

First record of *Ischnocnema octavioi* (Bokermann, 1965) from São Paulo state, Brazil

Tomáš Holer^{1,2}, Dalibor Sýkorovský¹ & Pavla Hejmanová¹

¹ Czech University of Life Sciences Prague, Faculty of Tropical AgriSciences, Kamýčká 129, 165 21, Prague 6 – Suchbát, Czech Republic.

² Corresponding author. E-mail: t.holer@seznam.cz

Abstract. We present the first record of *Ischnocnema octavioi* from São Paulo state, Brazil. Until now, the species was thought to be endemic to Rio de Janeiro, where it was known from fewer than 10 localities. Based on recent data, we recommend that the IUCN Red List status for this species be re-evaluated.

Key words. Anura; Brachycephalidae; Atlantic Forest; biogeography

The Atlantic Forest of Brazil is known as one of the richest biodiversity hotspots on Earth. In recent history, 90% of this ancient forest has been lost or become highly fragmented (CEPF 2016). In this ecoregion there are currently 543 species of amphibians, including 529 anurans, of which 88% are endemic, including one endemic family, Brachycephalidae, and many endemic genera (HADDAD et al. 2013). The genus *Ischnocnema* (Brachycephalidae) includes 33 species and was divided into 4 species groups (*I. guentheri* s.s., *I. parva* s.s., *I. lacteal* s.s. and *I. verrucosa* s.s.), based on morphological and

genetic characteristics (HEDGES et al. 2008, CANEDO & HADDAD 2012, FROST 2017).

Ischnocnema octavioi (Bokermann, 1965), belongs to the *I. verrucosa* species group, which also includes 6 other species (CANEDO et al. 2010, CANEDO & HADDAD 2012).

Ischnocnema octavioi (Fig. 1) is a small terrestrial species of frog with short legs and small digital discs. Dorsum is conspicuously tuberculate with W-shaped mark between front limbs. The iris is red with a vertical black bar. The reproductive strategy of this frog is not well known yet, but it presumably breeds by direct development, as do other similar species in the genus (BOKERMANN 1965, CANEDO et al. 2010). *Ischnocnema octavioi* inhabits primary and secondary forest up to 1200 m above sea level (a.s.l.) and its major threat is clearing of the forest (ROCHA et al. 2004). According to available literature, almost all previous records of *I. octavioi* are from the state of Rio de Janeiro, including the type locality, Estrada da Cascatinha, Tijuca Mountains (BOKERMANN 1965, COSTA et al. 2008, VRCIBRADIC et al. 2008, SIQUEIRA et al. 2009, SIQUEIRA et al. 2011, VRCIBRADIC et al. 2011, OUVERNAY et al. 2012; BITTENCOURT-SILVA & SIVA 2013, ALMEIDA-GOMES et al. 2014a, MARTINS et al. 2014). One exception is the record from Espírito Santo state, but this record probably based on *I. verrucosa* (Reinhardt & Lütken, 1862), a species with very similar characteristics to *I. octavioi* but having a different distribution (DANTAS & FERREIRA 2010).

Our research area was located on the edge of one of the largest remnants of Atlantic forest in the Serra do Mar, Bananal municipality, state of São Paulo, Brazil. During 2013 to 2015, we established a 700 m line transect on private property near Serra da Bocaina National Park and on the edge of Serra do Mar forest fragment. The transect extended from 22°44'05.5" S, 044°23'35.8" W to 22°43'59.2" S, 044°23'19.5" W. The elevation was approximately 700 m a.s.l. The forest fragment had the phytophysiognomy of primary forest, with pastures on the southern side and two small pastures, surrounded by forest, on the northwestern and northeastern sides. Cattle graze extensively on the pastures.

The transect started on the edge of the forest and continued inward, crossing one larger (5 m wide) and several smaller (1 m wide) streams. The forest supported high tree density with



Figure 1. One of the specimens of *Ischnocnema octavioi*. Photo by DS.



Figure 2. Habitat where the specimens were found. Bananal, Rio de Janeiro state, Brazil. Photo by DS.

closed canopy and sparse of undergrowth. The ground was covered by wet leaf litter with decaying wood (Fig. 2); the whole area was rocky and the terrain was often very steep.

The transect was searched for 3 days and three nights consecutively, using non-invasive visual encounter survey (VES) (HEYER et al. 1994). Recorded amphibians were photographed in situ for documentation and identification.

We recorded 3 specimens of *Ischnocnema octavioi*, each found during a different night survey, but all of them were from a transect section of approximately 30 m in length, located in the central part of the transect. The clearly visible difference in the size and coloration of the 3 specimens rejected the possible repeated observation of the same individual. Specimens were photographed and released. The photographs were then

compared to photographs and description of the holotype (BOKERMANN 1965). Specimens were not sexed. All specimens presented all key characteristics of the species including short hind limbs, unwebbed fingers with slightly differentiated discs, tuberculate dorsum with W-shaped mark, small, visible oval tympanum, prominent nostrils and red iris with a narrow black vertical bar (BOKERMANN 1965).

There are 4 species morphologically similar to *Ischnocnema octavioi*, all included in the *I. verrucosa* species group. Those species are *I. juipoca* (Sazima & Cardoso, 1978), *I. penaxavantino* (Giaretta, Toffoli, & Oliveira, 2007), *I. surda* (Canedo & Caramaschi, 2010), and *I. verrucosa* (CANEDO et al. 2010). *Ischnocnema juipoca* differs from *I. octavioi* by having a dark yellow iris and no W-shaped shoulder marking (iris red, shoulder mark present in *I. octavioi*) (SAZIMA & CARDOSO 1978). The iris color in *I. penaxavantino* is gray or copper and the bars of the W-shaped mark are not connected (GIARETTA et al. 2007). *Ischnocnema surda* has an indistinct tympanum and distinct white glandular-appearing nuptial pads in males (CANEDO et al. 2010). *Ischnocnema octavioi* most closely resembles *I. verrucosa*. However, the W-shaped marks of our specimens exhibited large, contrastingly colored tuberculate tips, as described in *I. octavioi* (BOKERMANN 1965, CANEDO et al. 2010). Identification of our specimens was also confirmed by local specialists Mauricio Almeida-Gomes and Emanuel Teixeira da Silva. We have summarized all key characteristics and differences of species similar to *I. octavioi* in Table 1. These characteristics confirm that our specimens belong to *I. octavioi*.

We present the first record of *Ischnocnema octavioi* from São Paulo state. Our record represents the westernmost locality of this species, more than 100 km west from the type locality and 50 km from the closest known locality. All verified records of the species are from Rio de Janeiro state (SIQUEIRA et al. 2009). One record from the state of Espírito Santo (DANTAS & FERREIRA 2010) is probably *I. verrucosa*; no description or photograph was provided. This record's locality is within the distribution area of a very similar species, *I. verrucosa*, and far from the distribution area of *I. octavioi* (CANEDO et al. 2010). The species is not present in the checklist of amphibian species of Espírito Santo (ALMEIDA et al. 2011), but some authors still report its occurrence in both Rio de Janeiro and Espírito Santo states (HADDAD et al. 2013, FROST 2017). Another misidentification was the record from Ilha Grande, Rio de Janeiro state (ROCHA et al. 2000, 2001); 2 specimens were described as *I. octavioi*, but after later examination they were reclassified as *I. guentheri* (Steindachner, 1864) (VRCIBRADIC et al. 2008). Nev-

Table 1. Key characteristics of species similar to *Ischnocnema octavioi* with highlighted differences in bold.

Species	Tuberculated dorsum	Short hind legs	Tympanum	Iris color	W-shaped mark	White nuptial pads in males
<i>I. octavioi</i>	Yes	Yes	Distinct	Red	Present, large tubercles on tips	Indistinct
<i>I. verrucosa</i>	Yes	Yes	Distinct	Red	Less visible, legs of W-shaped mark not in contact	Indistinct
<i>I. surda</i>	Yes	Yes	Indistinct	Red	Present	Distinct
<i>I. juipoca</i>	Yes	Yes	Distinct	Dark yellow	Absent	Indistinct
<i>I. penaxavantino</i>	Yes	Yes	Distinct	Gray, Copper	Less visible, legs of W-shaped mark not in contact	Indistinct

Table 2. List of all known records of *Ischnocnema octavioi*.

CONFIRMED RECORDS						
Record number	Locality (Rio de Janeiro state)	Latitude (S)	Longitude (W)	Year	Elevation of research area (m a.s.l.)	Reference
1	Estação Ecológica Estadual do Paraíso	22°26' – 22°32'	042°56'W	2004	40– 300	Vrcibradic et al. 2011
2	Reserva Ecológica de Guapiaçu	22° 24' S	042° 44'	2004–2014	30–700	ALMEIDA-GOMES et al. 2014
3	Parque Nacional da Serra dos Órgãos	22°27'S	043°00'	2006	unknown	COSTA et al. 2008
4	Parque Estadual do Cunhambebe	22°54'07"	043°53'33"	2010	100–600	OUVERNAY et al. 2012
5	Parque Estadual do Desengano	21° 52'	041° 54'	2006	1060–1500	SIQUEIRA et al. 2011
6	Parque Estadual dos Três Picos	22° 25'	042° 35'	2006	500–800	SIQUEIRA et al. 2009
7	Esparaiado	22°52'56"	042°41'04"	2011–2012	30–700	MARTINS et al. 2014
8	Morro São João	22°33'	042°02'	2005	320	VRCIBRADIC et al. 2008
9	Tijuca mountains (Type Locality)	22°56'55.475"	043°14'17.772"	1965	30–600	BOKERMANN 1965
10	Xandoca, Serra do Mar, São Paulo	22°44'01.018"	44° 23' 28.550"	2015	650–700	—
UNVERIFIED AND MISIDENTIFIED RECORDS						
Record number	Locality	Reason	Reference			
11	Rio de Janeiro state, Ilha Grande	Confirmed misidentification with <i>I. guentheri</i>	BITTENCOURT-SILVA & SIVA 2013			
12	Rio de Janeiro state, Multiple, Unknown name	Unconfirmed records, displayed on map without reference	CANEDO et al. 2010			
13	Espirito Santo state, Alfredo Chaves Municipality	Likely misidentification of <i>I. verrucosa</i>	DANTAS & FERREIRA 2010			

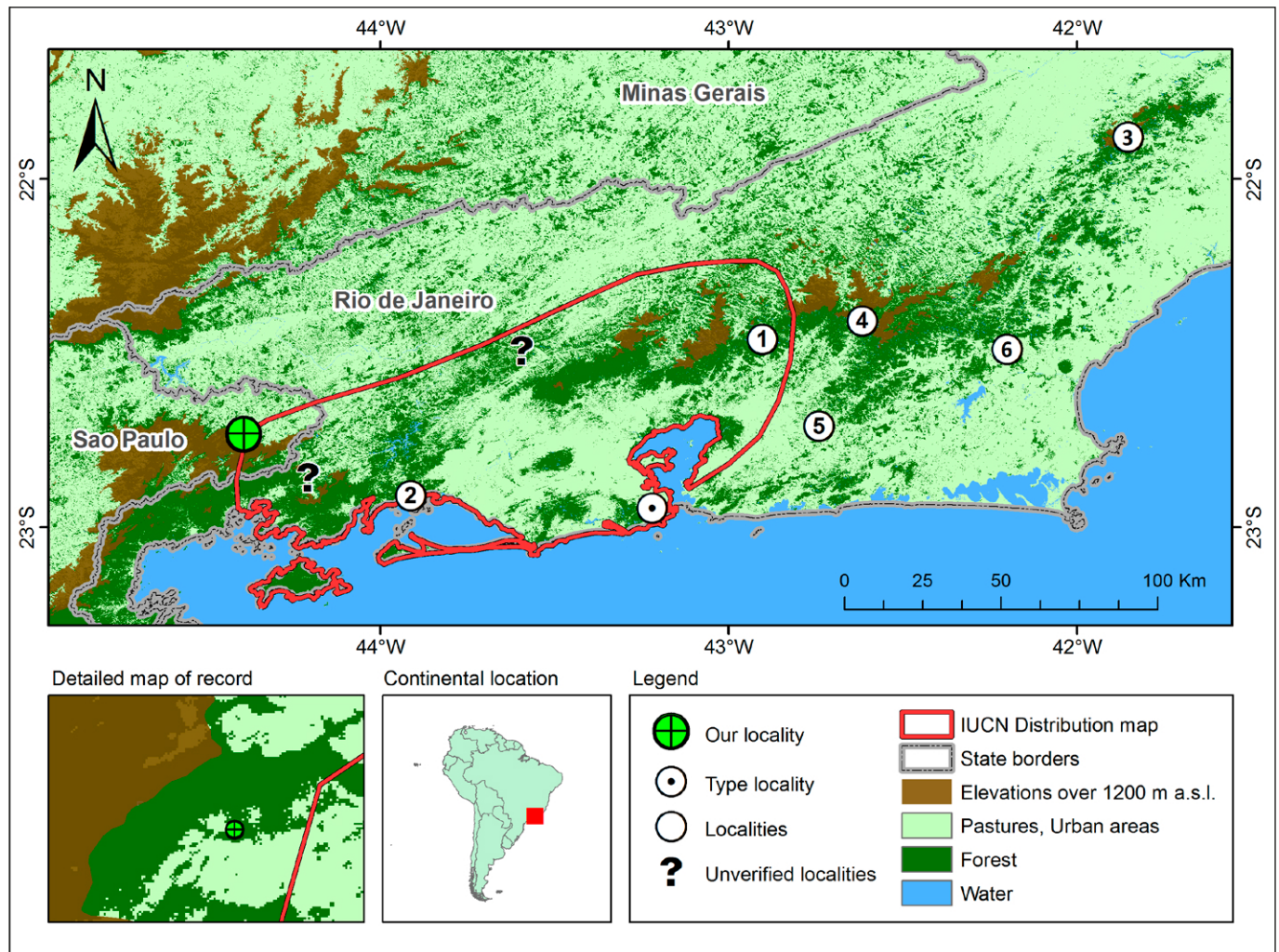


Figure 3. Map of all known records of *Ischnocnema octavioi* including our record –from São Paulo, Bananal municipality (green circle with a cross) and type locality in Tijuca Mountains (BOKERMANN 1965) – white circle with a dot. The map indicates suitable habitat for this species (forest = green) and one ecological barrier (elevations over 1200 m a.s.l. = brown) and species range estimated by IUCN. Localities: 1. Includes three adjacent localities: The Estação Ecológica Estadual do Paraíso (VRCIBRADIC et al. 2011); The Reserva Ecológica de Guapiaçu (ALMEIDA-GOMES et al. 2014) and Parque Nacional da Serra dos Órgãos (COSTA et al. 2008). 2. Parque Estadual do Cunhambebe (OUVERNAY et al. 2012). 3. Parque Estadual do Desengano (Siqueira et al. 2011). 4. Parque Estadual dos Três Picos (SIQUEIRA et al. 2009). 5. Esparaiado (MARTINS et al. 2014). 6. Morro São João (VRCIBRADIC et al. 2008). The two unverified localities based on CANEDO et al. (2010), are displayed as question mark (?).

ertheless, BITTENCOURT-SILVA & SIVA (2013) still included this Ilha Grande record in their publication on the insular anurans on the coast of Rio de Janeiro state.

According to the literature, there are 9 verified records of *Ischnocnema octavioi* from different localities described in Table 2 and Figure 3. Five of those records are located within the species' distribution as estimated by ROCHA et al. (2004) and 4 of them outside, which indicates that the map is outdated.

Ischnocnema octavioi was recorded on the ground in all previous reports. In our study, 2 specimens were found on the ground, but the third specimen was on a large leaf approximately 30 cm above the ground. The species has never been recorded outside of the forest and probably cannot reproduce outside of the forest (ALMEIDA-GOMES 2014b). All reported specimens were found at or below 800 m a.s.l., with 1 exception (over 1060 m a.s.l.) (Table 2). Maximum elevation for this species has been estimated as 1200 m a.s.l. (ROCHA et al. 2004). The high fragmentation and low density of the forest, and also the areas of high elevation, significantly reduce the available suitable habitat and consequently the distribution of the species, which is now highly fragmented (Fig. 3). Based on these data we recommend that the current IUCN Red List status of *I. octavioi* (Least Concern) (ROCHA et al. 2004) should be re-evaluated.

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