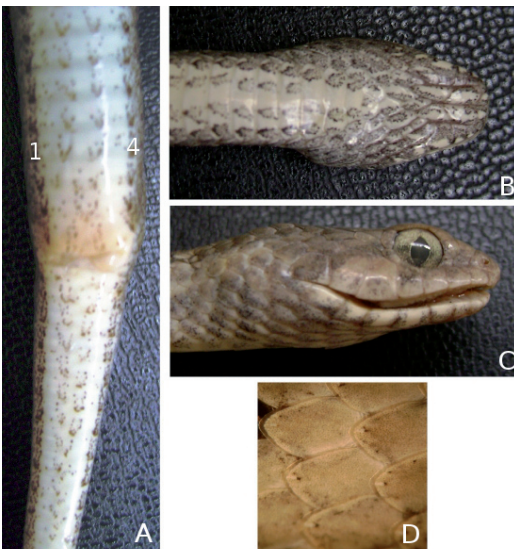


Figure 5. *Thamnodynastes* sp. 2: A- Ventral pattern with two pairs of lines, maintaining the same two pairs in the tail; B- Mental and gular regions blackened; C- Lateral view of head with infralabial half white scales; D- Smooth dorsal scales.

After analyzing specimens of *T. almae* and *T. sertanejo*, we obtained a third group of individuals with a number of distinct traits. These could have been from the species *T. strigatus* or *T. sp. 2*, since both have very similar pholidosis. Francisco L. Franco (currently working on the description of new species of the genus *Thamnodynastes*) confirmed that the species was *T. sp. 2* (Figure 5) (mean SLV of females was 365.9 ± 36.3 mm, range = 303.0-428.0 mm and tail length of $73.8 \pm$

10.9 mm, range = 55.0-91.0 mm; mean SVL of males was 316.1 ± 53.9 mm, range = 197.0-377.0 mm and tail length of 70.1 ± 13.0 mm, range = 41.0-85.0). The dorsal scale row formula in *T. sp. 2* (19-19-15) differs from that of *T. sertanejo* (17-17-11). *Thamnodynastes sp. 2* differs from *T. almae* by its smooth dorsal scales and the blackish gular and mental regions. The two records in the literature for *T. sp. 2* are presented in Appendix III.

The record in the state of Pernambuco for *T. almae* in Floresta is 45 km from its type locality in Rodelas, Bahia (Franco and Ferreira, 2002) and that of *T. sertanejo* in Salgueiro is 32 km from the nearest collection site in Jati, Ceará (Roberto *et al.*, 2009) (Figure 2). On the other hand, Sertânia, Pernambuco is the furthest record for *T. almae* that is 410 km from Itiúba, Bahia, and 185 km from its type locality in Rodelas, Bahia. The record of *T. sertanejo* from Sertânia is 350 km from its type locality in Jaguarari, Bahia, and 1060 km from the furthest site in Jaíba, Minas Gerais.

With respect to *T. sp. 2*, we consider the records of Juazeiro and Mucugê (Freitas and Silva, 2007), in the state of Bahia, as the nearest to ours in Petrolina, Pernambuco, 15 km and 417 km respectively. According to Franco and Ferreira (2002), *T. sp. 2* is distributed in the Caatingas domain in northeastern Brazil (Ab'Saber, 1974), in the São Francisco river drainage areas and coastal drainage regions in the states of Rio Grande do Norte and Bahia. With the exception of our records in Petrolina, Cabrobó and Floresta, Pernambuco, on the banks of the São Francisco River, Mauriti in Ceará, and Salgueiro and Sertânia in Pernambuco, are the localities furthest from the São Francisco river drainage areas (Figure 2).

All the occurrences of the three species of *Thamnodynastes* reported here are within the Caatinga morphoclimatic domain. We call attention to the sympatry between *T. almae* and *T. sertanejo* in Custódia, Pernambuco and Paulo Afonso, Bahia, *T. almae* and *T. sp. 2* in Floresta, Pernambuco, and *T. almae*, *T. sertanejo* and *T. sp. 2* in Cabrobó, Salgueiro and Sertânia, Pernambuco.

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Appendix I. Known occurrence localities of *Thamnodynastes almae* in Brazil, based on the literature. States: BA (Bahia), AL (Alagoas), PE (Pernambuco), PB (Paraíba), RN (Rio Grande do Norte), CE (Ceará). Acronyms: CHBEZ- Coleção Herpetológica do Departamento de Botânica, Ecologia e Zoologia/Universidade Federal do Rio Grande do Norte, IB and IBSP- Instituto Butantan, MFCH- Coleção de Herpetologia do Museu de Fauna da Caatinga, MZUFBA- Museu de Zoologia da Universidade Federal da Bahia, MZUSP- Museu de Zoologia da Universidade de São Paulo, UFPB- Universidade Federal da Paraíba.

Municipality (Locality)	State	Latitude (°S)	Longitude (°W)	Voucher number	Reference
1. Santa Maria (Fazenda Tanques)	RN	200894.06	9352215.07	CHBEZ 3044-3046	(Jorge and Freire, 2011).
2. Cabaceiras (Fazenda Bravo)	PB	799848.62	9171897.10	UFPB 4263	(Guedes, 2010)
3. Milagres	CE	502606.43	9198215.10	IBSP 76969	(Roberto, Ribeiro, and Melo, 2009)
6. Rodelas (Usina Hidrelétrica Luiz Gonzaga)	BA	-	-	IB 52134-52136	(Franco and Ferreira, 2002)
7. Petrolândia	PE	576913.24	8990332.60	IB 52119	(Guedes, 2010)
8. Paulo Afonso	BA	586005.14	8960828.42	MZUFBA 131-38	(Guedes, 2010)
9. Piranhas	AL	637162.24	8936719.69	MZUFBA 847	(Guedes, 2010)
12. Itiúba	BA	407046.91	8817063.36	MZUSP 5433-34	(Guedes, 2010)
16. Cabrobó	PE	449294	9058498	MFCH 1847, 1862	This study
17. Salgueiro	PE	486555	9117692	MFCH 1867	This study
19. São José de Piranhas	PB	555265	9213004	MFCH 1870	This study
20. Floresta	PE	662224	9097596	MFCH 1849-52, 1855-61, 1865, 1868-69	This study
21. Custódia	PE	580694	9040584	MFCH 1848, 1863-64	This study
22. Sertânia	PE	663989	9098058	MFCH 1853-54, 1866	This study

Appendix II. Known occurrence localities of *Thamnodynastes sertanejo* in Brazil, based on the literature. States: MG (Minas Gerais), BA (Bahia), PE (Pernambuco), CE (Ceará). Acronyms: FUNED- Fundação Ezequiel Dias, IBSP- Instituto Butantan, MFCH- Coleção de Herpetologia do Museu de Fauna da Caatinga, MNRJ- Museu Nacional, MZUSP- Museu de Zoologia da Universidade de São Paulo.

Municipality (Locality)	State	Latitude (°S)	Longitude (°W)	Voucher number	Reference
4. Jati	CE	499377.68	9156697.94	IBSP 76971	(Roberto et al., 2009)
5. Exu	PE	-	-	MZUSP 7180-81	(Bailey et al., 2005)
8. Paulo Afonso (Usina Hidrelétrica Itaparica)	BA	584187.23	8966360.91	FUNED 244	(Silveira and Cotta, 2006)
10. Juazeiro	BA	-	-	-	(Freitas and Silva, 2007)
11. Jaguarari (Mina Caraíba)	BA	403313.09	8909930.63	IBSP 26401	(Bailey et al., 2005)
14. Jaíba	MG	639610.39	8319133.09	FUNED 907, MNRJ 8048	(Silveira and Cotta, 2006)
16. Cabrobó	PE	449985	9065396	MFCH 1910, 1913, 1915, 1918	This study
17. Salgueiro	PE	484562	9115552	MFCH 1914, 1921	This study
21. Custódia	PE	657949	9097124	MFCH 1911-12	This study
22. Sertânia	PE	694139	9113202	MFCH 1917, 1919-20, 1922	This study
23. Terra Nova	PE	457941	9088718	MFCH 1916	This study

Appendix III. Known occurrence localities of *Thamnodynastes* sp. 2 in Brazil, based on the literature. States: BA (Bahia), PE (Pernambuco), CE (Ceará). Acronym: MFCH- Coleção de Herpetologia do Museu de Fauna da Caatinga.

Municipality (Locality)	State	Latitude (°S)	Longitude (°W)	Voucher number	Reference
10. Juazeiro	BA	-	-	-	(Freitas and Silva, 2007)
13. Mucugê	BA	-	-	-	(Freitas and Silva, 2007)
15. Petrolina	PE	329984	8968838	MFCH 1902-1909	This study
16. Cabrobó	PE	455112	9065928	MFCH 1871-79, 1882-83	This study
17. Salgueiro	PE	470021	9093454	MFCH 1886-87, 1900	This study
18. Mauriti	CE	526269	9170626	MFCH 1890-94, 1898	This study
20. Floresta	PE	577423	9037103	MFCH 1880-81, 1884, 1888, 1896-97, 1899	This study
22. Sertânia	PE	683109	9108834	MFCH 1889, 1895	This study