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RESEARCH ARTICLE

## Taxonomy of “Mouse-colored Tapaculos” (II): An endangered new species from the montane Atlantic Forest of southern Bahia, Brazil (Passeriformes: Rhinocryptidae: *Scytalopus*)

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### ABSTRACT

An isolated population of tapaculos attributed to *Scytalopus speluncae* has been known from the mountains of southeastern Bahia state, Brazil, since the early 1990s, and a second isolated population was discovered in 1999. Morphological and bioacoustic analyses of 11 specimens and several tape recordings indicated that these populations represent a new species, in agreement with a previous molecular phylogenetic study. This species is unambiguously distinguished from its closest relatives by 4 suites of characters: (1) morphometrics–body proportions, (2) plumage color, (3) vocalizations, and (4) genetics. Using each of these character sets, separately or in combination, one can distinguish with 100% confidence the new species from its sister lineages. The new species is known from only 5 localities distributed in 2 distinct mountain ranges, 1 on the eastern slopes of the Planalto da Conquista, between the municipalities of Boa Nova and Iguaí, and another in the Serra das Lontras, ~100 km to the southeast and only 37 km from the coast. The new species primarily inhabits undisturbed montane forest, from 660 to 1,140 m a.s.l. We estimated an area of occupancy of the species of only 5,885 ha and a density of 0.49 individuals ha<sup>-1</sup>, resulting in a total estimated population of 2,883 individuals. Forest remnants are under severe pressure from clandestine timber extraction and outright deforestation. Under IUCN criteria, this new species should be classified as “Endangered.”

**Keywords:** biogeography, conservation, endangered species, montane Atlantic Forest, *Scytalopus*, taxonomic revision, vocalizations

**Taxonomia dos “tapaculos-pretos” (II): Uma nova espécie da Mata Atlântica montana do sul da Bahia, Brasil (Passeriformes: Rhinocryptidae: *Scytalopus*) ameaçada de extinção**

### RESUMO

Uma população isolada, atribuída a *Scytalopus speluncae*, foi encontrada no início da década de 1990 em montanhas\* do sudeste da Bahia, Brasil; posteriormente, uma segunda população foi encontrada em 1999. Análises morfológicas de 11 espécimes de museu e bioacústicas de várias gravações indicam que estas aves representam uma nova espécie, concordando com um estudo molecular anterior. A nova espécie é inequivocamente distinta de seus parentes mais próximos em quatro conjuntos de caracteres: (1) morfometria/proporções do corpo, (2) coloração da plumagem, (3) vocalizações, e (4) aspectos genéticos. É possível distinguir com 100% de confiança a nova espécie de suas linhagens irmãs usando estes caracteres, separadamente ou em combinação. A nova espécie é encontrada em apenas cinco localidades distribuídas em dois complexos montanhosos, um na vertente leste do Planalto da Conquista, entre os municípios de Boa Nova e Iguaí, e outro na Serra das Lontras, cerca de 100 km a sudeste e somente a 37 km da costa. Esta nova espécie ocorre principalmente em floresta primária montana entre 660 e 1.140 m de altitude. Estimamos uma área de ocupação de apenas 5.885 ha e uma densidade de 0,49 indivíduos por ha para esta espécie, resultando em uma população estimada em 2.883 indivíduos. Os remanescentes florestais na área de ocorrência da espécie estão sob forte pressão de atividades ilegais de desmatamento e extração de madeira. De acordo com os critérios da IUCN, esta nova espécie deve ser classificada como *Em Perigo*.

**Palavras-chave:** biogeografia, conservação, espécie ameaçada, floresta atlântica montana, *Scytalopus*, revisão taxonômica, vocalizações

## INTRODUCTION

The Neotropical avian genus *Scytalopus* has a long history of taxonomic problems, primarily resulting from the relative uniformity of morphology throughout the genus, which poses several limitations for classification of the component taxa (Fjeldså and Krabbe 1990, Whitney 1994, Krabbe and Schulenberg 1997). In the past 2 decades, following the study of other character sources (vocalizations and genetics) in combination with morphology, no fewer than 12 species have been described, with a number of other taxa having been elevated to the species rank (Whitney 1994, Krabbe and Schulenberg 1997, 2003, Bornschein et al. 1998, 2007, Cuervo et al. 2005, Krabbe et al. 2005, Maurício 2005, Raposo et al. 2006, Krabbe and Cadena 2010, Whitney et al. 2010, Fjeldså 2013, Hosner et al. 2013).

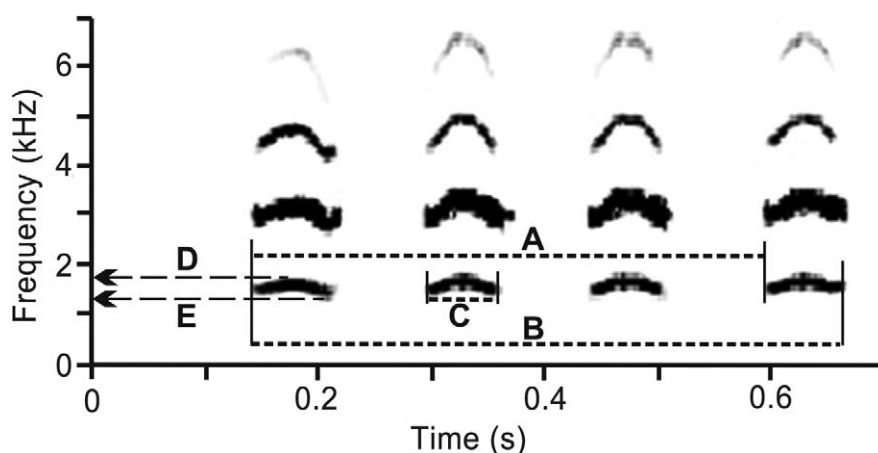
Particularly significant within this scenario was the discovery that the Brazilian *Scytalopus* were much more species-rich than previously thought, along with the surprising finding that the white-bellied taxa *indigoticus* (White-breasted Tapaculo) and *psychopompus* (Bahia Tapaculo) were not closely related to *Scytalopus*. These latter species were recovered by a molecular phylogeny as sister to the genus *Merulaxis*, rendering erection of the genus *Eleoscytalopus* to embrace both species (Maurício et al. 2008), a hypothesis further corroborated by other genetic studies (Mata et al. 2009, Ericson et al. 2010) and a morphology-based phylogeny (Maurício et al. 2012). Prior to 1998, the Brazilian *Scytalopus* comprised 4 species (Vielliard 1990, Krabbe and Schulenberg 1997), an insignificant diversity compared with the >30 species then known from the Andes and adjacent mountain chains. This difference becomes even more pronounced when one considers that those 4 Brazilian taxa included the 2 species now firmly placed in *Eleoscytalopus*. Thus, the only *Scytalopus* (as currently defined) known from Brazil through the late 1990s were *S. speluncae* (Mouse-colored Tapaculo) and *S. novacapitalis* (Brasília Tapaculo). The starting point that changed this scenario was the description of *S. iraiensis* (Wetland Tapaculo), which was accompanied by the suggestion that >1 species could be involved under the name *S. speluncae* (Bornschein et al. 1998). In fact, subsequent analyses showed that a new species, named *S. pachecoi*, and other presumably undescribed taxa—1 from southern Bahia and 1 from southern Brazil—were included under *S. speluncae* (Maurício 2005). Shortly thereafter, 3 new species were described: *S. notorius* (Raposo et al. 2006), *S. diamantinensis* (Diamantina Tapaculo; Bornschein et al. 2007), and *S. petrophilus* (Rock Tapaculo; Whitney et al. 2010). The first of these was soon relegated to a junior synonym of *S. speluncae* by Maurício et al. (2010), a position followed by Fjeldså (2013) and strongly endorsed by the South

American Classification Committee (Remsen et al. 2013; *contra* Raposo et al. 2012, Nemésio et al. 2013). Therefore, within ~12 yr, the Brazilian *Scytalopus*, collectively known as the *S. speluncae* group (Maurício 2005, Raposo et al. 2006, Bornschein et al. 2007, Whitney et al. 2010), jumped from 2 to 6 accepted species.

Another important advancement that appeared in the interim was the molecular phylogenetic study of Mata et al. (2009), which recovered the monophyly of these 6 species and of the *S. speluncae* group. Furthermore, Mata et al. (2009) showed that this group is structured into 3 well-corroborated clades: 1 composed of some genetically divergent lineages grouped under the name *S. speluncae*, 1 consisting of *S. iraiensis*, and 1 comprising *S. novacapitalis*, *S. pachecoi*, *S. diamantinensis*, and *S. petrophilus* (the *S. novacapitalis* clade). Notwithstanding these advances in our knowledge of the systematics and diversity of Brazilian *Scytalopus*, a major problem remained unresolved: the taxonomic composition of the widespread “Mouse-colored Tapaculo,” *S. speluncae*. Maurício (2005) found that populations of *S. speluncae* occupying montane forests from southern São Paulo to Rio Grande do Sul (his “southern *S. speluncae*”) were apparently diagnosable from those occupying forests from northeastern São Paulo to Espírito Santo (his “northern *S. speluncae*”), a taxonomic scenario fully congruent with the results of Mata et al. (2009).

Maurício (2005) also considered that an isolated northernmost population attributed to *S. speluncae*, first discovered and collected near Boa Nova, Bahia (see Forrester 1993, Gonzaga et al. 1995), presumably represented a new species. Following collection of a voice-recorded specimen in the Serra das Lontras above Arataca, Bahia, by B.M.W. and L.F.S., this hypothesis was strengthened (Silveira et al. 2005, Bornschein et al. 2007) and was also supported later by molecular analyses (Mata et al. 2009). However, it was clear that further study, including analyses of a representative number of skins and vocal specimens, would be required to permit a thorough taxonomic evaluation of the Bahian birds in the context of the *S. speluncae* group.

Here, continuing the series of papers initiated in Zootaxa 2518 revising the taxonomy of “Mouse-colored Tapaculos” (Maurício et al. 2010), we address the following questions. (1) Is the Bahian population of *S. speluncae* recognizable as a species under the 2 most commonly used species concepts in avian systematics (see Zink and McKittrick 1995, Remsen 2005, Zink 2006), namely the phylogenetic and the biological species concepts? (2) In which phenotypic character suites traditionally used in avian taxonomy (i.e. morphometrics—body proportions, plumage features, and vocalizations) are these birds distinct from other members of the *S. speluncae* group?



**FIGURE 1.** Sound parameters measured for this study, as taken from voice spectrograms. (A) Time interval used for pace calculation, taken from the beginning of a note to the beginning of a subsequent one; pace is obtained by dividing the number of counted notes by the time interval between them. (B) Total duration of a vocalization, taken from the beginning of the first note to the end of the last one. (C) Note length, measured from the beginning to the end of the same note. (D) Upper limit of frequency (“top”) of a note. (E) Lower limit of frequency (“bottom”) of a note. All measurements were taken from the fundamental, or first harmonic (i.e. the bottom element appearing in this and other spectrograms of this study); its visible frequency is distributed between D and E arrows, above which are the second and subsequent harmonics.

## METHODS

In December 2004 and August–September 2006, we searched for the Bahian *S. speluncae* in uplands reaching ~1,000 m a.s.l. in the municipalities of Boa Nova, Iguai, Camacan, and Arataca. We collected specimens with shotguns and housed them at the ornithological collections of the Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCP), Porto Alegre, and the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo.

We established a comparative framework that included all species in the *S. speluncae* group, namely *S. novacapitalis*, *S. pachecoii*, *S. diamantinensis*, *S. petrophilus*, *S. iraiensis*, and the remaining populations of *S. speluncae*; these latter were further divided into southern and northern *S. speluncae* following Maurício (2005). Our comparisons focused on 3 character suites: (1) morphometrics–body proportions, (2) plumage color, and (3) vocalizations. Specimens used for comparisons are deposited in several Brazilian museums (see [Supplementary Material Appendix A](#)). The following morphometric data were taken from specimens (with a caliper, to the nearest 0.1 mm): bill length (from distal edge of the operculum to the bill tip), length of the exposed culmen, bill depth (taken from the highest point of the culmen to the mandible’s ventral surface), wing length (chord), tail length (from the insertion of the central rectrices to their tip), and tarsus length (according to Sick 1997). Body masses were taken from the specimen labels. Measurements of unsexed specimens were excluded from the analyses. We also excluded measurements of worn feathers, and we did not

take tail measurements when both central rectrices were lacking. Capitalized color names mentioned in the text follow Smithe (1975).

We located birds in the field by recognizing their vocalizations; because birds promptly respond to their own song, we actively performed playbacks of the song to detect more individuals and attract them. After tape-recording vocalizations of an individual, we attempted to collect it. Vocalizations were recorded using Sony TCM 5000EV tape recorders and Sennheiser ME 66 and ME 67 microphones. Tape recordings are deposited at the Arquivo Sonoro Prof. Elias Coelho (ASEC), at the Universidade Federal do Rio de Janeiro, Brazil, and are publicly available upon request; numbers following the ASEC acronym are catalog numbers in that sound archive. We also used some available sound recordings such as those in Gonzaga and Castiglioni (2001) (see [Supplementary Material Appendix B](#)). Tape recordings were digitized at 44.1 kHz, 16 bit, and were analyzed using the programs Cool Edit 96 (Syntrillium, Phoenix, Arizona, USA) and Raven 1.2 (Cornell Lab of Ornithology, Ithaca, New York, USA). Measurements of both programs were compatible and were grouped for analysis. Spectrograms were produced on a personal computer with Cool Edit 96, with a Blackmann window and resolution of 256 bands. Vocal variables analyzed (from both songs and calls) were pace, total duration, and, for the individual notes, frequency, length, shape, and structure. For measurements of sound variables, we considered only the fundamental (Figure 1). “Pace” is defined as the number of notes delivered per second and was calculated by dividing the number of counted notes per the time interval between the beginning of the first

counted note and the beginning of the last one (Figure 1). Short sequences of the song from excited birds (e.g., those with <40 notes) were discarded for song analyses (see Bornschein et al. 2007). Songs presenting variations in the first notes had these notes discarded for pace calculation and for other descriptive song parameters (e.g., frequency, length, and shape of notes; see “warming” notes, Bornschein et al. 2007).

Measurements of frequency and note length of songs were taken from 15 notes of the middle section of each song. For multinoted calls, frequency and note length were taken from 1 note in the middle of the calls, and all notes were measured for shorter calls. When >1 recording was available for a given individual (e.g., 3 songs recorded from the same bird), a mean of its sample was calculated first; then the mean value obtained for each bird was the basis for the calculations of mean  $\pm$  SD. Most recordings were obtained after playback. Poor-quality recordings, as judged from spectrograms, were excluded from the analyses. Complete lists of specimens and tape recordings examined are listed in [Supplementary Material Appendices A and B](#), respectively.

## RESULTS

We collected 9 additional specimens (all by shot), and all were first tape-recorded; another 3 individuals were tape-recorded but not collected. Analysis of the total of 11 specimens and the tape recordings revealed that the Bahian population of *S. speluncae* is clearly diagnosable from all other Brazilian *Scytalopus* in terms of plumage color, morphometrics, and vocalizations, corroborating the earlier genetic analysis (see Mata et al. 2009). Given that we could find no other applicable name for this southern Bahian population, we propose the following:

***Scytalopus gonzagai* sp. nov.**  
Bahian Mouse-colored Tapaculo  
*Macuquinho-preto-baiano*

**Holotype.** MCP 2004: adult male from Serra do Rio Preto (14°37'49''S, 40°11'36''W; 1,110 m a.s.l.), municipality of Iguai, Bahia, Brazil; collected on August 28, 2006, by M.R.B., G.N.M., R.B.-L., and L. C. C. Robert. Tape-recorded (ASEC 17774 [song] and ASEC 17775 [song]) and prepared as a study skin by M.R.B. Tissue sample and carcass preserved in ethyl alcohol. This specimen was sequenced for the study of Mata et al. (2009).

**Paratypes.** MCP 2003: adult male, same locality and collectors as the holotype, collected at 1,140 m a.s.l. on August 27, 2006; tape-recorded (ASEC 17773 [song]). MCP 2005: subadult female from Serra do Pote (14°39'01''S, 40°07'09''W; 1,010 m a.s.l.), municipality of Iguai, Bahia, Brazil; same collectors and date as the

holotype; tape-recorded (ASEC 17781 [song] and ASEC 17782 [song and alarm call]). MCP 2006: adult male from Morro do Inglês (14°23'17''S, 40°09'10''W; 1,110 m a.s.l.), municipality of Boa Nova, Bahia, Brazil; collected on December 19, 2004, by M.R.B. and G.N.M.; tape-recorded (ASEC 17772 [song]). MZUSP 78810: adult male from Mata do Dr. Mauro (14°24'06''S, 40°06'44''W), municipality of Boa Nova, Bahia, Brazil; collected on August 26, 1993, by J.E.P., L. P. Gonzaga, C. Bauer and G. D. Castiglioni; tape-recorded (ASEC 17779 [song]). MCP 2008: adult male from the base of Morro Peito de Moça (15°10'02''S, 39°20'25''W; 710 m a.s.l.), Serra das Lontras, municipality of Arataca, Bahia, Brazil; collected on September 1, 2006, by M.R.B., G.N.M., R.B.-L., L. C. C. Robert, and C. A. F. R. Gatto; tape-recorded (ASEC 17784 [song]). MCP 2009: adult male, same locality and collectors as the paratype MCP 2008, collected at 840 m a.s.l. on September 2, 2006; tape-recorded (ASEC 17785 [song] and ASEC 17786 [song]). MCP 2013: subadult male, same locality and collectors as the paratype MCP 2008, collected at 660 m a.s.l. on September 2, 2006; tape-recorded (ASEC 17791, ASEC 17792, ASEC 17793, and ASEC 17794 [song in all takes]). MCP 2007: adult female, same locality, date, and collectors as the paratype MCP 2008, collected at 800 m a.s.l.; tape-recorded (ASEC 17783 [song]). MCP 2012: adult female, same locality and collectors as the paratype MCP 2008, collected at 760 m a.s.l. on September 2, 2006; tape-recorded (ASEC 17787 [alarm call], ASEC 17788 [song], ASEC 17789 [song], and ASEC 17790 [song]). MZUSP 78809: adult male, same locality as the paratype MCP 2008; collected on November 6, 1999, by L.F.S. and B.M.W. Paratypes MCP 2005, 2006, 2007, and 2013 were sequenced for the study of Mata et al. (2009).

**Diagnosis: Morphology and plumage.** The presence of a mobile nasal operculum and 4 notches in the sternum (as seen in a cursory inspection of the carcasses) immediately places *S. gonzagai* sp. nov. within the family Rhinocryptidae (Krabbe and Schulenberg 2003, Maurício et al. 2012). The allocation of the new species in the genus *Scytalopus* (*sensu* Krabbe and Schulenberg 1997) is based on the combination of small size (total length ~120 mm; body mass ~15 g), predominantly gray coloration, short tail (shorter than wing), and the comparatively less-elevated base of the bill (as opposed to *Myornis* and *Eugralla*, in which the culmen is elevated).

In the plumage diagnoses below, unless otherwise stated, the interspecific comparisons mentioned are based on full adult males (i.e. those having plain wing feathers, with no light marks); comparisons of morphometric data include adult and subadult males, females being dealt with separately.

From southern and northern *S. speluncae*, *S. gonzagai* sp. nov. differs by having rump and flanks between Mikado



**FIGURE 2.** *Scytalopus gonzagai* sp. nov. Adult male at Boa Nova, Bahia. Photo credit: Ciro Albano

Brown (121C) and Brussels Brown (121B) with conspicuous Blackish Neutral Gray (82) barring (more extensively over the flanks), instead of having plain gray flanks and rump (Figures 2 and 3). Although some adult males of both southern and northern *S. speluncae* may retain barred feathers on the flanks and rump from younger plumages, this pattern is very restricted or vestigial compared with that of the new species. *Scytalopus gonzagai* sp. nov. further differs from both southern and northern *S. speluncae* by having a more robust bill, which is much higher at the base (no overlap, including females; Table 1 and Figure 3C), a characteristic more readily seen by plotting bill depth against wing length (Figure 4). Moreover, the new species consistently differs from both forms of *S. speluncae* in presenting a distinct wing:tail ratio, with *S. gonzagai* sp. nov. having a shorter tail in relation to the wing length, a difference valid for both males and females (Figure 4); in absolute values of tail length, the new species differs (no overlap) only from northern *S. speluncae*, showing a considerable overlap with southern *S. speluncae* (Table 1). We note, however, that the sample sizes for the new species are small (especially because sexes are analyzed separately), precluding robust statistical analyses.

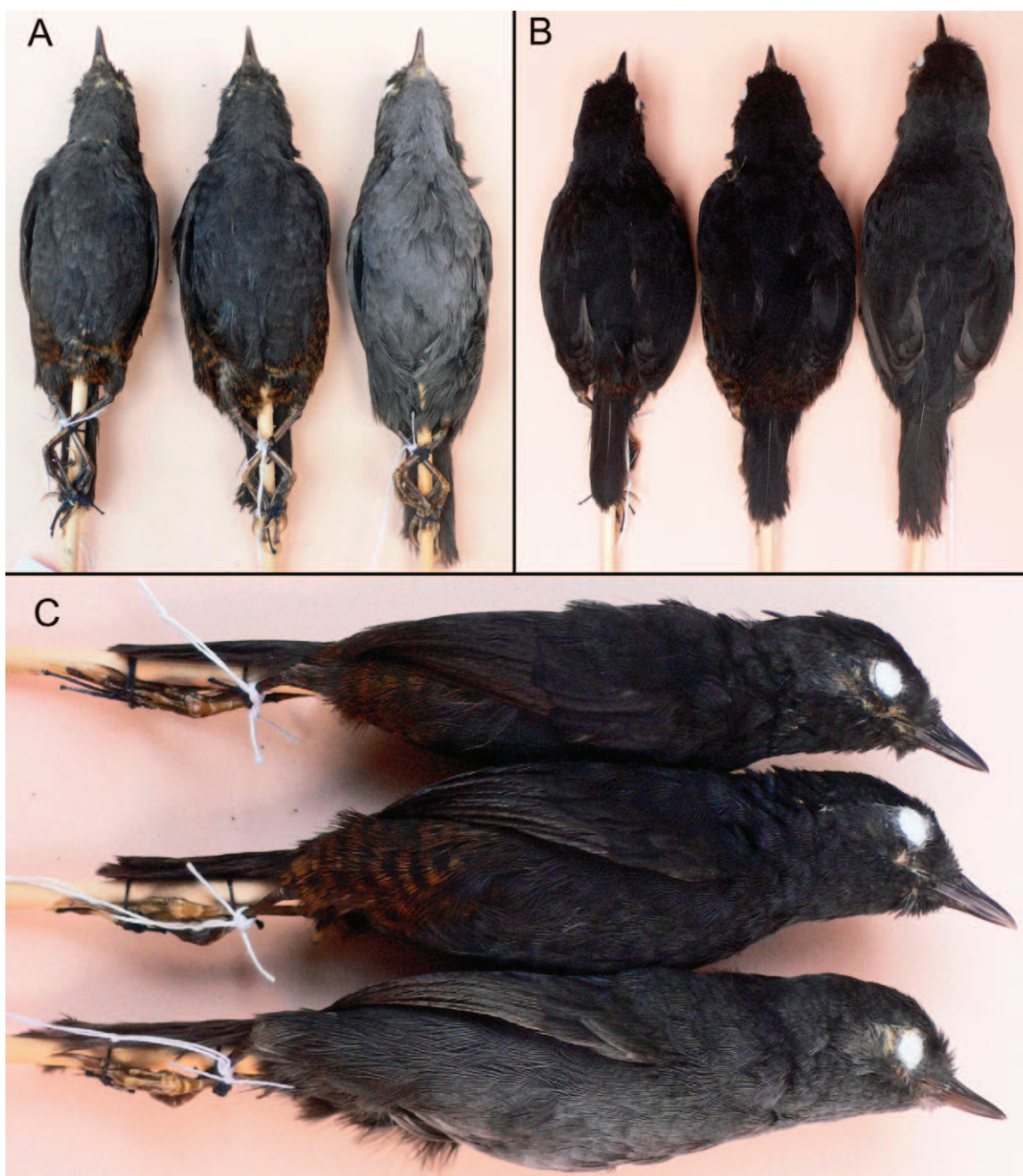
From the other members of the *S. speluncae* group, the new species is diagnosed as follows: From the *S. novacapitalis* clade (see above), it differs in having much darker gray underparts (Dark Neutral Gray [83] or darker vs. Medium Neutral Gray [84] or lighter) and blacker entire upperparts; in having the bill higher at the base (with a slight overlap with *S. diamantinensis*); and in having shorter tail (slight overlap with *S. pachecoi*) (Table 1; see Bornschein et al. 2007). From *S. iraiensis*, the new species differs by its brown flanks and rump barred black, instead of having these areas blackish or dark gray; in always having darker gray chin and throat (Dark Neutral

Gray or darker vs. Medium Neutral Gray or lighter); and in having the bill higher at the base (no overlap: Table 1; see Bornschein et al. 2007).

**Diagnosis: Voice.** From both southern and northern *S. speluncae*, the new species is readily recognized by its slower-paced song, the notes of which are delivered at a rate between 3.2 and 3.8 notes  $s^{-1}$  (mean = 3.5), instead of 4.3–5.7 notes  $s^{-1}$  (mean  $\geq 5$  notes  $s^{-1}$ ; Table 2 and Figure 5). The song notes of *Scytalopus gonzagai* sp. nov. differ from those of *S. speluncae* by presenting only a marked downward frequency modulation, with a slight and short upward modulation appearing in some recordings; both southern and northern *S. speluncae* song notes show a relatively long upward frequency modulation preceding the downward modulation (Figure 5). The new species also differs in the “kreew” call, a short, dry, and harmonic-rich trill shared only with *S. speluncae* (see below): in *S. gonzagai* sp. nov., this call lacks the final long note present in southern and northern *S. speluncae* and further differs from the former—and from the populations of the latter from the Serra dos Órgãos region, at least—in being multisyllabic (3 or 4 notes) instead of bisyllabic (Figure 6).

In comparison with the other members of the *S. speluncae* group, the new species is diagnosed as follows. Compared with the *S. novacapitalis* clade (see above), *S. gonzagai* sp. nov. differs by not having an accelerating song in its vocal repertoire, nor any type of monosyllabic calls; by presenting lower-pitched song notes (some overlap with *S. diamantinensis* and *S. novacapitalis*) and shorter (no overlap) alarm call notes (Table 2 and Figure 7; see Bornschein et al. 2007). Compared with *S. iraiensis*, the new species differs by lack of a distinct “warming” section at the beginning of songs, and by its slower-paced song (up to  $\sim 3.8$  notes  $s^{-1}$  vs. 4 or more in *S. iraiensis*); it also lacks the monosyllabic “peec” call (Table 2; see Bornschein et al. 2007). Compared with both the *S. novacapitalis* clade and *S. iraiensis*, *S. gonzagai* sp. nov. is diagnosed by having the “kreew” call type (see below).

**Description of holotype.** Loes, entire crown (including sides), nape, ear coverts, dorsal surface of neck, mantle, scapulars, and back Blackish Neutral Gray (82); rump and upper tail coverts between Mikado Brown (121C) and Brussels Brown (121B) barred Blackish Neutral Gray (extent of barring  $\sim 10$  mm); chin and throat between Dark Neutral Gray (83) and Blackish Neutral Gray, breast (including sides) and belly Blackish Neutral Gray; crissum Mikado Brown with blackish bars; flanks Brussels Brown barred Blackish Neutral Gray (extent of barring  $\sim 22$  mm); upper-wing coverts, remiges and rectrices Sepia (119); under-wing coverts Dark Neutral Gray. The holotype has 10 primaries, 9 secondaries, and 12 rectrices in a rather graduated tail. Soft-part colors: iris dark brown; bill black; mandibular commissure yellowish proximally and whitish distally; tarsus and



**FIGURE 3.** (A) Ventral and (B) dorsal views of adult male specimens of *Scytalopus gonzagai* sp. nov. (left: holotype, MCP 2004; center: MCP 2009) and *S. speluncae* (right: MCP 2047). Note the brown, barred flanks and rump of *S. gonzagai* sp. nov. and the plain gray flanks of *S. speluncae*, the latter presenting only 1 barred feather over the rather uniformly gray rump. (C) Lateral view of adult male specimens of *S. gonzagai* sp. nov. (above: holotype; center: MCP 2009) and *S. speluncae* (below: MCP 2047). Note the barred flanks and strong bill of *S. gonzagai* sp. nov., 2 conditions that diagnose the species from *S. speluncae*.

toes black with dark brown or grayish areas on the middle of the scutellae; under-surfaces of toes blackish; claws yellowish with light brownish base, that of the hallux being brownish with a yellowish tip. Measurements: total length 120.0 mm; exposed culmen 11.8 mm; bill length 6.2; bill depth 5.0; wing 49.5 mm; tail 37.6 mm; tarsus 19.6

mm; weight 14.9 g. Testes: 5.0 × 3.0 mm (left), 5.0 × 4.0 mm (right). No brood patch. Small amount of molt: some upper-wing coverts on the left wing, some under-tail coverts, and some feathers of head and back.

**Etymology.** The new taxon is named after our colleague Luiz Antonio Pedreira Gonzaga, who, among many other

**TABLE 1.** Measurements (mm) and weight (g) of specimens of *Scytalopus gonzagai* sp. nov. and *S. speluncae*, northern (N) and southern (S) populations (following Maurício 2005). Values are range, mean  $\pm$  SD (in parentheses), and sample size (n).

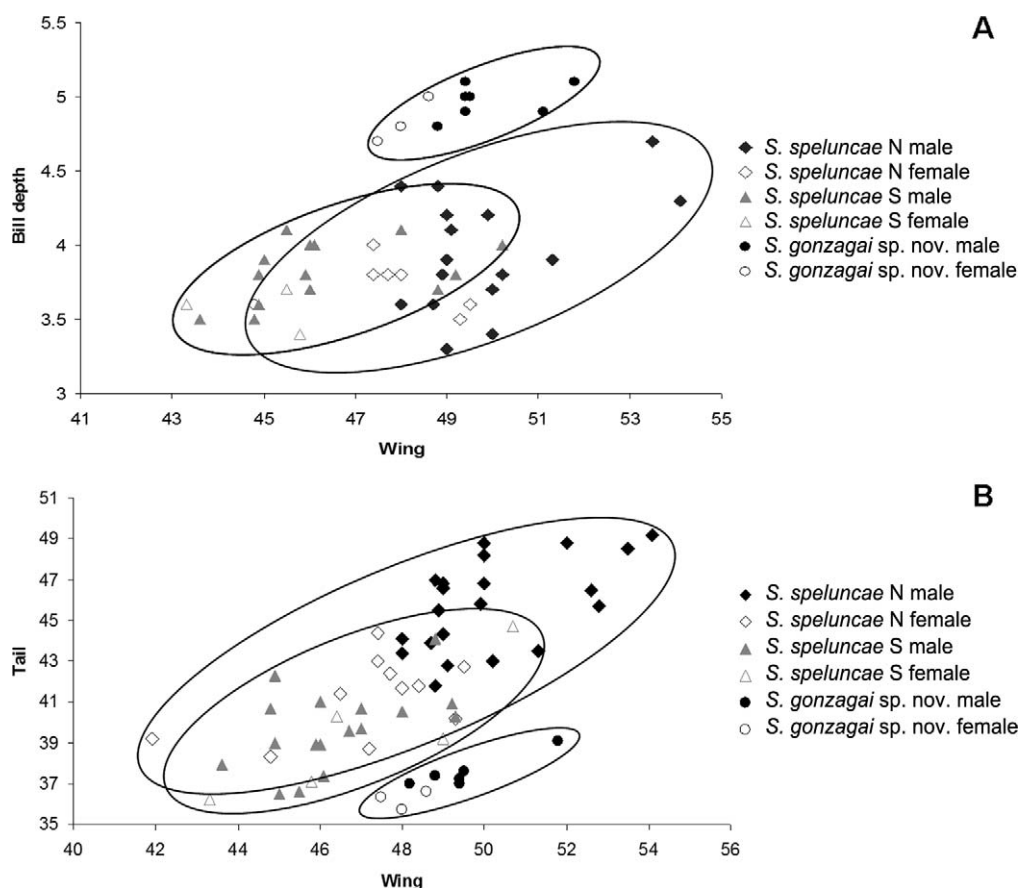
	<i>S. gonzagai</i> sp. nov.	<i>S. speluncae</i> N	<i>S. speluncae</i> S	<i>S. gonzagai</i> sp. nov.	<i>S. speluncae</i> N	<i>S. speluncae</i> S
Measurement	Males	Males	Males	Females	Females	Females
Exposed culmen	11.5–12.8 (12.16 $\pm$ 0.48) n = 8	10.8–12.0 (11.42 $\pm$ 0.36) n = 21	10.0–11.8 (10.93 $\pm$ 0.44) n = 19	12.0–12.1 (12.07 $\pm$ 0.06) n = 3	10.1–12.0 (10.88 $\pm$ 0.64) n = 9	10.4–11.3 (10.80 $\pm$ 0.39) n = 4
Bill length <sup>a</sup>	5.9–6.8 (6.30 $\pm$ 0.31) n = 8	5.1–6.5 (5.65 $\pm$ 0.39) n = 21	5.1–5.8 (5.46 $\pm$ 0.20) n = 20	6.0–6.7 (6.23 $\pm$ 0.40) n = 3	4.8–5.8 (5.29 $\pm$ 0.34) n = 10	4.8–5.5 (5.25 $\pm$ 0.29) n = 6
Bill depth <sup>b</sup>	4.8–5.1 (4.97 $\pm$ 0.11) n = 7	3.3–4.7 (3.95 $\pm$ 0.37) n = 19	3.5–4.1 (3.82 $\pm$ 0.20) n = 14	4.7–5.0 (4.83 $\pm$ 0.15) n = 3	3.5–4.0 (3.73 $\pm$ 0.17) n = 7	3.4–3.7 (3.57 $\pm$ 0.15) n = 3
Wing <sup>c</sup>	48.2–51.8 (49.70 $\pm$ 1.18) n = 8	48.0–54.1 (50.12 $\pm$ 1.79) n = 22	43.6–50.7 (46.85 $\pm$ 1.97) n = 20	47.5–48.6 (48.03 $\pm$ 0.55) n = 3	41.9–49.5 (47.15 $\pm$ 2.06) n = 12	43.3–50.7 (46.78 $\pm$ 2.65) n = 6
Tail <sup>d</sup>	37.0–39.1 (37.55 $\pm$ 0.79) n = 6	41.8–49.2 (45.77 $\pm$ 2.18) n = 22	36.5–44.1 (39.71 $\pm$ 1.97) n = 17	35.7–36.6 (36.20 $\pm$ 0.46) n = 3	38.3–44.4 (41.25 $\pm$ 1.94) n = 11	36.2–44.7 (39.50 $\pm$ 3.33) n = 5
Tarsus <sup>e</sup>	19.1–20.0 (19.43 $\pm$ 0.31) n = 8	19.1–21.3 (20.21 $\pm$ 0.52) n = 23	18.0–19.8 (18.90 $\pm$ 0.49) n = 19	18.2–19.1 (18.70 $\pm$ 0.46) n = 3	18.5–20.6 (19.41 $\pm$ 0.63) n = 11	17.2–20.2 (19.00 $\pm$ 1.15) n = 6
Weight	14.2–16.7 (15.43 $\pm$ 0.92) n = 7	13.3–16.0 (15.01 $\pm$ 0.85) n = 8	11.2–14.9 (12.96 $\pm$ 1.00) n = 16	14.2–15.3 (14.73 $\pm$ 0.55) n = 3	14.1–15.8 (14.85 $\pm$ 0.73) n = 4	12.3–15.0 (13.26 $\pm$ 1.19) n = 5

<sup>a</sup> From distal edge of operculum to bill tip.<sup>b</sup> From highest point of culmen.<sup>c</sup> Chord.<sup>d</sup> From insertion of central rectrices to their tip.<sup>e</sup> Following Sick (1997).

contributions to Brazilian ornithology (starting in 1974), inaugurated the scientific ornithological exploration of the montane Atlantic Forest of southern Bahia, which resulted in 2 new species descriptions (Gonzaga and Pacheco 1995, Pacheco and Gonzaga 1995) and several range extensions (Gonzaga et al. 1995). These contributions were decisive to call attention to the priority of conserving the region, allowing inclusion of the humid forests of the Boa Nova area as part of an Important Bird Area (Bencke et al. 2006) and, more recently, within a national park (Parque Nacional de Boa Nova). Furthermore, Gonzaga prepared the first specimen of this new taxon, here included among the paratypes (MZUSP 78810).

**Variation in the type series.** Adult males in the type series are similar to the holotype, differing as follows: MCP 2003, 2006, and 2008 and MZUSP 78810 have lighter gray underparts, which are nearest to Dark Neutral Gray (83); in MCP 2003, 2008, and 2009 the brown and black barring on the flanks is more extensive, between 25 and 30 mm. In all specimens, the brown and black barring over the rump is also more extensive than in the holotype, covering between 11 and 18 mm. The individuals that are most dissimilar to the holotype are the females; thus, 1 of those 3 in the type series (MCP

2005) is described here: Crown Blackish Neutral Gray washed Warm Sepia (221A); nape, dorsal surface of neck, mantle, scapulars, and back Warm Sepia; lower back and rump between Mikado Brown (121C) and Brussels Brown (121B) barred Blackish Neutral Gray; chin, throat, breast, and upper belly between Dark Neutral Gray and Medium Neutral Gray (84); lower belly and crissum Cinnamon (39) barred Blackish Neutral Gray; flanks Cinnamon to Mikado Brown barred Blackish Neutral Gray (extent of barring  $\sim$ 37 mm); remiges Sepia (219) edged Warm Sepia, with outer vane of the outermost primary extensively Mikado Brown; outermost lesser upper-wing coverts Clay Color (123B) with a wide subterminal Blackish Neutral Gray bar and a narrower terminal bar of the same color; remaining lesser-wing coverts Sepia edged Warm Sepia; greater upper-wing coverts Sepia edged Warm Sepia, with some inner coverts having a Blackish Neutral Gray area; tertials Warm Sepia with a subterminal Blackish Neutral Gray bar, which further extends parallel to the rachis for most of the feather's length, most markedly in the outer vane; some tertials with a terminal or subterminal dot Clay Color on the outer vane; remiges Sepia (119). It has 11 rectrices (the 6th feather of the left side lacking). Soft-part colors of



**FIGURE 4.** Scatter plot comparing measurements of *Scytalopus gonzagai* sp. nov. and *S. speluncae*, with northern (N) and southern (S) populations of the latter considered separately. (A) Bill depth (or height) at the base against wing chord. (B) Tail length against wing chord. *Scytalopus gonzagai* sp. nov. shows no overlap with southern and northern *S. speluncae* in either comparison, falling completely outside variation in those forms.

birds in the type series are, in general, similar to that of the holotype, with only slight differences. For measurements of paratypes, see Table 1.

**Vocalizations.** The new species has 3 types of vocalizations: the song, the alarm call, and what we term the “kreew” call, which is probably a contact call (see Maurício 2005). Song is typical of the *S. speluncae* group, being the long repetition of a simple note whose spectral signature is a short (0.04–0.07 s; mean = 0.05 s), downward frequency modulation at 2.1–3.3 kHz (top of the fundamental; mean = 2.6 kHz) with a well-marked second harmonic (Figure 5 and Table 2). In some individuals a short upward frequency modulation is visible in the spectrograms. The pace of delivery of this note ranges from 3.2 to 3.8 notes  $s^{-1}$  (mean = 3.5 notes  $s^{-1}$ ). The alarm call is also typical for the group, consisting of 3 or 4 notes of 0.05–0.11 s duration (mean = 0.07 s) at 1.6–2.2 kHz (fundamental; mean = 1.9 kHz) with a pace of 4.9–8.9 notes  $s^{-1}$  (mean = 6.8 notes  $s^{-1}$ ; Table 2 and Figure 7). The spectrographic signature of notes shows considerable polymorphism, with nearly “flat” notes to L-shaped ones

(Figure 7). The “kreew” call is a harmonic-rich series of “dry” notes uttered at a pace of 24.6–27.8 notes  $s^{-1}$  (mean = 26.1 notes  $s^{-1}$ ); each note is ~0.02 s in duration, and the fundamental is at ~1.8 kHz (Table 2 and Figure 6). Although our sample of tape recordings for this call is minimal (19 “kreew” calls from the same individual), we have heard it in the field from another 4 individuals, whose calls were aurally identical to those that were tape-recorded. As discussed below, this call type is present in the repertoire of all populations of *S. speluncae*.

**Habitat.** *Scytalopus gonzagai* sp. nov. inhabits the undergrowth of humid montane evergreen forest (“floresta ombrófila densa montana,” *sensu* Veloso et al. 1991). Most sites occupied by the species were primary forest, with trees 15–25 m tall. However, the territories of some individuals included second-growth or disturbed forest with canopy 8–15 m tall; only a single territory (of an immature-subadult male) was entirely within second-growth forest. The specific sectors where we found the birds were humid and shadowed areas with  $\geq 1$  densely vegetated ravines, some with stands of *Chusquea* sp. or

**TABLE 2.** Measurements of selected variables of songs and calls of *Scytalopus gonzagai* and *S. speluncae*: pace (notes s<sup>-1</sup>), song duration (s), frequency (kHz), and note length (s). Frequency values refer to the fundamental of individual notes. Values are range and mean  $\pm$  SD (in parentheses). *Scytalopus speluncae* is divided into northern (N) and southern (S) populations following Maurício (2005).

Character	<i>S. gonzagai</i> sp. nov.	N ( <i>S. speluncae</i> )	S ( <i>S. speluncae</i> )
Song <sup>a</sup>	<i>n</i> = 14 individuals, <i>n</i> = 39 songs	<i>n</i> = 16 individuals, <i>n</i> = 33 songs	<i>n</i> = 41 individuals, <i>n</i> = 43 songs
Pace	3.18–3.84 (3.50 $\pm$ 0.18)	4.29–5.75 (5.26 $\pm$ 0.33)	4.56–5.86 (5.06 $\pm$ 0.31)
Duration	12.79–317.77 (89.35 $\pm$ 81.12)	9.56–109.13 (38.51 $\pm$ 19.09)	26–165 (86.5 $\pm$ 42.72)
Frequency: upper limit	2.1–3.3 (2.60 $\pm$ 0.29)	2.2–5.2 (3.10 $\pm$ 0.85)	3.7–5.5 (4.60 $\pm$ 0.40)
Frequency: lower limit	1.1–1.7 (1.50 $\pm$ 0.33)	0.9–1.7 (1.20 $\pm$ 0.20)	0.8–1.9 (1.30 $\pm$ 0.20)
Note length	0.041–0.076 (0.05 $\pm$ 0.00)	0.052–0.072 (0.06 $\pm$ 0.00)	0.029–0.056 (0.04 $\pm$ 0.00)
Alarm call <sup>b</sup>	<i>n</i> = 4 individuals and 128 calls	<i>n</i> = 34 individuals and 1,382 calls	<i>n</i> = 7 individuals and 110 calls
Pace	4.94–8.40 (6.81 $\pm$ 0.61)	2.55–7.09 (4.85 $\pm$ 1.08)	6.38–10.43 (8.55 $\pm$ 1.07)
Frequency: upper limit	1.62–2.24 (1.89 $\pm$ 0.10)	1.5–3.06 (1.87 $\pm$ 0.16)	3.6–4.6 (3.93 $\pm$ 0.27)
Frequency: lower limit	1.4–1.8 (1.50 $\pm$ 0.10)	1.2–1.7 (1.40 $\pm$ 0.20)	0.8–1.9 (1.30 $\pm$ 0.20)
Note length	0.051–0.109 (0.07 $\pm$ 0.01)	0.059–0.164 (0.10 $\pm$ 0.01)	0.041–0.069 (0.05 $\pm$ 0.01)
Call <sup>c</sup>	<i>n</i> = 1 individual and 9 calls	<i>n</i> = 4 individuals and 44 calls	<i>n</i> = 6 individuals and 43 calls
Pace	24.59–27.78 (26.12 $\pm$ 1.00)	20.68–32.47 (25.69 $\pm$ 3.35)	17.86–29.41 (23.51 $\pm$ 2.74)
Duration	0.096–0.139 (0.10 $\pm$ 0.01)	0.172–0.400 (0.30 $\pm$ 0.14)	0.096–0.168 (0.12 $\pm$ 0.02)
Frequency: upper limit of first note	1.6–1.8 (1.80 $\pm$ 0.10)	1.6–2.2 (2.00 $\pm$ 0.30)	1.2–1.8 (1.50 $\pm$ 0.30)
Frequency: lower limit of first note	1.3–1.4 (1.40 $\pm$ 0.04)	1.0–1.4 (1.20 $\pm$ 0.00)	0.8–1.2 (1.00 $\pm$ 0.10)
Note length: first note	0.018–0.022 (0.02 $\pm$ 0.00)	0.017–0.026 (0.02 $\pm$ 0.00)	0.015–0.026 (0.02 $\pm$ 0.00)
Frequency: upper limit of middle note	1.7–1.8 (1.80 $\pm$ 0.00)	1.6–2.2 (2.00 $\pm$ 0.30)	–
Frequency: lower limit of middle note	1.3–1.4 (1.40 $\pm$ 0.10)	1.1–1.5 (1.30 $\pm$ 0.00)	–
Note length: middle note	0.019–0.022 (0.02 $\pm$ 0.00)	0.017–0.027 (0.02 $\pm$ 0.00)	–
Frequency: upper limit of last note	–	2.2–3.2 (2.60 $\pm$ 0.50)	1.4–2.1 (1.70 $\pm$ 0.30)
Frequency: lower limit of last note	–	1.2–1.5 (1.20 $\pm$ 0.10)	0.9–1.3 (1.10 $\pm$ 0.00)
Note length: last note	–	0.046–0.071 (0.06 $\pm$ 0.00)	0.057–0.120 (0.08 $\pm$ 0.02)

<sup>a</sup> Numbers of recordings adequate for measurements of song duration (complete and nearly complete recorded series of notes) were as follows: 27 for southern *S. speluncae*, 27 for northern *S. speluncae*, and 30 for *S. gonzagai*. Frequency and note-length measurements were not possible for 1 song of southern *S. speluncae* and 6 of *S. gonzagai*. See text.

<sup>b</sup> The number of alarm call notes was variable: southern *S. speluncae*, 3–9 (most often 5); northern *S. speluncae*, 1–5 (most often 1). *S. gonzagai* sp. nov., 2–5 (most often 4). All measurements are from the central note.

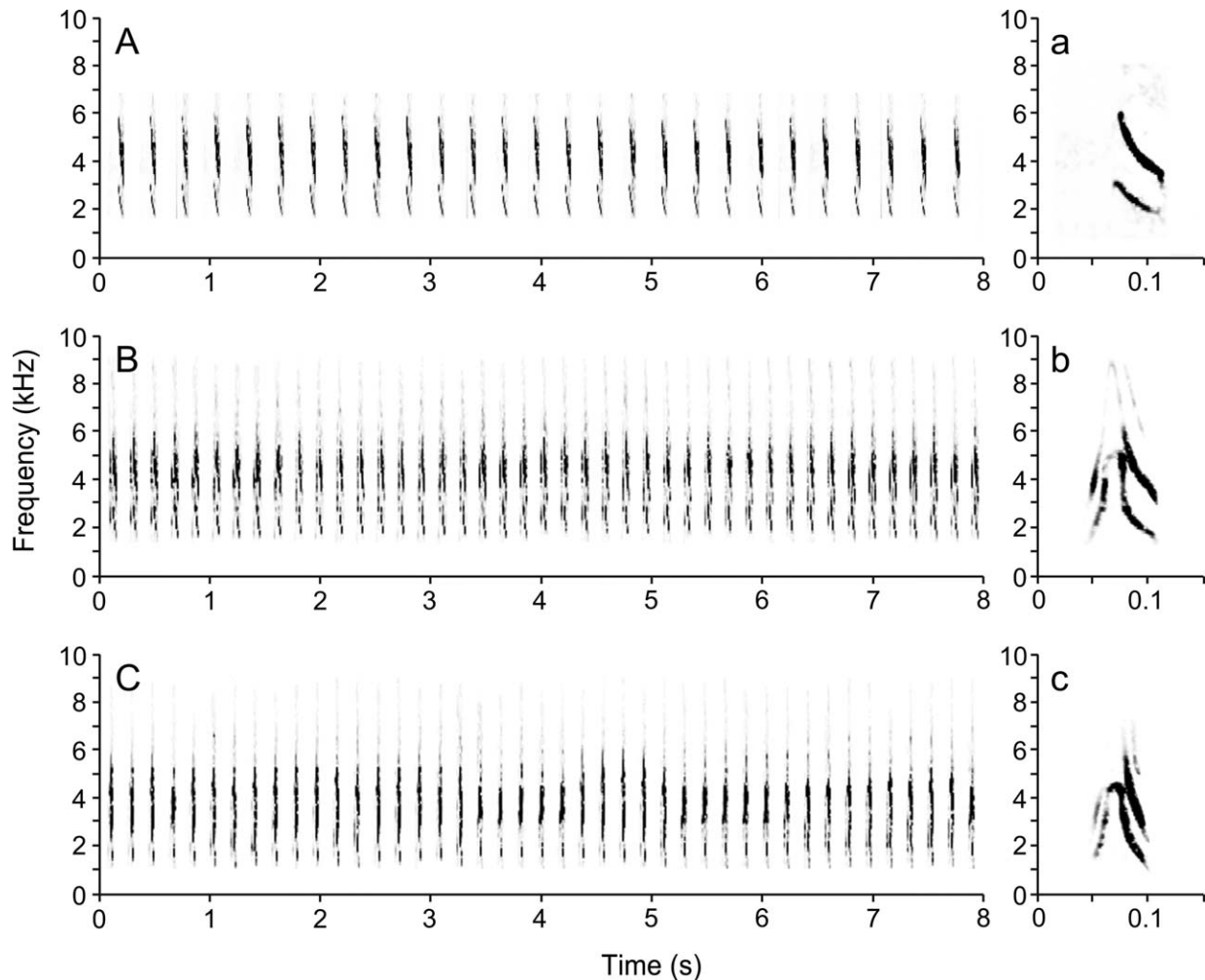
<sup>c</sup> The number of call notes was variable: *S. gonzagai* sp. nov., 3–4 notes (most often 3); northern *S. speluncae*, 3–12 notes (most often 5); and southern *S. speluncae*, 2 notes. Frequency and note-length measurements were not possible for 17 calls from northern *S. speluncae* and for 11 calls from 2 individuals of southern *S. speluncae*; sonograms of 2 other individuals were inspected only visually because of poor recording quality.

*Merostachys* sp. bamboos, the former providing more extensive cover.

**Distribution and population.** *Scytalopus gonzagai* sp. nov. is known from 3 municipalities (Boa Nova, Iguai, and Arataca) and 5 localities distributed in 2 distinct montane massifs of the southeastern sector of Bahia state, Brazil (Figure 8). Localities in Boa Nova and Iguai municipalities are in the eastern slopes of the Planalto da Conquista; these are Morro do Inglês, Mata do Dr. Mauro (both on the Serra da Ouricana), Serra do Rio Preto, and Serra do Pote. All these sites are located 114–124 km from the coast. The locality in the municipality of Arataca is a mountain range called the Serra das Lontras–Javi complex, which is only 37 km from the sea. There, the new species has been found between 660 and 840 m a.s.l. and in the Boa Nova–Iguai region between 930 and 1,140 m a.s.l. Given that the gap between the coastal ranges and the

Planalto da Conquista seaward slopes is ~100 km and includes terrain as low as 140 m a.s.l., populations from these 2 regions are almost certainly disjunct.

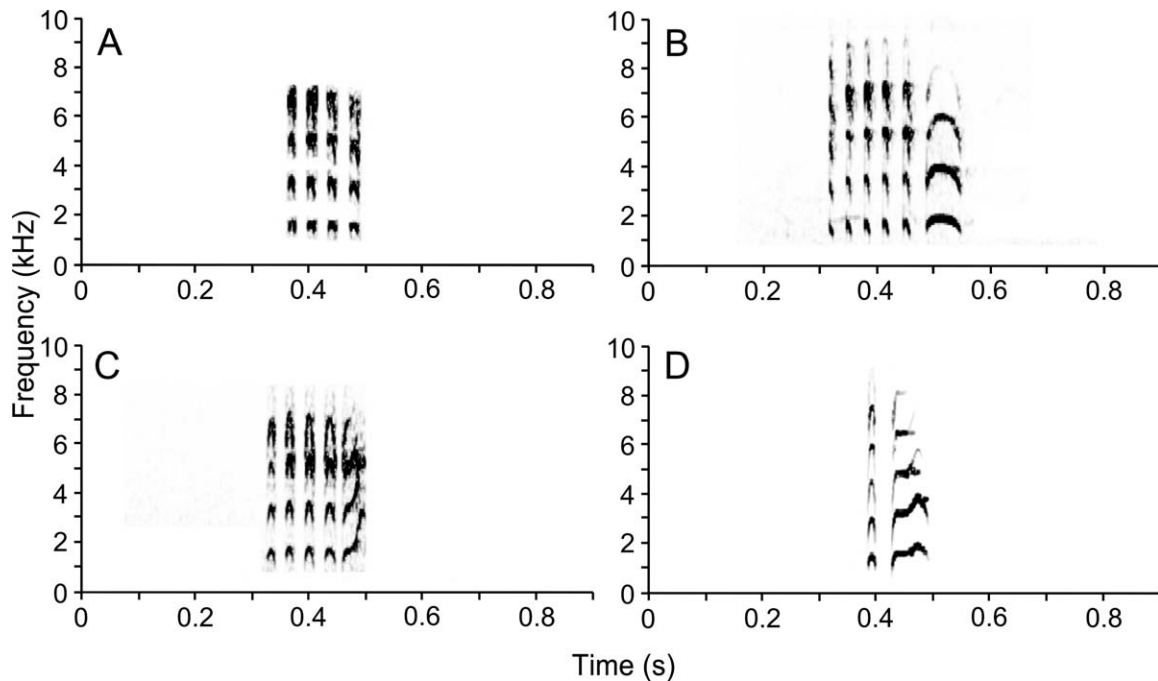
The distributional gap between the ranges of *S. gonzagai* sp. nov. and northern *S. speluncae* is 630 km, considering a nearly straight line running along the coastal ranges on the border of Minas Gerais and Espírito Santo–Bahia states (see Whitney et al. 2010: fig. 2). Within this gap most mountain ranges are relatively low, rarely reaching 800 m a.s.l. (IBGE 1998) and, thus, presumably not harboring *Scytalopus* habitat, though there are a few exceptions. One of these is the Alto Cariri area, in the border of Bahia and Minas Gerais states, an area with a large forest remnant of ~17,000 ha, including large tracts of montane humid forests above 800 m elevation (Bencke et al. 2006). Fieldwork in the montane forests of Alto Cariri, although revealing the presence of several montane Atlantic Forest



**FIGURE 5.** Spectrograms of songs of *Scytalopus gonzagai* sp. nov. and *S. speluncae*. **(A)** *S. gonzagai* sp. nov., Morro do Inglês, Boa Nova, Bahia, December 19, 2004 (after playback; ASEC 17772); adult male, paratype (MCP 2006). **(a)** Song note of *S. gonzagai* sp. nov. in detail. **(B)** Northern *S. speluncae*; Pico dos Marins, Piquete, São Paulo, October 12, 2002 (after playback; ASEC 17796); adult male (MCP 1177). **(b)** Song note of northern *S. speluncae* in detail. **(C)** Southern *S. speluncae*; Serra do Umbu, Maquiné, Rio Grande do Sul, December 16, 2001 (after playback; ASEC 17797); adult male (MCP 988). **(c)** Song note of southern *S. speluncae* in detail. Spectrograms of individual notes (a, b, and c) represent an enlargement of 10 $\times$  in the time scale compared with A, B, and C. Spectrograms in A, B, and C illustrate the slower song pace of *S. gonzagai* sp. nov. compared with the other taxa (the measurements for each individual refer to the pace of the entire sequence, of which only an 8-s section is shown): *S. gonzagai* sp. nov.,  $\sim 3.4$  notes  $s^{-1}$ ; northern *S. speluncae*,  $\sim 5.7$  notes  $s^{-1}$ ; southern *S. speluncae*,  $\sim 5.3$  notes  $s^{-1}$ . All recordings by G.N.M.

bird taxa, did not find any representatives of the genus *Scytalopus* (M.R.B. and G.N.M. personal observation). The surveyed areas included elfin forests (“floresta ombrófila densa altomontana,” *sensu* Veloso et al. 1991) at 1,000 m a.s.l. (the highest point of the Alto Cariri region) where M.R.B. and G.N.M. employed insistent playback of the songs of both *S. gonzagai* sp. nov. and *S. speluncae* during  $\sim 4$  hr, with no responses. Furthermore, R. Ribon and collaborators conducted extensive ornithological exploration of this area; the only rhinocryptid they found was *Eleoscytalopus indigoticus* (R. Ribon personal communication). Therefore, we suggest that this 630-km hiatus is not an artifact of sampling. More to the interior, there is a

continuum of area well above 800 m a.s.l. between the range of northern *S. speluncae* and the highlands around Boa Nova, where *S. gonzagai* sp. nov. occurs. However, most of this land is formed by the Espinhaço Range of inland Minas Gerais and Bahia, where habitat is not appropriate for *S. gonzagai* sp. nov. and *S. speluncae* and the only representatives of the genus to occur are those of the *S. novacapitalis* clade, which occupies drier, seasonal forests (Bornschein et al. 2007, Mata et al. 2009, Whitney et al. 2010). Moreover, there is a large sector of the Espinhaço Range in northern Minas Gerais and south-central Bahia where habitats are even drier and where no *Scytalopus* occur (Whitney et al. 2010).



**FIGURE 6.** Spectrograms of the “kreew” call of *Scytalopus gonzagai* sp. nov. and *S. speluncae*. (A) *S. gonzagai* sp. nov., Morro do Inglês, Boa Nova, Bahia, August 29, 2006 (after playback; ASEC 17771; tape-recorded by R.B.-L.). (B) Northern *S. speluncae*, Serra da Vargem Grande, Divino, Minas Gerais, December 5, 2004 (unsolicited; ASEC 17798; tape-recorded by C. A. F. R. Gatto). (C) Northern *S. speluncae*, Pico do Selado, Distrito de Monte Verde, Camanducaia, Minas Gerais, May 16, 2007 (ASEC 17799; tape-recorded by M.R.B.). (D) Southern *S. speluncae*, Jozafaz, São Francisco de Paula, Rio Grande do Sul, September 3, 2002 (unsolicited; ASEC 17800; tape-recorded by G.N.M.).

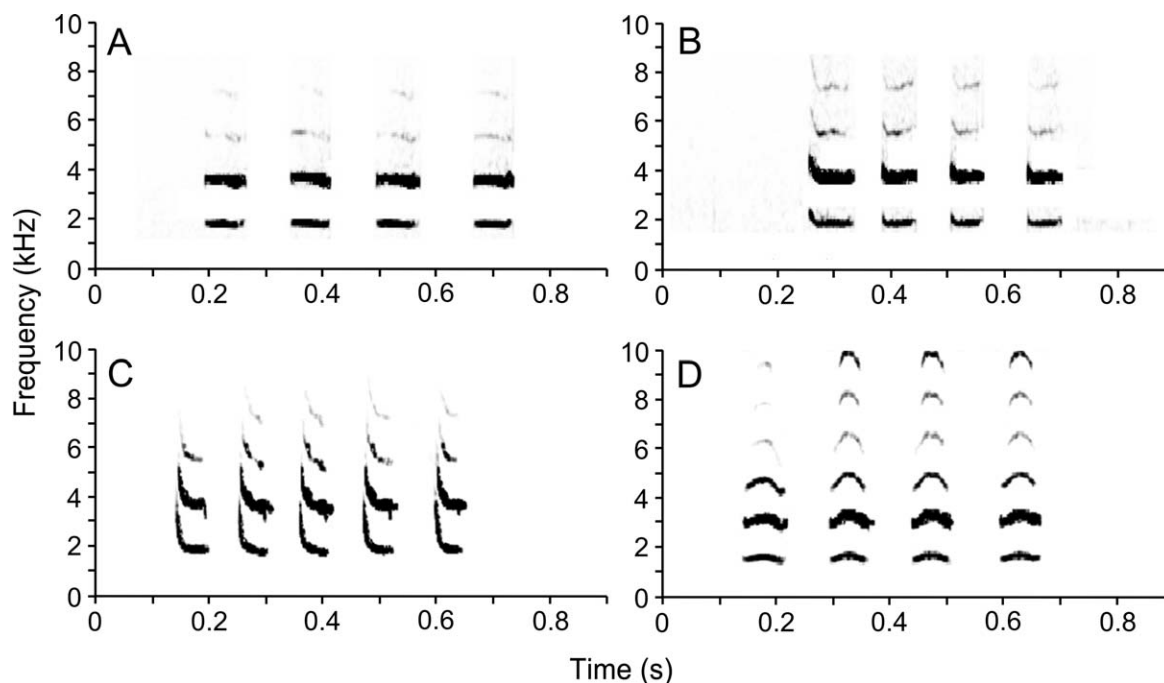
We set a point of reference for potential occurrence of *S. gonzagai* sp. nov. at the minimum altitude records obtained at Serra das Lontras (660 m a.s.l.), where we worked from 570 m elevation upward. We measured sampled areas and forest remnants in the program GEPATH 1.4.4 (available at: <http://www.sgrillo.net/googleearth/gepath.htm>). This effort resulted in the identification of a polygon of 2,970 ha, which also included patches of vegetation in early stages of regeneration. However, because the new species occurs only rarely in this second-growth forest, we considered only mature forest as appropriate habitat, which resulted in a total of 2,878 ha of potential area of occupancy. For the Boa Nova–Iguaí region (or Planalto da Conquista), where our fieldwork included elevations as low as ~750 m a.s.l., we set the minimum altitude at 930 m, our lowest elevation with records of *S. gonzagai* sp. nov. in that region. Considering only forest and vegetation in advanced stages of regeneration, independent of the area of the remnants and distance from larger remnants, this resulted in a potential area of occupancy of 3,007 ha (205 patches of forest; mean = 14.7 ha).

*Scytalopus gonzagai* sp. nov. is an uncommon species. In 2004, we found only a lone male at Morro do Inglês and on contiguous slopes, despite intensive playback-aided

searches during 3 days of work. In 2006, we detected again a lone individual at this area after specific searches for the species during a day. In the other sites, we found the following number of individuals: at Mata do Dr. Mauro, 3 territorial males; at Serra do Rio Preto, 2 males; at Serra do Pote, a pair; and at Serra das Lontras, 9 birds. The 17 individuals we found during fieldwork in 2006 occupied areas that we had selected previously because they contained good forest remnants at appropriate altitudes.

At Serra das Lontras, we sampled 28.5 ha and detected 7 males and 2 females. Assuming that there is a balanced ratio of females to males (which is quite possibly not the reality), this would result in a presumed 14 mature individuals for the sampled area occurring in a density of 1 pair ha<sup>-4</sup> of forest, or 0.49 individuals ha<sup>-1</sup>. It was not possible to obtain an estimate for the Boa Nova–Iguaí region. Calculating that density for the estimated area of occupancy of the species (5,885 ha) results in a tentative, preliminary total estimated population of 2,883 individuals.

**Behavior.** The new species behaves much like other *Scytalopus* species, being difficult-to-see animals living mostly among the dark, dense plant cover of humid places. It hops on the ground and over rocks, fallen logs, and low,



**FIGURE 7.** Spectrograms of alarm calls of *Scytalopus gonzagai* sp. nov. and *S. speluncae*. (A) *S. gonzagai* sp. nov., Morro do Inglês, Boa Nova, Bahia, August 29, 2006 (after playback; ASEC 17771; tape-recorded by R.B.-L.). (B) *S. gonzagai* sp. nov., Serra do Pote, Iguai, Bahia, August 28, 2006 (ASEC 17782; tape-recorded by M.R.B.). (C) Southern *S. speluncae*, Serra do Umbu, Maquiné, Rio Grande do Sul, December 16, 2001 (unsolicited; ASEC 17803); adult female (MCP 987; tape-recorded by G.N.M.). (D) Northern *S. speluncae*, Serra do Bananal, Bananal, São Paulo, March 20, 1995 (unsolicited; ASEC 17804; tape-recorded by D. R. C. Buzzetti).

tangled branches  $\leq 2$  m above ground. We detected lone males ( $n = 12$ ) or pairs ( $n = 3$ ); we found females only accompanying territorial males. Females also give the species' song.

## DISCUSSION

### Diagnostic Character Suites

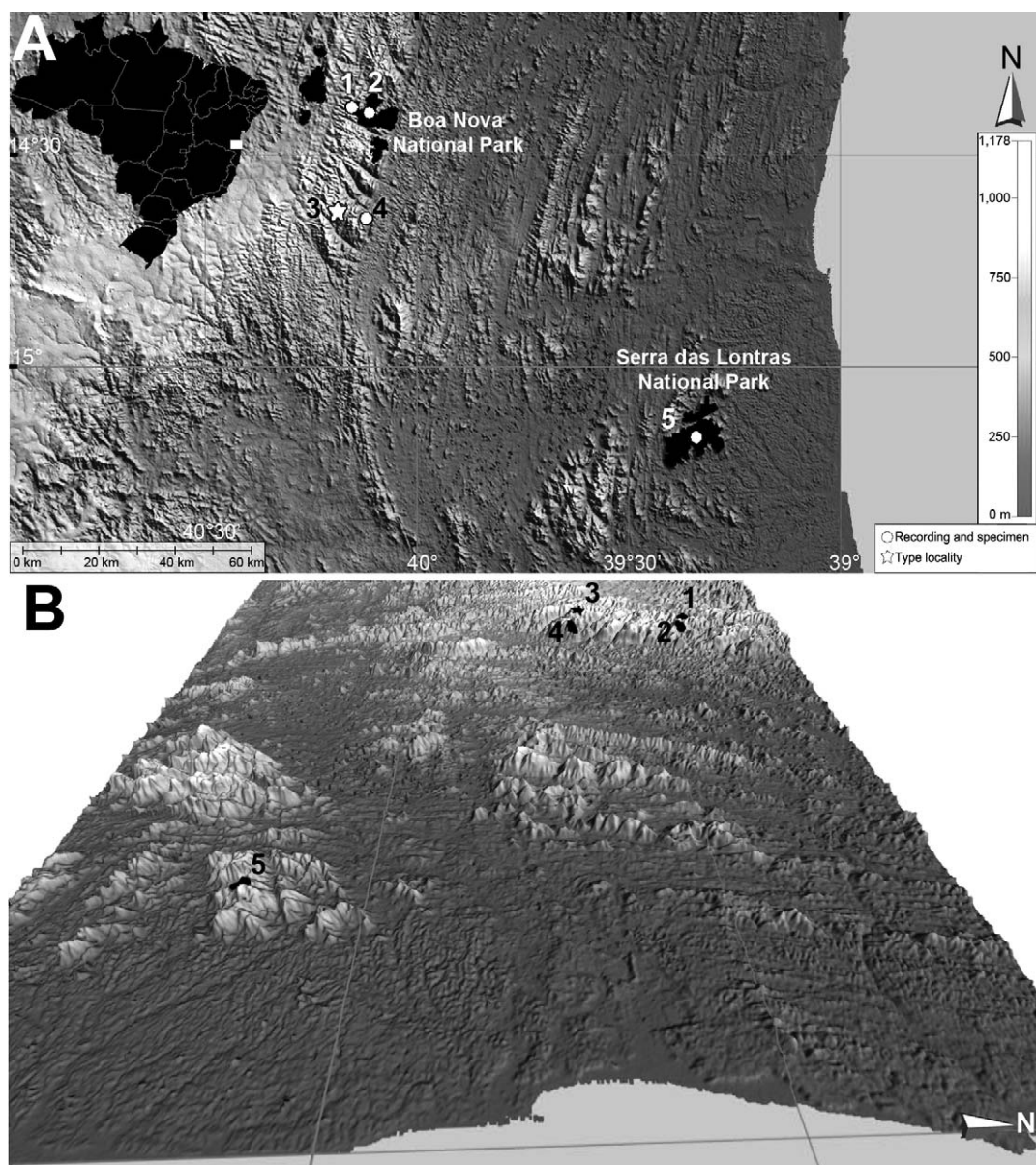
The new species is unambiguously distinguished from its closest relatives (see below) by 4 suites of characters, namely (1) morphometrics–body proportions, (2) plumage color, (3) vocalizations, and (4) genetics. Using each of these suites, separately or in combination, one can distinguish with 100% confidence the new species from its sister lineages (but note that females are not separable by plumage).

### Systematic Relationships

The “kreew” call described above occurs in the vocal repertoire of all populations of *S. speluncae* and *S. gonzagai* sp. nov. (Maurício 2005, present study). The homology of this call type through the populations of these 2 taxa is supported by the similarity in harmonic structure (3 or 4 harmonics), general spectrographic signature (clear upward–downward frequency modulation), temporal organization (mean pace 22–26 notes  $s^{-1}$ ), frequency

distribution (fundamental generally  $< 2$  kHz; Table 2 and Figure 6), and aural quality (as evaluated in the field or in recordings). We found no similarly harmonic-rich and fast-paced call in the descriptions and spectrograms of other *Scytalopus* spp., including Andean tapaculos (Whitney 1994, Krabbe and Schulenberg 1997, 2003, Bornschein et al. 1998, 2007, Cuervo et al. 2005, Krabbe et al. 2005, Maurício 2005, Krabbe and Cadena 2010, Hosner et al. 2013). Therefore, we hypothesize that the “kreew” call may be a synapomorphy for a *S. speluncae* + *S. gonzagai* sp. nov. clade, although at present we cannot suggest what its homologue among the great variety of calls known for the genus as a whole might be.

Mata et al. (2009) presented a broad analysis of Brazilian *Scytalopus* including all currently recognized species and some subpopulations in a molecular phylogeny using combined data for the mitochondrial genes cytochrome *b* (CYB; 461 aligned base pairs [a.b.p.]) and NADH-subunit 2 (ND2; 620 a.b.p.), and the nuclear genes beta-fibrinogen intron 7 (FIB7; 882 a.b.p.) and the glyceraldehyde-3-phosphate dehydrogenase intron 11 (G3PDH; 676 a.b.p.). All data partitions using parsimony, maximum likelihood, and Bayesian inference recovered all sampled individuals of *S. gonzagai* sp. nov. ( $\leq 5$ , depending on the analysis) as forming a well-supported monophyletic clade; these



**FIGURE 8.** Geographic distribution of *Scytalopus gonzagai* sp. nov., with all known localities restricted to eastern Bahia state, northeastern Brazil (**A**, **B**). Note the lowland areas that cause the disruption of the species distribution into 2 populations, and also the presence of records within 2 national parks (**A**; park areas in white).

sampled individuals included the holotype (MCP 2004) and 4 paratypes (MCP 2005–2007 and MCP 2013). The new species was recovered in 2 different positions within a “Mouse-colored Tapaculo” clade. Most analyses, including that with all genes combined, returned *S. gonzagai* sp. nov. as basal to the other populations of *S. speluncae*, although combined data for ND2 and FIB7 suggested that the new species is more closely related to the northern *S. speluncae*, with southern *S. speluncae* appearing as sister to *S. iraiensis*. In any event, except for the latter result, the genetic data corroborate our

suggestion, based on voice, that *S. speluncae* and *S. gonzagai* sp. nov. form a monophyletic clade.

### Species Concepts and Taxonomic Ranking

Because the new species is a fully diagnosable entity whose diagnostic character states are constant over a considerable geographic area, it fulfills the requirements of the phylogenetic species concept to be recognized as valid. However, evaluating it under the framework of the biological species concept is more difficult, because the new species is allopatric in relation to *S. speluncae*, thus avoiding any direct assessment of reproductive isolation or cohesion.

Using the “degree of differentiation criterion,” in which one must consider the amount of phenotypic differentiation among sympatric species of the same genus or species-group (da Silva and Straube 1996), we selected an example of sympatry among Brazilian *Scytalopus* to calibrate our comparisons. It is now well known that the songs of all species in the *S. speluncae* group are very similar, differing only in pace and/or in a few parameters such as note frequency and length (Bornschein et al. 1998, 2007, Maurício 2005). Songs of *S. iraiensis* and southern *S. speluncae* differ diagnostically only in frequency—the former having lower-pitched notes—and in the modulation of a few “warming” notes of the beginning of the song of the former; they also differ in habitat preferences (the former lives in dense tall grass in marshes, rarely entering forest cover; the latter inhabits forest and, locally, tall grass in high-altitude fields), in contact calls, and in some plumage characters (gray shading of the underparts); in terms of size, they overlap broadly in all measurements (Bornschein et al. 1998, 2007, Maurício 2005). Despite being not radically distinct from each other, *S. iraiensis* and southern *S. speluncae* maintain their phenotypic and genetic integrity along their largely sympatric ranges, with no signs of hybridization (Bornschein et al. 1998, 2007, Mata et al. 2009, Whitney et al. 2010, G.N.M. and M.R.B. personal observation). Given that the differences between *S. gonzagai* sp. nov. and both southern and northern *S. speluncae* in terms of song (pace and note shape) and plumage—proportions (barring pattern and bill–wing and tail–wing relationships) are similar or greater in magnitude to those observed between *S. iraiensis* and southern *S. speluncae*, we argue that, if eventually coming into secondary contact with *S. speluncae*, the new species would maintain its identity as a reproductively isolated unit; in other words, *S. gonzagai* sp. nov. would be more appropriately ranked as a species—instead of a subspecies—under the biological species concept. In any event, it is important to note that Krabbe and Schulenberg (1997) advocate that populations of *Scytalopus* that differ consistently in songs (especially in pace and note shape) must be considered distinct biological species, irrespective of diagnosability in calls and plumage, and this criterion has been followed closely in subsequent taxonomic decisions (e.g., Cuervo et al. 2005, Krabbe et al. 2005), being accepted by the South American Classification Committee (Remsen et al. 2013). Therefore, given that the song of *S. gonzagai* sp. nov. is perfectly distinguishable in pace and note shape from that of *S. speluncae*, our suggestion of biological species status for the former is in accordance with that approach of taxon-ranking decisions in the genus.

### Biogeography

The genetic data presented by Mata et al. (2009) indicated that the new species is the surviving representative of an old,

Miocene-aged lineage. Regarding ND2, genetic distance between *S. gonzagai* sp. nov. and the other populations of *S. speluncae* ranged from 9.6% to 11.6% (mean  $\pm$  SD = 10.40  $\pm$  0.94). The combined distances for CYB and ND2 between *S. gonzagai* sp. nov. and the other populations of *S. speluncae* ranged from 8.0% to 9.3% (mean  $\pm$  SD = 8.70  $\pm$  0.67). The molecular clock estimate given by Mata et al. (2009) for the *S. speluncae* clade indicated that the divergence between *S. gonzagai* sp. nov. and the other populations of *S. speluncae* occurred at  $\sim$ 7.7 mya.

The limited geographic range of *S. gonzagai* sp. nov. overlaps partially with 2 of the 4 areas of avian endemism proposed for the Atlantic Forest by da Silva et al. (2004), namely Central Bahia and Coastal Bahia centers. They defined Central Bahia on the basis of 4 avian taxa: *Formicivora iheringi* (Narrow-billed Antwren), *Rhopornis ardesiacus* (Slender Antbird), *Synallaxis cinerea* (= *S. whitneyi*; Bahia Spinetail), and *Phylloscartes beckeri* (Bahia Tyrannulet). Coastal Bahia was defined by the presence of 2 species: *Acrobatornis fonsecai* (Pink-legged Graveteiro) and *Eleoscytalopus psychopompus* (Bahia Tapaculo). Populations of *S. gonzagai* sp. nov. that occupy the Boa Nova–Iguaí region are in the eastern margin of the Central Bahia center, while that in the Serra das Lontras lies in the Coastal Bahia center (see da Silva et al. 2004). It is relevant to note that the Central Bahia species are montane taxa, as is *S. gonzagai* sp. nov., whereas those defining the Coastal Bahia area are lowland taxa. Therefore, we suggest that *S. gonzagai* sp. nov. is an additional species of the Central Bahia center, possibly together with an apparently new *Heliobletus* species (see Silveira et al. 2005); this center, on the other hand, might be expanded to embrace montane areas to the east, such as Serra das Lontras, as its eastern limit. This area, in turn, would represent the contact of those 2 centers, given that *A. fonsecai* occurs up to 550 elevation whereas *S. gonzagai* sp. nov., *Synallaxis cinerea*, and *P. beckeri* occur on the same slopes only above 600 m a.s.l. (Silveira et al. 2005). In this context, it appears that the name “Central Bahia” for that montane center is not adequate at all, because at least these latter 3 species also occur very close to the coast, in the Serra das Lontras area. Therefore, we suggest that replacement with other names would better avoid misinterpretations, changing Central Bahia to “Montane Bahia” and Coastal Bahia to “Lowland Coastal Bahia” centers. In any event, we suggest that these Bahian centers need a revision to better reflect actual distribution of taxa because, for example, *A. fonsecai* and *E. psychopompus* have nonoverlapping ranges.

### Conservation

A little more than half of the area of occupancy of *S. gonzagai* sp. nov. is inside recently decreed Brazilian national parks (58.4%; 3,437 ha), in particular the Serra das Lontras population, which is encompassed by the Serra das

Lontras National Park, and 2 remnants in the Serra da Ouricana, including Morro do Inglês and Mata do Dr. Mauro, both within Boa Nova National Park (Figure 8). Historical satellite images provided in Google Earth allow us to make some comparisons between the environmental condition of the area of occupancy of *S. gonzagai* sp. nov. in December 1969 versus April 2012. Surprisingly, no additional mature forest remnants were found visible in 1969 images (with <10 exceptions) in comparison with present-day ones. Additionally, some montane areas with early stages of forest succession have regenerated into advanced stages today.

Despite this somewhat favorable circumstance, >40% of the potential area of occupancy of the new species is under great pressure from clandestine timber extraction, deforestation, and frequent burning to expand areas for pastures and agriculture; these activities continue to diminish the forest cover (both primary and secondary) in the Boa Nova–Iguaí region. Considering the fact that the new species has a small area of occupancy—only 3.5% of bird species in the world have geographic distribution less than or similar to that of *S. gonzagai* sp. nov. (see Reinert et al. 2007)—this scenario places the species under grave conservation concern. According to criteria of the IUCN (2012) to classify the conservation status of species, *S. gonzagai* sp. nov. clearly qualifies as Endangered (criteria B.2.a.b.(iii)) (IUCN 2012).

The region of southern Bahia has remained forested as a refuge during cold and dry climatic periods in the Pleistocene, having high diversity of species and several endemic species of plants and vertebrates (e.g., Soderstrom et al. 1988, Rodrigues et al. 2002, Carnaval et al. 2009, Recoder et al. 2010). *Scytalopus gonzagai* sp. nov. is another endangered and endemic species of this region, and its formal scientific description draws attention to new areas for investment in conservation, specifically the essentially unprotected forest remnants in the mountains south of Boa Nova National Park, which encompasses most of our “Boa Nova–Iguaí” region. We strongly recommend that more fieldwork be undertaken in these montane forest patches to survey their vertebrate fauna and to identify more appropriate conservation measures (e.g., establishment of local conservation strategies) to ensure maintenance of such important forest remnants as the Serra do Rio Preto, the type locality of *S. gonzagai* sp. nov.

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CORRECTION

## Erratum: Taxonomy of “Mouse-colored Tapaculos” (II): An endangered new species from the montane Atlantic Forest of southern Bahia, Brazil (Passeriformes: Rhinocryptidae: *Scytalopus*)

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### ABSTRACT

In a recent paper, we described a new bird species, *Scytalopus gonzagai*, and proposed the English name “Bahian Mouse-colored Tapaculo” for it (Maurício et al. 2014). However, this proposal conflicts with general principles of the formation of English names and, thus, we propose the name “Boa Nova Tapaculo” for *S. gonzagai*.

**Keywords:** Boa Nova, Boa Nova Tapaculo, English name, *Scytalopus gonzagai*

### RESUMO

Em um trabalho recente descrevemos uma nova espécie de ave, *Scytalopus gonzagai*, para a qual recomendamos o nome comum em inglês “Bahian Mouse-colored Tapaculo” (Maurício et al. 2014). Entretanto, essa proposição conflita com as regras para a formação de nomes comuns em inglês. Assim, propomos um novo nome comum em inglês para *S. gonzagai*: “Boa Nova Tapaculo”.

**Palavras-chave:** Boa Nova, Boa Nova Tapaculo, nome comum em inglês, *Scytalopus gonzagai*

In a recent paper, we described a new bird species, *Scytalopus gonzagai*, for which we proposed the English name “Bahian Mouse-colored Tapaculo” (Maurício et al. 2014). However, this proposal conflicts with general principles of the formation of English names, in that there is already a species called “Mouse-colored Tapaculo” (*S. speluncae*; sensu Maurício et al. 2010) without a modifier. Thus, to preserve our originally proposed English name for *S. gonzagai*, we would have to introduce a modifier to the existing name, such as “Southern” (resulting in “Southern Mouse-colored Tapaculo”) or an equivalent term. However, it is beyond our intention to propose a modifier for the English name “Mouse-colored Tapaculo,” because it is a well-established name in the ornithological literature, both scientific and amateur (e.g., bird-watching guides). Therefore, we discarded this option, and the only alternative was to propose a novel English name for *S. gonzagai*. The alternative of shortening the name to “Bahian Tapaculo”

was discarded because this name has long been applied to *Eleoscytalopus psychopompus*, another tapaculo endemic to the Brazilian state of Bahia. Therefore, we propose “Boa Nova Tapaculo” as the English name for *S. gonzagai*.

The following aspects justify our proposal: (1) Boa Nova is the first place where the new species was found, collected, and recorded; (2) all additional known localities for the species are within ~120 km to the southeast of Boa Nova; (3) Boa Nova is an internationally well-known birding site; and (4) Boa Nova is an Important Bird Area (IBA), which motivated the creation of the Boa Nova National Park and the Boa Nova Wildlife Refuge, both in 2010. Thus, “Boa Nova Tapaculo” well represents all other known sites for *S. gonzagai*, and it also highlights important conservation initiatives of international relevance. The new English name formally proposed here for *S. gonzagai* has recently been adopted by the South American Classification Committee (Remsen et al. 2015).

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