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SHORT COMMUNICATION

New records and notes on defensive behavior of *Thamnodynastes rutilus* (Prado 1942)

Novos registros e notas sobre comportamento defensivo de *Thamnodynastes rutilus* (Prado 1942)

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Abstract

Snakes of the genus *Thamnodynastes* Wagler 1830 are viviparous, opisthoglyphous and have elliptical vertical pupil. Among all of the 11 species that occur in Brazil, *T. rutilus* is easily diagnosed by having a reddish spot in the sixth infralabial. Information about biology, ecology, distribution and behavior of *T. rutilus* is very scarce in the literature. Such lack of information leads to poor species management and difficulty for taking conservation measures when needed. Thus, this study brought new insights about *T. rutilus* geographical distribution, amplifying its previously known occurrence area, as well as providing new data about the species natural defensive behavior.

Keywords: Squamata, Tachymenini tribe, snakes, conservation, Minas Gerais.

Resumo

Serpentes do gênero *Thamnodynastes* Wagler 1830 são vivíparas, opistóglifas e possuem pupila vertical elíptica. Dentre todas as 11 espécies que ocorrem no Brasil, *T. rutilus* é facilmente diagnosticada por possuir uma mancha vermelha na sexta infralabial. Informações sobre a biologia, ecologia, distribuição e comportamento dessa espécie são escassas na literatura. Tais lacunas podem acarretar em um manejo inadequado da espécie e em dificuldades na tomada de medidas conservacionistas, quando necessárias. Assim, este estudo traz novas informações sobre a distribuição geográfica de *T. rutilus*, ampliando sua área de ocorrência previamente conhecida, assim como fornecendo novos dados acerca do comportamento defensivo em condições naturais para esta espécie.

Palavras-chave: Squamata, tribo Tachymenini, serpentes, conservação, Minas Gerais.

Snakes of the genus *Thamnodynastes* are dipsadids (Costa and Bérnils, 2015) belonging to the subfamily Xenodontinae, which is widely distributed throughout South America (Bailey *et al.*, 2005). They are viviparous, opisthoglyphous and have elliptical vertical pupil (Franco and Ferreira, 2002). The genus comprises 19 valid species, 11 of which occur in Brazil: *T. almae* Franco e Ferreira 2002 *T. chaquensis* Bergna e Alvarez 1993; *T. hypoconia* (Cope 1860); *T. lanei* Bailey, Thomas e Silva Jr. 2005; *T. longicaudus* Franco, Ferreira, Marques e Sazima 2003; *T. nattereri* (Mikan 1828); *T. pallidus* (Linnaeus 1758); *T. ramonriveroi* Manzanilla e Sánchez 2005; *T. rutilus* (Prado 1942); *T. sertanejo* Bailey, Thomas e Silva Jr. 2005; and *T. strigatus* (Günther 1858) (Costa and Bérnils, 2015). Despite the

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recent contributions to the knowledge of the genus, there are still much confusion about the taxonomic status of the group (Franco and Ferreira, 2002; Bailey and Thomas, 2007).

The species *Thamnodynastes rutilus* can be easily distinguished from its congeners by having a reddish spot in the sixth infralabial in both sides of the head (Franco and Ferreira, 2002). This species was originally described as *Dryophylax rutilus* by Prado (1942), which besides the redescription, also discussed the systematic position of the genus *Dryophylax*. Afterwards, Vanzolini (1948) reviewed Prado's description and placed *D. rutilus* in the genus *Thamnodynastes*. The species' geographic distribution is restricted to only a few localities in the states of São Paulo, Minas Gerais, Mato Grosso do Sul, Rio de Janeiro and Distrito Federal (Franco and Ferreira, 2002). Information about the biology, ecology and behavior of this species is very scarce in the literature, with few documented captures, some data without many details about behavior and diet (Marques *et al.*, 2015), and a single observation of parturition in captivity followed by a posterior event of cannibalism, practiced by the only female born in the litter over one of its siblings (Araújo *et al.*, 1998).

Here we provide an updated distributional map of *Thamnodynastes rutilus* compiled from the literature, online databases [Instituto Butantan (IBSP), Fundação Ezequiel Dias (FUNED) and Universidade Federal de Minas Gerais - Instituto de Ciências Biológicas (UFMG-ICB) collections were accessed through SpeciesLink website; vouchers not examined] (SpeciesLink, 2016) and sporadic records during fieldwork. We considered just those information that contained precise data about the location record. Additionally, following the nomenclature from a few studies regarding behavior of snakes available in the literature (Greene, 1988; Sazima, 1992; Martins and Oliveira, 1998; Tozetti, 2012), we present data about *T. rutilus* defensive behavior in natural conditions.

We found 14 occurrence localities to *T. rutilus* through literature (Prado, 1943; Araújo *et al.*, 1998; Franco and Ferreira, 2002; Gonçalves *et al.*, 2007; Condez *et al.*, 2009; Costa *et al.*, 2014), and other five points were added through records from SpeciesLink database. Two records were made through sporadic fieldwork, in 2014 and 2015, respectively. The first record was made on October 26, 2014, during a fieldwork in the Fazenda São

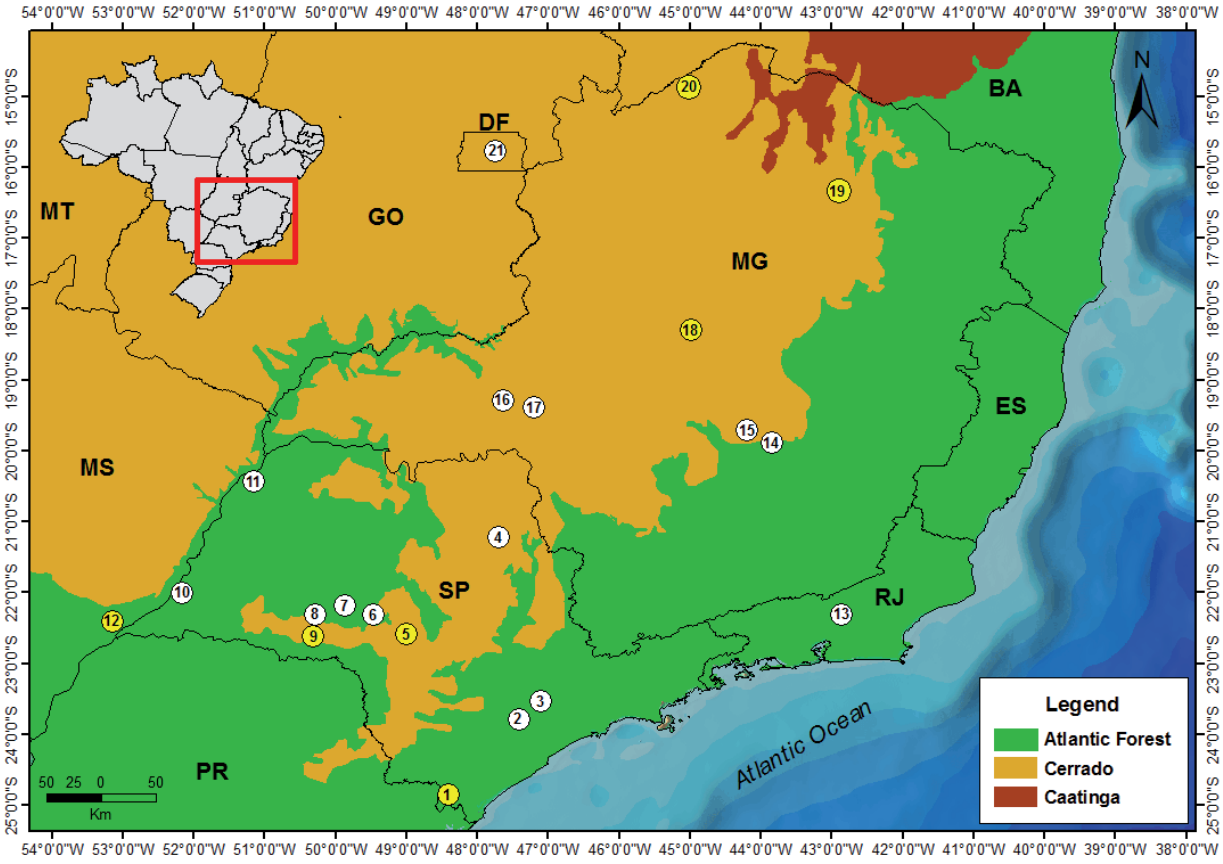

Figure 1. Geographical distribution of *Thamnodynastes rutilus* in central and southeastern Brazil. White circles: literature records; yellow circles: new records.

Francisco, municipality of Grão Mogol (16°10'36.87"S, 42°46'09.55"W; *Datum* WGS 84; 780m), northern Minas Gerais. A specimen of *T. rutilus* was recorded by Clodoaldo Lopes de Assis (CLA) around 19:30 h moving on arboreal vegetation on the bank of a stream, approximately 140 centimeters above the ground. The site is embedded in the Espinhaço Mountain Range and has a vegetation mosaic formed by Cerrado, Atlantic Forest and rocky fields. The specimen (male, snout-vent length = 413 mm, tail length = 165 mm) was collected and deposited in the Museu de Zoologia João Moojen at the Universidade Federal de Viçosa (MZUFV 2440). A second record was on February 20, 2015, during a field expedition in the Private Reserve of the Natural Patrimony Vereda Caraíba, located in the municipality of Bonito de Minas (14°45'09.16"S, 45°06'14.06"W; *Datum* WGS 84; 656m), northern Minas Gerais, an adult specimen of *T. rutilus* was observed and photographed by Douglas Henrique da Silva (DHS) over a vegetation in flooded environment during the night. The site is located in a transition region between Caatinga and Cerrado biomes (Brandão, 1994).

Thamnodynastes rutilus features a relatively wide geographic distribution, mainly for the states of São Paulo (SP) and Minas Gerais (MG), but with scarce records for Mato Grosso do Sul (MS), Rio de Janeiro (RJ) and Distrito Federal (DF) (Prado, 1943; Arújo *et al.*, 1998; Franco and Ferreira, 2002; Gonçalves *et al.*, 2007; Condez *et al.*, 2009; Costa *et al.*, 2014). Our results extend its geographical distribution beginning in the nearest points in the literature: Barra do Turvo (SP) extend ca. 156 km southwest of Piedade (SP), Bonito de Minas (MG) ca. 320 km northeast from Brasilia (DF) and Grão Mogol (MG) ca. 428 km northeast from Esmeraldas (MG), these being the limits south, north and east respectively. The material examined by Franco and Ferreira (2002) contains a specimen collected at Sérgio Motta Hydroelectric Plant (IB 61627), in the state of Mato Grosso do Sul, but it does not specify the municipality. Thus we consider the record in Baytaporã (MS), as the westernmost limit of occurrence of the species, extending its distribution ca. 113 km southwest of Presidente Epitacio (SP). The current geographic distribution of *T. rutilus* includes areas of the Cerrado and Atlantic Forest phytophysiognomies, as well transition regions between these two biomes, including rocky fields in the Espinhaço Mountain Range, and also transition areas between the Cerrado and Caatinga biome in its northernmost limit of occurrence (Figure 1 and Table 1).

Table 1. Recorded localities for *Thamnodynastes rutilus* in central and southeastern Brazil.

Point on map	Municipality	State	Source
1	Barra do Turvo	SP	SpeciesLink (IB 33113)
2	Piedade	SP	Condez *et al.* (2009)
3	São Roque	SP	Franco and Ferreira (2002)
4	Ribeirão Preto	SP	Franco and Ferreira (2002)
5	Agudos	SP	SpeciesLink (IB 10338)
6	Gália	SP	Prado (1943)
7	Marília	SP	Franco and Ferreira (2002)
8	Lutécia	SP	Franco and Ferreira (2002)
9	Assis	SP	SpeciesLink (IB 32245)
10	Presidente Epitácio	SP	Franco and Ferreira (2002)
11	Ilha Solteira	SP	Franco and Ferreira (2002)
12	Batayporã	MS	SpeciesLink (IB 30681)
13	Teresópolis	RJ	Gonçalves *et al.* (2007)
14	Belo Horizonte	MG	Araújo *et al.* (1998)
15	Esmeraldas	MG	Araújo *et al.* (1998)
16	Nova Ponte	MG	Costa *et al.* (2014)
17	Perdizes	MG	Franco and Ferreira (2002)
18	Três Marias	MG	SpeciesLink (UFMG-REP 1098)
19	Grão Mogol	MG	Present study
20	Bonito de Minas	MG	Present study
21	Brasília	DF	Franco and Ferreira (2002)

Both specimens of *T. rutilus* (Figure 2) recorded by DHS and CLA, respectively, showed defensive posture when disturbed, exhibiting the following behaviors when handled: (1) cloacal discharge, (2) strike with bite and (3) locomotor escape. When set free on the ground, six behaviors were characterized when disturbed: (1) head triangulation, (2) false strike, (3) erratic movements, (4) locomotor escape, (5) S-shaped posture and (6) elevation of the anterior portion of the body. The specimens exhibited a defensive repertoire composed of many different defensive strategies. When the snake did erratic movements or was moving to escape, it always remained with the S-shape posture, triangulation of the head and the posterior third of the body raised.

Marques *et al.* (2015) described four defensive behaviors for *T. rutilus* (body flattening, head triangulation, strike and cloacal discharge) of which only body flattening was not observed in this study. Ectothermic animals depend on environmental temperature to carry out their activities and react to stimuli (Goode and Durvall, 1989; Pough *et al.*, 2008). Although we did not consider environmental temperature during observations, the absence of this behavior may be related with it. It has been observed that snakes adjust their defensive behavior according to temperature, being more passive in colder days (Shine *et al.*, 2000). Other possible explanation relies on the fact that snake anti-predator displays are in part heritable and highly variable within populations, so that the individual behavior might not be always consistent (Arnold and Bennett, 1984). In this particular case, the lack of a trigger (e.g., an odor or insight of a particular predator) could also be the reason of why the individuals of *T. rutilus* did not display the body flattening behavior.

Figure 2. Specimens of *Thamnodynastes rutilus* recorded in Minas Gerais, southeastern Brazil. A: specimen recorded in Bonito de Minas; B, C and D: specimen recorded in Grão Mogol (MZUFV 2440), showing detail of elevation of the anterior portion of the body, triangulation of the head and S-shaped posture.

Thamnodynastes rutilus presented a diverse set of defensive behaviors, displaying both performances commonly seen in terrestrial species (erratic movements) as those seen in arboreal ones (head lift and neck S-coil) (Martins and Oliveira, 1998; Marques *et al.*, 2015), which is expected for a species that live in both types of microhabitats (Marques *et al.*, 2015) and may be under pressure of different kinds of predators (Greene, 1988). Strike with bite and cloacal discharge were recorded only during the animal manipulation, and possibly is an extreme defensive mechanism to discourage their ingestion by the predator (Tozetti *et al.*, 2009), suggesting that this species is able to adjust their defensive behavior according to the threat level imposed by the predator. Still, the pattern of cryptic coloration and the defensive behavior repertoire (head triangulation, false strike, S-shape posture and elevation of the anterior portion of the body) similar to that described for the genus *Bothrops* (Sazima, 1988; Araújo and Martins, 2006) suggests that *T. rutilus* mimics sympatric species of this genus. Other similar cases among colubrid species mimicking viperids or elapids based on the similarity of the color patterns and behavior have been reported (Gans and Latifi, 1973; Sánchez-Herrera *et al.*, 1981; Yanoski and Chani, 1988; Marques and Puorto, 1991), and experiments using models mimicking dangerous species showed that in most cases, such characteristics prevent predators from striking (Dell'Aglio *et al.*, 2012).

In conclusion, *T. rutilus* is a poorly known Brazilian species, and data about its biology, ecology, distribution and behavior are still very scarce in the literature. Such kinds of information are essential for taking conservation measures, management of species, programs of captive breeding and others. Thus, more studies are still needed in order to fill gaps about the knowledge of this species in a way to better understand its relationship with other organisms and the ecosystem.

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