

**New Species of *Ischnocnema* (Anura: Brachycephalidae) from the State of Minas Gerais, Southeastern Brazil, with Comments on the *I. verrucosa* Species Series**

Author(s) :Clarissa Canedo, Bruno V. S. Pimenta, Felipe S. F. Leite, and Ulisses Caramaschi

Source: Copeia, 2010(4):629-634. 2010.

Published By: The American Society of Ichthyologists and Herpetologists

DOI: 10.1643/CH-09-159

URL: <http://www.bioone.org/doi/full/10.1643/CH-09-159>

---

BioOne ([www.bioone.org](http://www.bioone.org)) is a nonprofit, online aggregation of core research in the biological, ecological, and environmental sciences. BioOne provides a sustainable online platform for over 170 journals and books published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Web site, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/page/terms\\_of\\_use](http://www.bioone.org/page/terms_of_use).

Usage of BioOne content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

# New Species of *Ischnocnema* (Anura: Brachycephalidae) from the State of Minas Gerais, Southeastern Brazil, with Comments on the *I. verrucosa* Species Series

Clarissa Canedo<sup>1</sup>, Bruno V. S. Pimenta<sup>2</sup>, Felipe S. F. Leite<sup>3</sup>, and Ulisses Caramaschi<sup>4</sup>

**Field activities in several localities within the basin of the Doce River, state of Minas Gerais, Brazil, resulted in the collection of a new *Ischnocnema* that we assign to the *I. verrucosa* species series. The new species resembles *I. verrucosa* and *I. octavioi* by its possession of small digital discs, short legs, conspicuously tuberculate dorsal surfaces, a W-shaped mark between the shoulders with two large tubercles at the bases, and a red iris with a vertical black bar in life. It differs from *I. verrucosa* and *I. octavioi* by its possession of externally indistinct tympanum and tympanic annulus and visible white glandular-appearing nuptial pads in males. We also assign *I. octavioi* and *I. penaxavantino* to the *I. verrucosa* species series.**

THE genus *Ischnocnema* was removed from the synonymy of *Eleutherodactylus* on the basis of molecular evidence (Heinicke et al., 2007). Currently, *Ischnocnema* contains 32 species distributed in central and eastern Brazil, and adjacent northern Argentina (Frost, 2009; Targino et al., 2009). Hedges et al. (2008) recognized five species series in this genus (*Ischnocnema guentheri*, *I. lactea*, *I. parva*, *I. ramagii*, and *I. verrucosa* series), which they regarded to be preliminary convenience groupings rather than clades diagnosed by shared-derived characters.

Faunal inventories in the Doce River basin, state of Minas Gerais, in southeastern Brazil yielded specimens of a species that we describe herein and assign to *Ischnocnema*. Comparisons of the new species with similar species of *Ischnocnema* lead us to also reconsider the species series recognized by Hedges et al. (2008).

## MATERIALS AND METHODS

We analyzed 27 paratypes of *Ischnocnema octavioi* as well as the holotype and 17 topotypes of *I. verrucosa* (Material Examined). Institutional abbreviations are as listed at <http://www.asih.org/codons.pdf>, except CFBH (Célio F. B. Haddad collection, Instituto de Biociências, Universidade Estadual Paulista “Júlio de Mesquita Filho,” Rio Claro, São Paulo, Brazil), MCNAM (Amphibian Collection, Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil), and MZUFV (Museu de Zoologia “João Moojen de Oliveira,” Universidade Federal de Viçosa, Minas Gerais, Brazil).

Morphological nomenclature mainly follows former literature on the genus (Heyer, 1984; Hedges et al., 2008). The following measurements were employed for descriptions: snout–vent length (SVL), head length, head width, eye diameter, upper eyelid width, interorbital distance, internarial distance, eye–nostril distance, thigh length, shank length, tarsus length, and foot length. All measurements

were taken with a caliper to the nearest 0.1 mm, following Cei (1980). Geographic coordinates and elevations were taken with a GARMIN Legend HCX GPS receiver. Some elevational data were later obtained with Google Earth version 5.0.1.

## RESULTS

*Ischnocnema octavioi* possesses the characters of the *I. verrucosa* species series (Hedges et al., 2008), including short legs (shank length 45.9–57.1% SVL; mean 53.0%;  $n = 27$ ), tuberculate dorsum, and small digital discs. In addition, *I. octavioi* has a conspicuously tuberculate dorsum, W-shaped mark between the shoulders with two large tubercles at the bases, and red iris with a vertical black bar in life as does *I. verrucosa*.

In the original description of *Ischnocnema penaxavantino*, Giarretta et al. (2007) related this species to *I. juipoca* and compared this species to species historically thought to be closely related to *I. juipoca*, which currently includes species in *Eleutherodactylus*, *Ischnocnema*, and *Pristimantis* (Giarretta et al., 2007). The species of *Ischnocnema* used in their comparisons were *I. juipoca*, *I. octavioi*, and *I. verrucosa*. In our examination of the type series of *I. penaxavantino*, we found that it also possesses many of the character states currently used to diagnose the *I. verrucosa* species series (*sensu* Hedges et al., 2008), including a tuberculate dorsum as *I. juipoca* (although less tuberculate than *I. verrucosa* and *I. octavioi*), and small digital discs (discs do not seem more expanded than in *I. juipoca*, *I. octavioi*, and *I. verrucosa* in contrast to statements in the original description). Moreover, *I. penaxavantino* also possesses a W-shaped mark between the shoulders (although it is less distinct than in *I. verrucosa* and *I. octavioi* since the legs of the W-mark on dorsum do not touch each other medially).

This evidence lead us to include both *Ischnocnema octavioi* and *I. penaxavantino* in the *I. verrucosa* species series, which

<sup>1</sup> Universidade Estadual Paulista “Júlio de Mesquita Filho,” Instituto de Biociências, Departamento de Zoologia, 13506-970 Rio Claro, SP, Brasil; E-mail: clarissa.canedo@gmail.com. Send reprint requests to this address.

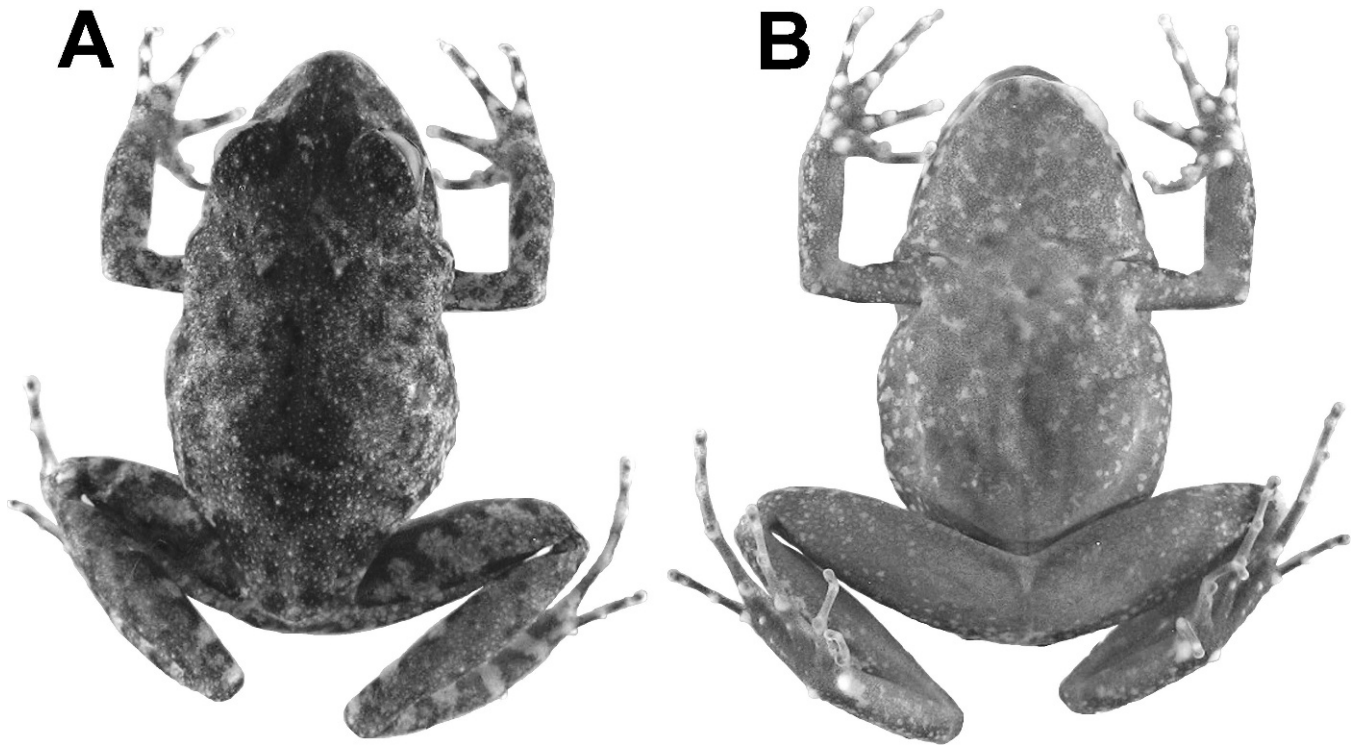
<sup>2</sup> BBM Consultoria Ambiental Ltda., Av. Prudente de Moraes 621/807, Cidade Jardim, 30350-143 Belo Horizonte, MG, Brasil; E-mail: bvergueiopimenta@gmail.com.

<sup>3</sup> Universidade Federal de Minas Gerais, Instituto de Ciências Biológicas, Departamento de Zoologia, Laboratório de Herpetologia, Av. Antônio Carlos, 6627, Pampulha, 31270-901 Belo Horizonte, MG, Brasil; E-mail: fsfleite@gmail.com.

<sup>4</sup> Universidade Federal do Rio de Janeiro, Museu Nacional, Departamento de Vertebrados, Quinta da Boa Vista, 20940-040 Rio de Janeiro, RJ, Brasil; E-mail: ulisses@acd.ufrj.br.

Submitted: 24 August 2009. Accepted: 11 May 2010. Associate Editor: D. Kizirian.

© 2010 by the American Society of Ichthyologists and Herpetologists DOI: 10.1643/CH-09-159



**Fig. 1.** Holotype of *Ischnocnema surda*, new species, MNRJ 57808 (SVL 25.1 mm) in dorsal (A) and ventral (B) views.

already included *I. verrucosa* and *I. juipoca* (Hedges et al., 2008). All the species in this series were hence compared in details to the new species from the Doce River basin described below.

### *Ischnocnema surda*, new species

Figures 1–2; Table 1

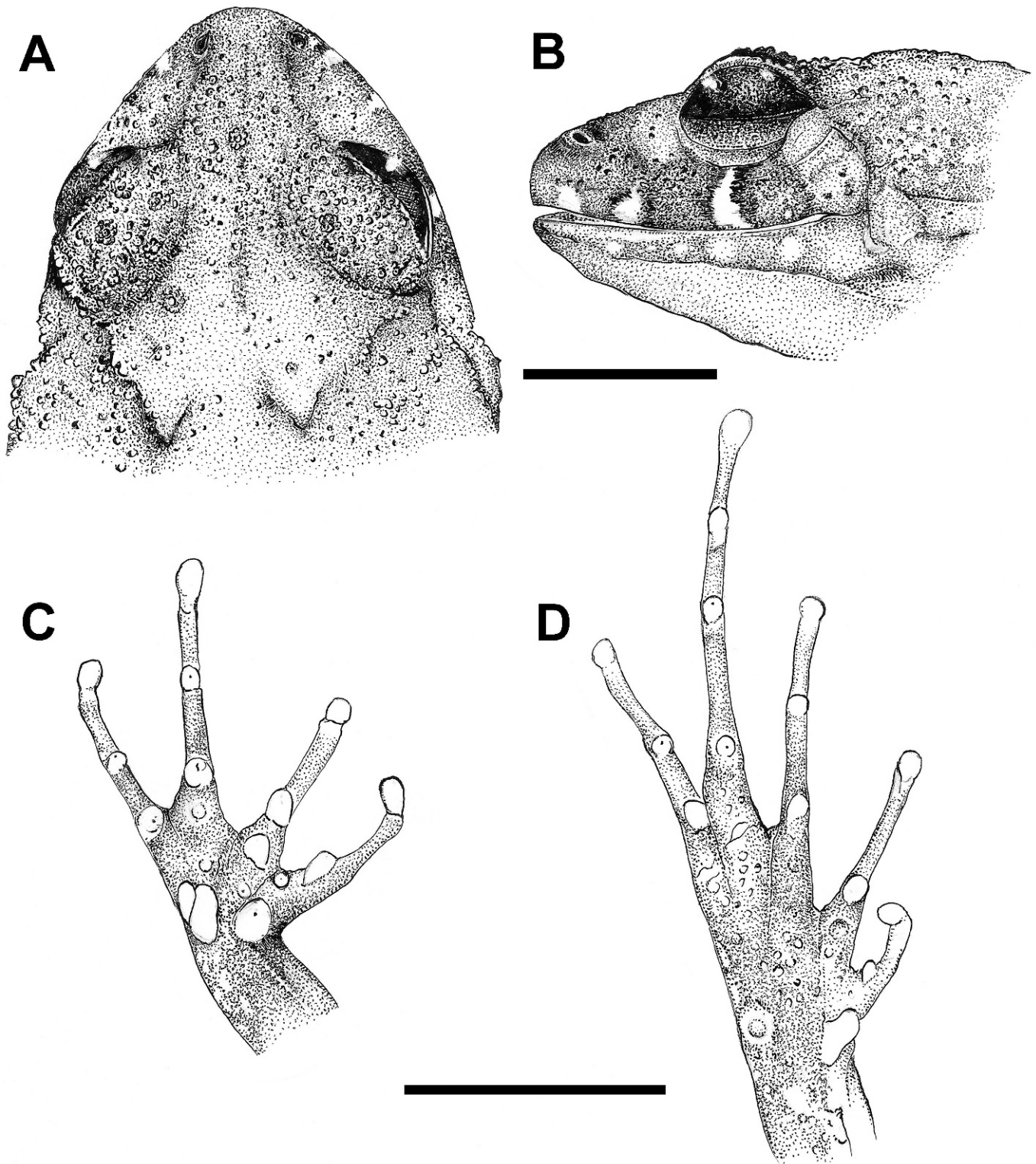
**Holotype.**—MNRJ 57808, adult female (Figs. 1–2), Brazil, state of Minas Gerais, municipality of Ouro Preto, Estação Ecológica do Tripuí, 20°23'06"S, 43°32'24"W, January 1995, A. S. Guimarães-Neto.

**Paratypes.**—MNRJ 57809, MZUFV 2320, males, MZUFV 2317, female, collected with the holotype. MCNAM 10841, male, Brazil, state of Minas Gerais, municipality of Santa Bárbara, Serra do Baú near the village of Galego, 20°02'21"S, 43°34'28"W, 811 m a.s.l., 31 October 2008, B. V. S. Pimenta and M. W. F. Faria. MCNAM 10860, male, Brazil, state of Minas Gerais, municipality of Mariana, abandoned *Eucalyptus* plantation at the margins of the road between the towns of Mariana and Catas Altas, 20°10'46"S, 43°28'42"W, 931 m a.s.l., F. S. F. Leite and T. L. Pezzuti. MCNAM 10968–69, males, 22 May and 23 June 2007, respectively; MCNAM 10970, female, 30 September 2007; MCNAM 10972–73, females, 9 November 2007 and 4 December 2008, respectively; MCNAM 10974–76, males, 9 December 2008; MCNAM 10977, male, 17 February 2008; all from Brazil, state of Minas Gerais, municipality of Marliéria, Parque Estadual do Rio Doce, 19°46'47"S, 42°35'58"W, 300 m a.s.l., C. R. Rievers. MCNAM 10978, female, Brazil, state of Minas Gerais, municipality of Rio Piracicaba, next to the Água Limpa iron mine, 19°55'15"S, 43°12'32"W, 765 m a.s.l., 13 September 2008, C. R. Rievers.

**Diagnosis.**—*Ischnocnema surda* differs from the species of the *I. parva*, *I. ramagii*, and *I. lactea* series mainly by the rounded small discs (discs are pointed in the species of the *I. parva* series and at least the outer digital discs are moderate to large in the species of the *I. ramagii* and *I. lactea* series). The new species also differs from most species of the *I. parva*, *I. ramagi*, and *I. lactea* series but *I. holti*, *I. manezinho*, and *I. sambaqui* by presenting a W-shaped mark between the shoulders. *Ischnocnema surda* differs from the species of the *I. guentheri* series by the presence of short legs, a subacuminate snout in dorsal view, and tuberculate dorsal skin with a W-shaped mark between the shoulders (*I. guentheri* series presents long legs, acuminate snout in dorsal view, and smooth or finely granular dorsal skin with no W-shaped mark).

*Ischnocnema surda* resembles species in the *I. verrucosa* series, differing from them in having a tympanum and tympanic annulus that is externally indistinct (distinct in the species of the *I. verrucosa* series as rearranged above) and distinct white glandular-appearing nuptial pads in males (indistinct in the other species of the *I. verrucosa* series). The new species also differs from *I. juipoca* and *I. penaxavantino* by its red iris in life (not red in these species: iris dark yellow in *I. juipoca* according to Sazima and Cardoso, 1978; iris gray to copper both in *I. juipoca* and *I. penaxavantino*; Giaretta et al., 2007:fig. 4).

**Description of holotype.**—Body moderately robust; head slightly longer than wide; snout subacuminate in dorsal view (Fig. 2A) and acuminate in lateral view (Fig. 2B); nostrils elliptical, slightly protuberant, located near the tip of snout, oriented laterally; canthus rostralis moderately distinct, curved; loreal region concave; eyes protuberant, eye diameter larger than interorbital distance; tympanum and tympanic annulus externally indistinct; supratympanic fold nearly straight from the corner of eye to a posterior acute



**Fig. 2.** Holotype of *Ischnocnema surda*, new species, MNRJ 57808. Dorsal (A) and lateral (B) views of head; ventral views of hand (C) and foot (D). Scale bars = 5 mm.

angle with an abruptly descendent portion directed to the corner of the mouth; choanae moderate in size, nearly rounded; tongue large, rounded; dentigerous processes of vomer positioned medial and slightly posterior to choanae, medially separated by short gap, with clubbed extremities closer than the thinner anterior tips, each process with three odontoids in a straight row. Forelimbs long, slender; fingers slender; fingers III and IV weakly fringed; finger discs very

small; finger lengths  $I < II \sim IV < III$  (Fig. 2C); palmar tubercle rounded, its diameter slightly smaller than thenar tubercle, which is ovoid; supernumerary tubercles developed, prominent, conical; subarticular tubercles single, large, prominent, conical. Legs slender; shank slightly longer than thigh; sum of thigh and shank lengths larger than snout-vent length; tarsal fold absent; toes slender, long; toe discs very small; toe lengths  $I < II < III \sim V < IV$  (Fig. 2D); inner metatar-

**Table 1.** Measurements in Millimeters of Type Specimens of *Ischnocnema surda*, New Species: Mean  $\pm$  Standard Deviation (Range).

	Males (n = 10)	Females (n = 6)
SVL	19.0 $\pm$ 1.26 (17.6–21.4)	24.7 $\pm$ 1.33 (22.4–25.9)
Head length	8.0 $\pm$ 0.42 (7.3–8.6)	10.1 $\pm$ 0.75 (9.1–11.2)
Head width	7.0 $\pm$ 0.58 (6.4–8.2)	9.5 $\pm$ 1.07 (8.1–11.0)
Eye diameter	2.7 $\pm$ 0.31 (2.2–3.1)	3.6 $\pm$ 0.29 (3.2–3.9)
Upper eyelid width	2.0 $\pm$ 0.20 (1.7–2.4)	2.4 $\pm$ 0.31 (1.8–2.6)
Interorbital distance	2.4 $\pm$ 0.21 (2.0–2.6)	2.6 $\pm$ 0.23 (2.2–2.8)
Internarial distance	1.8 $\pm$ 0.16 (1.5–2.0)	2.1 $\pm$ 0.23 (1.7–2.3)
Eye–nostril distance	2.2 $\pm$ 0.15 (1.9–2.4)	2.7 $\pm$ 0.26 (2.3–3.0)
Thigh length	9.9 $\pm$ 0.54 (9.3–10.8)	12.7 $\pm$ 0.94 (11.0–13.6)
Shank length	10.4 $\pm$ 0.67 (9.4–11.5)	13.2 $\pm$ 0.81 (11.6–13.7)
Tarsus length	5.8 $\pm$ 0.62 (4.9–6.8)	7.6 $\pm$ 0.72 (6.3–8.3)
Foot length	9.5 $\pm$ 0.35 (8.8–9.9)	12.1 $\pm$ 0.77 (11.0–12.9)
Head length/Head width	1.2 $\pm$ 0.08 (1.0–1.2)	1.1 $\pm$ 0.05 (1.0–1.1)
Eye diameter/Interorbital distance	1.1 $\pm$ 0.13 (1.0–1.4)	1.4 $\pm$ 0.12 (1.2–1.5)
Shank length/SVL	0.5 $\pm$ 0.02 (0.5–0.6)	0.5 $\pm$ 0.02 (0.5–0.6)
Shank length/Thigh length	1.0 $\pm$ 0.05 (1.0–1.1)	1.0 $\pm$ 0.05 (1.0–1.1)
(Thigh length + Shank length)/SVL	1.1 $\pm$ 0.05 (1.0–1.2)	1.0 $\pm$ 0.03 (1.0–1.1)

sal tubercle large, prominent, ovoid; outer metatarsal tubercle half the diameter of the inner tubercle, prominent, conical; supernumerary tubercles small, numerous, covering the whole plantar surface; subarticular tubercles single, large, prominent, conical. Dorsal skin tuberculate; tubercles in interorbital area and dorsal snout smaller than those on dorsal body; row of large tubercles overlying proximal edge of upper eyelid; small and large tubercles densely scattered on dorsal body; larger tubercles forming W-shaped mark in suprascapular region; swollen postcommisural gland; flanks with small granules; ventral surfaces smooth; outer margins of forearms and tarsi with many very small tubercles. Measurements (in mm): SVL 25.1; head length 10.5; head width 10.4; eye diameter 3.8; upper eyelid width 2.5; interorbital distance 2.8; internarial distance 2.3; eye–nostril distance 2.9; thigh length 13.0; shank length 13.4; tarsus length 8.3; and foot length 12.9.

General color pattern in preservative dark brown; W-shaped mark gray; flanks predominantly light gray with dark brown blotches; arms, legs, and digits with dark brown transversal bars over light brown background; two dark brown bars over light brown background from the dorsum of snout to upper lip, and two from lower eyelid to upper lip; dark brown mark above the supratympanic fold corner; postcommisural gland with a light gray bar. Gular region, chest, belly, and ventral surfaces of upper arms and thighs brown, marbled with light gray; posterior side of thighs dark brown with minute light gray dots in the medial half; inguinal region brown, without light marks.

**Variation.**—In our sample, females are larger than males (Table 1). Adult males present vocal slits and visible white glandular-appearing nuptial pads. Some specimens show a row of small granules on the edge of upper eyelid. General color pattern can be light gray with brown marks. Some specimens have immaculate cream ventral surfaces; white dots over cream background may be present. Specimens observed in life present some reddish tubercles on hands, feet, and dorsum and red iris with a narrow vertical, black bar. All reddish coloration faded after preservation. Table 1 presents the variation in measurements.

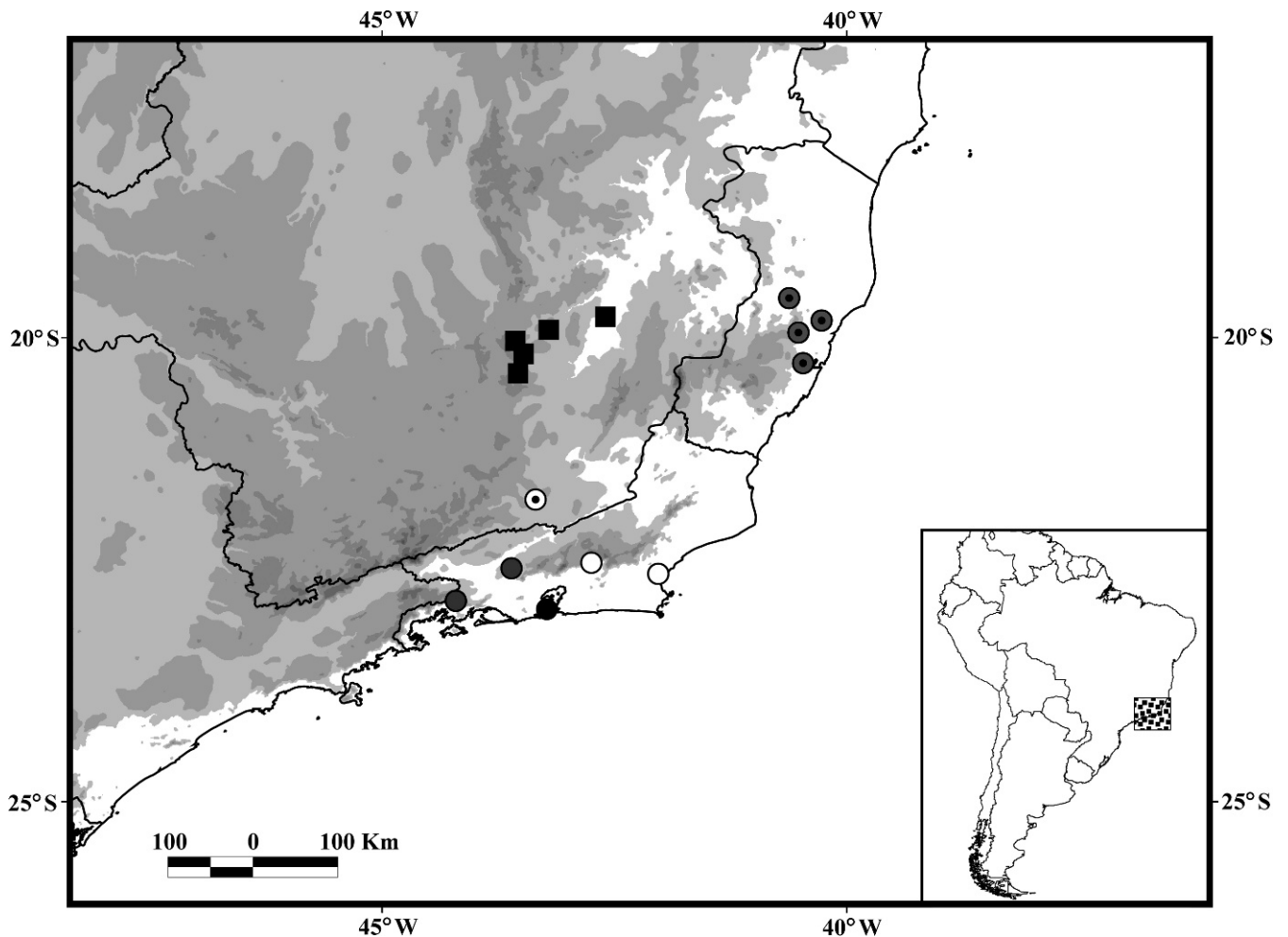
**Distribution and ecology.**—*Ischnocnema surda* is currently known from secondary seasonal semideciduous patches of Atlantic Rainforest in the municipalities of Ouro Preto, Marliéria, Rio Piracicaba, and Santa Bárbara, and from an abandoned *Eucalyptus* plantation with an understory in advanced ecological succession stage in the municipality of Mariana. All these localities, except Marliéria, are at 750–950 m in mountains composing the meridional portion of the Serra do Espinhaço, a mountainous complex ranging from the central region of Minas Gerais, southeastern Brazil, to the northern region of the state of Bahia, northeastern Brazil (Nascimento et al., 2005; Pimenta et al., 2008). Specimens from Marliéria were collected at the Parque Estadual do Rio Doce, the largest continuous forest remnant of Atlantic Forest in the state of Minas Gerais, consisting of plain areas around 300 m (Fig. 3). All localities are included in the basin of the Doce River. Data on life history are not available, since most specimens were collected in pitfall traps with drift fences, except those from Rio Piracicaba (no detailed data on collection methods for the specimens from Ouro Preto).

**Etymology.**—The specific epithet, a Latin adjective meaning “deaf,” is an allusion to the indistinct external tympanum and tympanic annulus in the new species.

## DISCUSSION

We assign *Ischnocnema octavioi*, *I. penaxavantinho*, and *I. surda* to the *I. verrucosa* species series, which already included *I. verrucosa* and *I. juipoca* (Hedges et al., 2008). The addition of the new taxa to the group does not require modification of the combination of characters used by Hedges et al. (2008) to diagnose this series. Hedges et al. (2008) stated that the condition of the nuptial pads is unknown; we verified that all species except *I. surda* lack nuptial pads.

The *Ischnocnema guentheri* species series now includes *I. pipeda*, *I. erythromera*, *I. gualteri*, *I. guentheri*, *I. henselii*, *I. hoehnei*, *I. izecksohni*, *I. nasuta*, *I. oea*, and *I. vinhai*. Characters in the definition of this series are unchanged except the condition of nuptial pads. According to Hedges et al. (2008), nuptial pads are absent in *I. hoehnei* and unknown



**Fig. 3.** Distribution of *Ischnocnema surda*, new species (black squares), *Ischnocnema verrucosa* (type locality white dotted circle; other localities gray dotted circles), and *Ischnocnema octavioi* (type locality black solid circle; data from literature white solid circles; other localities gray solid circles). Contour shading represents 400 m intervals.

in several other species. Heyer (1984), however, reported nuptial pads as “white glandular-appearing nuptial asperities” for the *Eleutherodactylus guentheri* cluster, composed by the following species: *I. epipeda*, *I. erythromera*, *I. gualteri*, *I. guentheri*, *I. nasuta*, and *I. oea*. Caramaschi and Kisteumacher (1989) described white nuptial pads on thumbs of the male paratype of *I. izecksohni*. Kwet and Solé (2005) resurrected *I. henselii*, formerly a junior synonym of *I. guentheri*, and described its nuptial pads as “indistinct, cream nuptial asperities.” We also observed white glandular-appearing nuptial pads in the adult male paratype of *I. hoehnei* (MZUSP 11000). Hence, nuptial pads are present in the species of this series; the condition is unknown only in *I. vinhai*.

Finally, although a consideration of the taxonomic status of *Ischnocnema octavioi* and *I. verrucosa* is beyond the scope of this paper, we did not observe any character states that will distinguish them. In addition, the collection localities reported for the two taxa suggest bordering geographic distributions (Fig. 3).

#### MATERIAL EXAMINED

*Ischnocnema hoehnei*: Brazil: state of São Paulo: municipality of Santo André, Paranapiacaba, MZUSP 11000 (paratype).

*Ischnocnema juipoca*: Brazil: state of São Paulo: municipality of Campinas, Souzas, MNRJ 4103 (holotype); Observatório de Capricórnio, Joaquim Egídio, CFBH 1341; municipality of Jundiá, Açude da Ermida, Serra do Japi, CFBH 709–11; municipality of Itatiba, CFBH 8612; municipality of Campos de Jordão, Retiro, CFBH 9904; municipality of São Luís do Paraitinga, CFBH 7239, 18641; municipality of Caieiras, CFBH 19697. State of Minas Gerais: municipality of Araxá, CFBH 11584; municipality of Poços de Caldas, Morro do Ferro, CFBH 4450; municipality of Camanducaia, Monte Verde, CFBH 17574.

*Ischnocnema octavioi*: Brazil: state of Rio de Janeiro, municipality of Rio de Janeiro: Tijuca, MZUSP 73670 (holotype), 73591–94, 73560–62, 73604–08, 73630–35, 73637–39, 73672, 74425, 74475–77 (paratypes).

*Ischnocnema penaxavantino*: state of Minas Gerais: municipality of Uberlândia, ZUEC 13639 (holotype), 13640–49 (paratypes).

*Ischnocnema verrucosa*: Brazil: state of Minas Gerais: municipality of Juiz de Fora, ZMK 1180 (holotype of *Leiuperus verrucosus*), UFJF 648–49, 664–65, 668–69, 671, 679–80, 685–90, 701–02, 755. State of Espírito Santo: municipality of Colatina, Rio Mutum, MNRJ 121 (holotype of *Eupsophus verrucosus*, junior synonym of *Leiuperus verrucosus*); municipality of Santa Teresa, MNRJ 16137, 28338–41, 34899–901;

municipality of Cariacica, CFBH 2272–73, MNRJ 28413, ZUEC 9188–89; municipality of Aracruz, CFBH 2180, 4183, 4492–94, MNRJ 17746–47.

#### ACKNOWLEDGMENTS

We thank V. Orrico and M. Targino for critically reading the manuscript; A. Duarte, C. Reis, M. Faria, M. Lindemann, B. Fehlberg, R. Mourão, and T. Pezzuti for fieldwork assistance; C. Rievers for the collection of additional specimens; M. Targino for assistance with dissection of the tympanic region; L. Nascimento for use the laboratory facilities at MCNAM; and R. Carvalho, R. Feio, C. Haddad, L. Nascimento, L. Toledo, and H. Zaher for loaning specimens under their care. Fundação de Amparo à Pesquisa do Estado de São Paulo–FAPESP provided financial support for CC. Conselho Nacional de Desenvolvimento Científico e Tecnológico provided financial support for UC. Specimens from municipalities of Santa Bárbara and Rio Piracicaba were collected during faunal inventories conducted by VALE and coordinated by Delphi Projetos e Gestão Ltda. Specimens were collected under collection permits 453/2008 NUFAS/MG proc. 02015.010474/2008-91 and 566/2008 NUFAS/MG proc. 02015.012908/2008-98.

#### LITERATURE CITED

- Caramaschi, U., and G. Kisteumacher.** 1989. A new species of *Eleutherodactylus* (Anura: Leptodactylidae) from Minas Gerais, Southeastern Brazil. *Herpetologica* 44:423–426.
- Cei, J. M.** 1980. Amphibians of Argentina. *Monitore Zoologico Italiano (N.S.) Monograph* 2:1–609.
- Frost, D. R.** 2009. Amphibian Species of the World: An Online Reference. Version 5.3 (12 February 2009). Electronic database accessible at <http://research.amnh.org/herpetology/amphibia/>. American Museum of Natural History, New York (Accessed on 15 June 2009).
- Giaretta, A. A., D. Toffoli, and L. E. Oliveira.** 2007. A new species of *Ischnocnema* (Anura: Eleutherodactylinae) from open areas of the Cerrado Biome in southeastern Brazil. *Zootaxa* 1666:45–51.
- Hedges, S. B., W. E. Duellman, and M. P. Heinicke.** 2008. New World direct-developing frogs (Anura: Terrarana): molecular phylogeny, classification, biogeography, and conservation. *Zootaxa* 1737:1–182.
- Heinicke, M. P., W. E. Duellman, and S. B. Hedges.** 2007. Major Caribbean and Central American frog faunas originated by ancient oceanic dispersal. *Proceedings of the National Academy of Sciences of the United States of America* 104:10092–10097.
- Heyer, W. R.** 1984. Variation, systematics, and zoogeography of *Eleutherodactylus guentheri* and closely related species (Amphibia: Anura: Leptodactylidae). *Smithsonian Contributions to Zoology* 402:1–42.
- Kwet, A., and M. Solé.** 2005. Validation of *Hylodes henselii* Peters, 1870, from Southern Brazil and description of acoustic variation in *Eleutherodactylus guentheri* (Anura: Leptodactylidae). *Journal of Herpetology* 39:521–532.
- Nascimento, L. B., M. Wachlevski, and F. S. F. Leite.** 2005. Anuros, p. 209–229. *In: Serra do Espinhaço Meridional: Paisagens e Ambientes.* A. C. Silva, L. C. V. S. F. Pedreira, and P. A. A. Abreu (eds.). O Lutador, Belo Horizonte, Brazil.
- Pimenta, B. V. S., M. Wachlevsky, and C. A. G. Cruz.** 2008. Morphological and acoustical variation, geographic distribution, and conservation status of the spinythumb frog *Crossodactylus bokermanni* Caramaschi and Sazima, 1985 (Anura, Hylodidae). *Journal of Herpetology* 42:481–492.
- Sazima, I., and A. J. Cardoso.** 1978. Uma espécie nova de *Eleutherodactylus* do sudeste Brasileiro (Amphibia, Anura, Leptodactylidae). *Revista Brasileira de Biologia* 38:921–925.
- Targino, M., P. N. Costa, and S. P. Carvalho-e-Silva.** 2009. Two new species of the *Ischnocnema lactea* species series from Itatiaia Highlands, southeastern Brazil (Amphibia, Anura, Brachycephalidae). *South American Journal of Herpetology* 4:139–150.