



A taxonomic revision of Chotoy spinetail *Schoeniophylax phryganophilus*

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Abstract

Chotoy spinetail *Schoeniophylax phryganophilus* is widely distributed in southern and eastern South America. What was believed to be a geographically disjunct population was described, as *S. p. petersi*, from eastern Brazil, in the valley of the Rio São Francisco, in northern Minas Gerais and western Bahia, based on comparatively minor plumage characters (chiefly colour and strength of the streaking). Its range was subsequently believed to extend to the northeast Brazilian state of Piauí. We analysed a total of 91 specimens of *Schoeniophylax* (74 *S. p. phryganophilus*, 17 *S. p. petersi*) for external morphology (plumage and biometrics), and 27 recordings of the species' main song (22 *S. p. phryganophilus* and five *S. p. petersi*). We found no evidence to support intraspecific geographical variation, which is unsurprising in the light of vastly increased fieldwork that has removed any obvious disjunction in the distribution of *Schoeniophylax*, and we therefore recommend that the species be returned to monotypy.

Keywords Citizen science · Furnariidae · Phylogeography · Synallaxiinae · Subspecies

Introduction

Chotoy spinetail *Schoeniophylax phryganophilus* (Vieillot, 1817) is the sole member of its genus and is placed in the Synallaxiinae (Furnariidae). Vieillot based his new name on an earlier indication by Félix de Azara (and the latter's observations in Paraguay), but there is no known type material in existence; the name *Synallaxis tecellata* Temminck, 1824, is its synonym (holotype collected by Augustin Saint-Hilaire in Brazil and held in the Muséum national d'Histoire naturelle, Paris (MNHN C.G. 2004.70); photographs examined). Vaurie (1971, 1980) advocated treating

Schoeniophylax as a subgenus of the geographically widespread and generally morphologically conservative genus *Synallaxis*, but this arrangement is not supported by the most comprehensive molecular phylogenies of the Furnariidae to date (Derryberry et al. 2011; Harvey et al. 2020), wherein *Schoeniophylax* was resolved as sister to white-bellied spinetail *Mazaria propinqua* (Claramunt 2014). The latter species is an Amazonian river island specialist, whilst the distribution of *S. phryganophilus* is centred on the Paraná River basin region. Voice represents another strong discriminant from *Synallaxis* (e.g., Canevari et al. 1991; Sick 1997; Remsen 2003; GMK pers. obs.).

Chotoy spinetail is amply distributed in southern and eastern South America, occurring in eastern Bolivia, southern Brazil (western São Paulo, Mato Grosso do Sul, southern Rio Grande do Sul), much of Paraguay, north-east Argentina (south to northern Buenos Aires and north-east San Luis provinces) and Uruguay, with an apparently disjunct population in eastern Brazil (northern Minas Gerais, western Bahia, and northern Piauí) (Vaurie 1980; Ridgely and Tudor 1994; Remsen 2003, 2010, 2020; Santos et al. 2010; BirdLife International 2016; Pearman and Areta 2020). The species is generally common and is found in principally open habitats: riparian thickets and second-growth scrub, areas with scattered trees and shrubs, edges of marshes, gallery

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woodland and monte woodland, from near sea level to 500 m (Remsen 2003).

The apparently isolated population in eastern Brazil became known only in the 1940s, based on specimens collected by Ernst Garbe at Pirapora (17°21'S, 44°56'W), Minas Gerais, and (Cidade da) Barra (11°05'S, 43°10'W), Bahia, both localities in the São Francisco Valley (Pinto 1944, 1948); it was unknown to Hellmayr (1925:73–74). Pinto (1948) described this population as a new subspecies, *S. p. petersi*, with holotype MZUSP 8388, an adult male collected by Garbe at Pirapora in May 1912. Pinto (1948) reported that his new subspecies, named for James Lee Peters (1889–1952), differs from the nominate race by (our translation): “crown with weaker [rufous] tone; greyish-brown of forehead clearer and more restricted; superciliary clearer (almost white, instead of yellowish-white), ear-coverts with clearer coloration and less distinctly streaked; breast less tinged cinnamon; cleaner belly (in some specimens almost white in centre). Furthermore, ... the dark streaks on the upperparts are thinner and clearer; undertail-coverts are almost always cleaner [whiter]; rectrices more pallid and

slightly darker only close to the rachis.” The accuracy of this diagnosis was questioned by Vaurie (1980) and Brammer (2002), while Remsen (2003) suggested that *petersi* differs from the nominate “only in being smaller” (which of itself would not automatically invalidate subspecific status).

The range of *petersi* became better known only recently. Published records between 1990 and 2010 determined it to be rather widely distributed across north-central and north-east Minas Gerais (e.g. Willis and Oniki 1991; Kirwan et al. 2001, 2004; Vasconcelos et al. 2006). Subsequently, Santos et al. (2010) collected specimens of the species in northern Piauí, 800 km north of Barra (the previous northernmost locality), in an area of transition between the Cerrado and the Caatinga. While Santos et al. (2010) did not assign them to subspecies, they have generally been presumed to involve *petersi* (del Hoyo and Collar 2016). More recently, citizen science data (principally WikiAves and GBIF) have demonstrated that Chotoy spinetail is more widespread in Brazil than any source in the mainstream literature currently recognises (e.g., BirdLife International 2016) (Fig. 1). Evidently, the species is also recorded in southern Mato Grosso, more

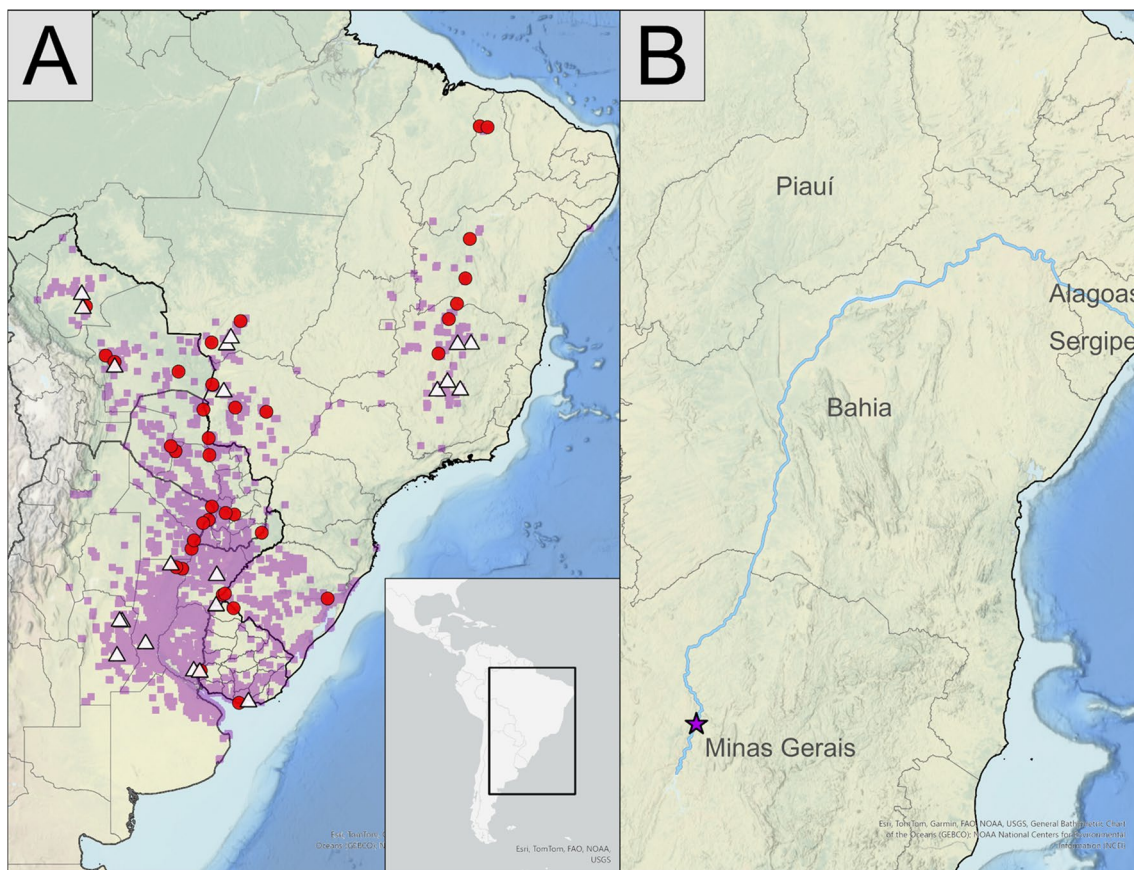


Fig. 1 **A** Records of Chotoy spinetail *Schoeniophylax phryganophilus* from GBIF.org (2023) and WikiAves (2023) (purple markers) across South America overlaid with localities of specimens (red circles) and

sound recordings (white triangles) used in this study. **B** Inset of Brazilian states discussed in text, showing also the type locality of *S. p. petersi* (purple star) and the Rio São Francisco (blue line)

widely in Rio Grande do Sul, sporadically in Santa Catarina and western Paraná (all presumably the nominate), as well as virtually all of the northern half of Minas Gerais (including the far west, at the border with northwest São Paulo, southwest Goiás, and northeast Mato Grosso do Sul), the Distrito Federal, north-east Goiás, much of western Bahia, and various parts of Piauí (all *petersi*?). This much larger and more continuous distribution, and doubts as to the validity of *petersi* already voiced by many authorities (Vaurie 1980; Brammer 2002; Kirwan et al. 2004; Vasconcelos et al. 2006), have prompted the present formal test of whether subspecies can be diagnosed in *Schoeniophylax*.

Methods

External morphology

We analysed plumage and biometrics. Eighty-six specimens of *Schoeniophylax* (see Supplementary Material 1) were examined and measured by GMK at seven institutions: the Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (MZUSP) ($n = 14$); the Natural History Museum, Tring, UK (NHMUK) ($n = 13$); Museum für Naturkunde, Berlin, Germany (ZMB) ($n = 2$); Leibniz Institute for the Analysis of Biodiversity Change, Museum Koenig, Bonn, Germany (ZFMK) ($n = 4$); Field Museum of Natural History, Chicago, USA (FMNH) ($n = 23$); National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (USNM) ($n = 13$); and Museu Nacional, Rio de Janeiro, Brazil (MNRJ) ($n = 17$). Five additional specimens (all tentatively assigned to *petersi*) were measured (but not analysed for plumage colours) by M. A. Crozariol at Museu Paraense “Emílio Goeldi”, Belém, Brazil (MPEG), following detailed guidance from GMK to minimize variation in measuring techniques. In total, 74 specimens of *S. p. phryganophilus* and 17 specimens of *S. p. petersi* were measured, including the holotype of the latter (MZUSP 8388). Most available specimens of *Schoeniophylax* at these institutions were examined; however, for example, two specimens from Río Pilcomayo, Formosa province, Argentina, housed at NHMUK, were too damaged to extract useful data. Each analysed specimen was measured for four characters: flattened wing chord length, tail length (from the tip to the insertion at the base of the rectrices), culmen length (from the tip to skull) and tarsus length (from the notch at the rear of the intertarsal joint to the lower edge of the last complete scute before the bifurcation of the toes). Wing and tail measurements were taken using a metal wing rule with a perpendicular stop at zero, to the nearest 0.5 mm, whilst bill and tarsus measurements were taken using electronic callipers, to the nearest 0.01 mm. Measurement terminology conforms to that used by Svensson (1992). Plumages were

also studied, and for each specimen (excluding those housed at MPEG) the colour of the crown, forehead, superciliary area, ear-coverts, breast, belly, dorsal stripes, and undertail-coverts was recorded. Alphanumeric colour codes used are from Munsell Soil Color Charts (2000). Other (capitalised) colours with double- or triple-digit identifiers are from Smithe (1975).

Sexing Chotoy spinetails on plumage and mensural characters is impossible, and all sex designations are based on the available label data. Seven immature and ten unsexed specimens (all nominate) were excluded from the analyses, leaving the final total numbers of specimens used in any of the statistical analyses as 59 nominate and 17 *petersi*.

We also tested the extent to which the pattern of morphometric variation observed in *Schoeniophylax* might be clinal from north to south. This was assessed using a Spearman's correlation coefficient between the latitude of the collection site (in decimal degrees south of the equator) and all four mensural characters. Geographic coordinates of the collection localities were largely obtained from relevant ornithological gazetteers, with a few being recorded on specimen labels (Paynter 1989, 1992, 1994, 1995; Paynter and Traylor 1991). Additional data points had to be removed for the clinal analysis because the collection locality (e.g., NHMUK 1881.2.18.180 “Bolivia” and USNM 390795 “Paraguay”) could not be identified very or at all precisely.

Bioacoustics

The main song of Chotoy spinetail is a series of low-pitched chortling ‘cho’ notes that change (usually rather abruptly) to a fast, quieter rattle towards the end (Fig. 2). This is sometimes accompanied by a second bird emitting a higher series of inverted V-shaped notes to form a duet. Sound recordings were compiled of both taxa using files deposited at xeno-canto (www.xeno-canto.org; XC), the Macaulay Library (www.macaulaylibrary.org; ML) and those sent to us upon request. Poor-quality recordings were removed from analysis. In total, 27 recordings of Chotoy spinetail's main song (22 *S. p. phryganophilus* and five *S. p. petersi*) (Supplementary Material 2) were measured. The small sample size of duets precluded a robust statistical comparison.

Sonograms were visualised and analysed in Raven Lite v2.0 (Bioacoustics Research Program, Cornell Laboratory of Ornithology, Ithaca, NY, USA) using Hann window with an FFT of 1024 and overlap of 90%. A ‘strophe’ was interpreted as a single burst of song. Seven vocal parameters were measured for each strophe: 1) total duration; 2) total number of notes; 3) duration of slower notes as a ratio of the total strophe length; 4) the pace (notes per second) of the first five notes; 5) the pace of the concluding five notes; 6) minimum frequency of the strophe; and 7) maximum frequency of the strophe. We measured

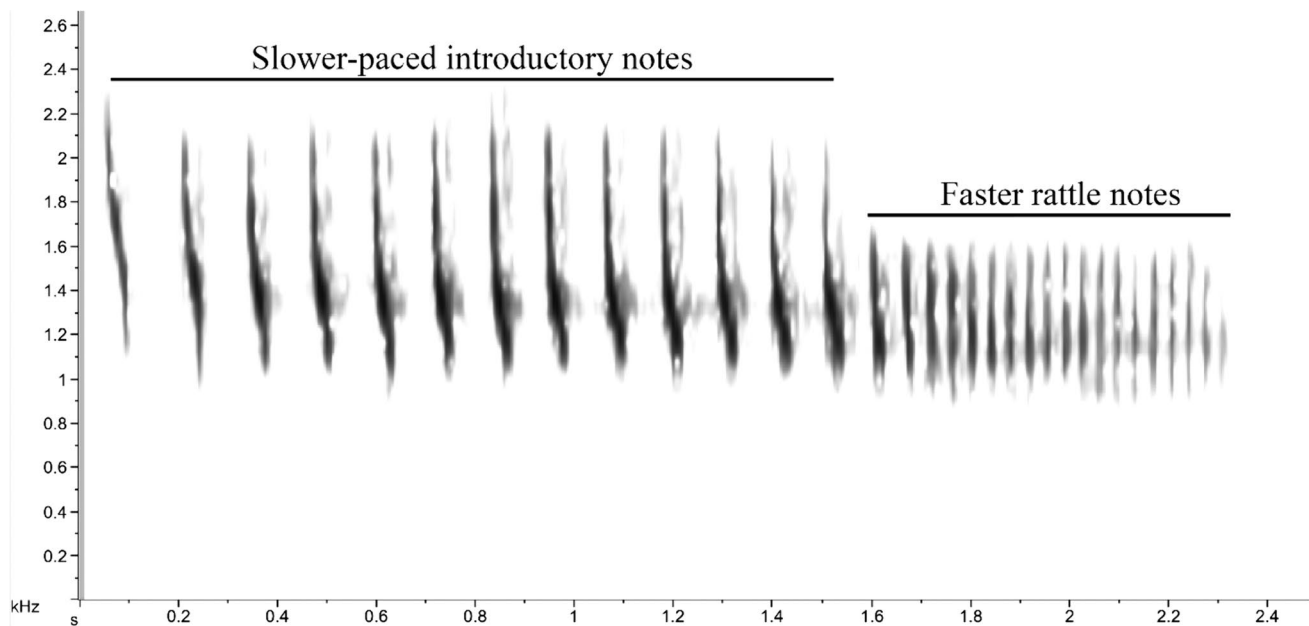


Fig. 2 Sonogram of the main song of Chotoy spinetail *Schoeniophylax phryganophilus* showing distinction of slower introductory notes from faster concluding rattling notes [*S. p. phryganophilus*, XC51488, Uruguay]

five strophes for each recording, or all strophes (always > 3) if the recording contained fewer than five strophes; the mean for each parameter of each individual recording was then calculated. All parameters were measured by the same individual (AJB) for consistency.

Statistical comparisons

For both the morphometric and bioacoustic datasets, parameters were compared using Welch's unpaired t-test applying a Bonferroni correction (where the threshold for statistical significance is set at $P < 0.05/n_v$). For morphometric data, analyses were performed separately for each sex. Because testing statistical significance alone does not fully elucidate how distinctive populations are, we additionally tested traits using diagnosability formulae. For this we adopt the "75% rule" interpretation recommended by Patten and Unitt (2002), where Population B (*petersi*) is considered 'diagnosable' only if 75% of its individuals lie outside 99% of the variation in Population A (*phryganophilus*), and the reverse. Where this threshold was not met, we also tested the more liberal diagnosability interpretation of the "75% rule", where 75% of Population B lies outside 75% of the variation in Population A.

Results

External morphology

Plumage

Figure 3 shows two specimens of nominate *phryganophilus* collected in Paraguay compared to one *petersi* (topotypical, having been collected at Pirapora, Minas Gerais) in dorsal, ventral and lateral views, illustrating variation within populations (note the differences in the streaking of the upperparts between the two Paraguay specimens) but the lack of clear differences between the described subspecies. The specific details of this variation are discussed below.

Crown

Nominate *phryganophilus* usually has the crown terra cotta intermixed with Olive Brown (close to 28) ($n = 28$ male, $n = 20$ female) but some variation was observed: red



Fig. 3 Specimens of nominate *Schoeniophylax p. phryganophilus* (**a**, **b** and **c**) from Paraguay (NHUMUK 1905.10.12.192 and NHMUK 1925.9.2.72) at the Natural History Museum, Tring (Guy M. Kirwan © Trustees of the Natural History Museum, London) compared with

(**d**, **e** and **f**) one of *S. p. petersi* (MPEG 30501) held at the Museu Paraense “Emilio Goeldi”, Belém, in ventral, dorsal, and lateral views (Marco Aurélio Crozariol)

intermixed (sparsely) with Olive Brown ($n=3$ male, $n=2$ female), red (2.5YR 4/8) intermixed with greyish brown (10YR 5/2) ($n=2$ female) or greyish brown (10YR 4/2) ($n=1$ male), red (2.5YR 4/6) intermixed with very little greyish brown (10YR 5/2) ($n=1$ male), red (2.5YR 4/6) almost without any greyish brown ($n=1$ male), and one female had the crown almost entirely greyish brown, with virtually no red. The crown of *petersi* varied from all red (2.5YR 4/6) ($n=1$ female) to red (2.5YR 4/6) admixed greyish brown (10YR 5/2) ($n=1$ male, $n=4$ female) or terra cotta admixed Olive Brown ($n=3$ male, $n=3$ female).

Forehead

In most specimens of both taxa, the forehead was recorded as either greyish brown (10YR 5/2) (nominate $n=1$ male, $n=2$ females; *petersi* $n=1$ male, $n=5$ females) or Olive Brown (28) (nominate $n=25$ males, $n=18$ females; *petersi* $n=3$ males, $n=3$ females). Thirteen *phryganophilus* specimens differed subtly in having their forehead close to Olive Brown (28) ($n=6$ males, $n=5$ females), very dark greyish

brown (10YR 3/2) ($n=1$ male) or very restricted greyish brown (10YR 5/2) ($n=1$ male).

Superciliary area

Nominate birds' superciliary area was recorded as off-white (pale 119D/92) ($n=4$ males, $n=1$ female), close to or Olive Brown (28) ($n=5$ males, $n=6$ females), pale grey ($n=10$ males, $n=9$ females), very pale brown (10YR 8/2 or 10YR 8/3) ($n=4$ males, $n=4$ females), white (10YR 8/1) ($n=1$ male, $n=1$ female) or whitish ($n=9$ males, $n=4$ females). The superciliary area in *petersi* was recorded as off-white ($n=1$ male, $n=2$ females), whitish ($n=1$ male, $n=1$ female), pale grey ($n=1$ male), pale yellow (2.5Y 8/2) ($n=1$ female) or very pale brown (10YR 8/2) ($n=1$ male, $n=4$ females).

Ear-coverts

Usually pale brown or olive brown in both subspecies. In the nominate race this tract is usually Olive Brown (28) ($n=25$ males, $n=16$ females) or close to the latter ($n=5$ males, $n=5$ females), with smaller numbers of pale brown (10YR

6/3) ($n = 1$ male, $n = 1$ female) very pale brown (between 10YR 6/3 and 10YR 8/2) ($n = 1$ male, $n = 1$ female), very pale brown (10YR 8/2) ($n = 1$ male, $n = 1$ female), dark greyish brown (10YR 4/2) ($n = 1$ male) or greyish brown (10YR 5/2) ($n = 1$ female). Subspecies *petersi* specimens typically had the ear-coverts Olive Brown (28) ($n = 3$ males, $n = 3$ females) or pale brown (10YR 6/3) ($n = 2$ females), with light brownish grey (10YR 6/2) ($n = 1$ female), light grey (10YR 7/2) ($n = 1$ female), very pale brown (10YR 8/3) ($n = 1$ female) and very pale brown (10YR 7/3) ($n = 1$ male) also recorded.

Breast

Little variation was observed compared to other characters. The breast of *petersi* was recorded as either brownish yellow (10YR 6/6) ($n = 1$ female), brownish yellow (10YR 6/8) ($n = 1$ female), yellowish brown ($n = 3$ males, $n = 3$ females) or yellowish brown (10YR 5/8) ($n = 1$ male, $n = 3$ females). The breast of the nominate race is usually yellowish brown (marginally darker or paler than 10YR 5/8) ($n = 30$ males, $n = 18$ females) or yellowish brown (10YR 5/8) ($n = 3$ males, $n = 1$ female), with other variations as follows: brownish yellow (10YR 6/8) ($n = 1$ female), deep yellowish brown ($n = 1$ female), Isabella Color ($n = 1$ female), pale yellowish brown (paler than 10YR 5/8) ($n = 3$ female) and very pale brownish yellow (close to 10YR 6/8) ($n = 1$ brown).

Belly

The belly colour of *petersi* varies from pale yellow (2.5Y 8/2) ($n = 1$ male, $n = 4$ females), whitish admixed with yellow (close to 2.5Y 8/2) ($n = 3$ males, $n = 3$ females), to pure white (2.5Y 8/1) ($n = 1$ female). Nominate *phryganophilus* from pale yellow (2.5Y 8/2) ($n = 3$ males, $n = 3$ females) to pale buff ($n = 1$ male, $n = 1$ female), pale grey ($n = 1$ male,

$n = 2$ females), light grey (5Y 7/2) ($n = 1$ male), whitish admixed with yellow ($n = 17$ males, $n = 12$ females), whitish admixed grey (close to 5Y 7/2) ($n = 11$ males, $n = 5$ females), whitish ($n = 1$ female) or white ($n = 1$ female).

Dorsal stripes

In both subspecies, these vary from brownish black (nominate $n = 3$ males, $n = 2$ females; *petersi* $n = 3$ males, $n = 2$ females) to black (2.5Y 2.5/1) (nominate $n = 4$ males, $n = 6$ females; *petersi* $n = 1$ male, $n = 5$ females) or black (close to Blackish Neutral Gray [82] or Dark Neutral Gray [83]) (nominate $n = 27$ males, $n = 17$ females; *petersi* $n = 1$ female).

Undertail-coverts

In both subspecies the colour was principally recorded as light yellowish brown (*phryganophilus* $n = 22$ males, $n = 13$ females; *petersi* $n = 3$ males, $n = 3$ females). In the nominate race, some individuals had the undertail-coverts pale yellow (between 2.5Y 8/2 and 2.5Y 8/3) ($n = 8$ males, $n = 7$ females), pale yellow (2.5Y 7/3) ($n = 1$ male), pale yellow (2.5Y 7/4) ($n = 2$ females), pale yellow (2.5Y 8/3) ($n = 1$ male), light yellowish brown (2.5Y 6/4) ($n = 1$ male, $n = 2$ females), or very light yellowish brown (closest to but paler than 2.5Y 6/4) ($n = 2$ females). In race *petersi*, pale yellow (2.5Y 8/3) ($n = 1$ male, $n = 4$ females) and pale yellow (2.5Y 8/2) ($n = 1$ female) were recorded.

External morphology: morphometrics

Sex differences were not detected in either taxon with the sole exception of wing chord length in nominate *phryganophilus*, wherein males exhibit marginally longer wings (Table 1). In none of our four measured morphometric

Table 1 Morphometric data (in mm) of Chotoy spinetail *Schoeniophylax phryganophilus* between sexes and taxa

Variable	Sex	<i>S. p. phryganophilus</i>				<i>S. p. petersi</i>				<i>S. p. petersi</i> (excluding MPEG specimens)			
		Mean	SD	Range	<i>n</i>	Mean	SD	Range	<i>n</i>	Mean	SD	Range	<i>n</i>
Wing	M	62.4*	2.02	58.5–68.0	34	60.1	1.97	57.3–62.5	7	62.5	3.35	58.0–67.0	4
	F	60.2	1.89	55–63	25	59.1	1.91	55.9–62.7	10	58.8	1.89	55.9–62.7	8
Tail	M	118.4	9.64	97–135	27	117.3	2.23	115–120	5	118.7	1.89	116–120	3
	F	112.7	8.91	91.0–123.0	22	118.1	3.94	111.2–124.3	9	117.7	4.38	111.2–124.3	7
Culmen	M	13.2	0.70	11.7–15.6	34	14.3	0.78	13.7–15.6	7	13.7	0.44	13.0–14.2	4
	F	13.1	0.68	12.1–14.5	25	14.2	1.02	12.7–15.6	10	13.5	0.64	12.7–15.1	8
Tarsus	M	22.2	0.94	20.7–24.5	34	21.4	0.67	20.7–22.3	7	20.7	0.79	20.6–22.3	4
	F	21.6	1.19	19.1–24.0	25	21.1	0.55	20.1–21.9	10	21.0	0.61	20.1–22.0	8

*Asterisks indicate that the mean measurements of males differ significantly ($P < 0.05$) from females of the same taxon. Although *S. p. petersi* was on average smaller in most characters (except bill), none of the differences was significant at $P < 0.05$

characters did we find evidence to support the claim that *petersi* is smaller than the nominate (Table 1), although we must caution that our sample size was comparatively small versus that for the nominate and measurements were compiled by more than one worker. In only one character did the means of the two taxa ostensibly differ significantly: the culmen length of female *petersi* being greater than that of *phryganophilus*; however, this result was not significant once subject to a Bonferroni correction. In most characters (tail, culmen and tarsus length in males, wing and tarsus in females), the range of measurements of *petersi* was entirely circumscribed by the variation exhibited by nominate *phryganophilus*. Where overlap was not total (wing length males, tail and culmen length females), it was nearly so, with neither interpretation of the “75% rule” being met in any character. These results were the same whether the five MPEG *petersi* specimens (which were measured by a different person) were included or excluded.

We found no correlation between the latitude of specimens measured and any morphometric character (Table 2).

Bioacoustics

The means of no vocal parameter differed between the two populations (Table 3). In addition, for all variables the range of measurements of *petersi* was encompassed by the range of *phryganophilus*, thus in no character are the vocalisations of *petersi* diagnostic. In no pairwise statistical comparison did the means of parameters differ between taxa, with or without

a Bonferroni correction applied. Moreover, visual inspection of sonograms revealed no conspicuous differences between the two.

Discussion

Despite universal recognition in global checklists, we find no evidence from morphology (plumage and biometrics) and vocalisations to maintain *petersi* as a valid taxon. Vaurie (1980) stated that ‘The population of the valley of the Rio São Francisco may average paler and less heavily streaked on the back..., but a specimen I have seen from Bahia falls within the range of individual variation of the other populations, and, in any event, a population difference of this kind does not warrant nomenclatural recognition’. Although his evidence was extremely limited, and he lacked the benefit of the larger dataset compiled here, Vaurie’s diagnosis appears to have been entirely correct. In his original description, Pinto (1948) identified several plumage characters of apparent diagnosability based on four specimens in MZUSP (all of which were examined as part of this study), but we determine that no plumage character observed in *petersi* is unmatched in at least some *phryganophilus* (with considerable variation in both taxa). This result is mirrored in our morphometric and bioacoustic datasets.

While Remsen (2003) too appeared to dismiss plumage differences between the two taxa, he argued that *petersi* is smaller (a claim not made by Pinto 1948), although no

Table 2 Spearman’s rank correlation between the latitude of the collection site (in decimal degrees south of the equator) and morphometric characters. No correlation was significant at $P < 0.05$

Morphometric character	Males	Females
Wing length	$n = 32$, $R = -0.007$, $P = 0.970$	$n = 29$, $R = -0.100$, $P = 0.627$
Tail length	$n = 30$, $R = -0.274$, $P = 0.169$	$n = 28$, $R = 0.290$, $P = 0.190$
Culmen length	$n = 32$, $R = 0.250$, $P = 0.159$	$n = 29$, $R = 0.346$, $P = 0.083$
Tarsus length	$n = 32$, $R = -0.190$, $P = 0.282$	$n = 29$, $R = -0.280$, $P = 0.278$

Table 3 Summary statistics of seven bioacoustic parameters of Chotoy spinetail *Schoeniophylax phryganophilus*. No difference was significant at $P < 0.05$

Variable	<i>S. p. phryganophilus</i> ($n = 22$)			<i>S. p. petersi</i> ($n = 5$)		
	Mean	SD	Range	Mean	SD	Range
Number of notes	24.53	4.36	16.3–31.0	24.20	1.48	22.0–26.0
Total duration	2.21	0.56	1.5–3.3	2.37	0.49	1.75–2.8
% of strophe duration of slower notes	78.08	12.66	54.3–100.0	76.41	3.46	72.3–80.4
Pace of first five notes (notes/second)	7.46	0.98	4.8–8.9	7.35	0.55	6.6–8.1
Pace of final five notes (notes/second)	24.82	6.92	8.3–36.2	25.32	4.75	18.6–31.3
Minimum frequency (Hz)	840.32	87.41	618.0–976.8	891.93	85.42	743.6–962.5
Maximum frequency (Hz)	2220.97	178.31	1890.2–2588.6	2246.11	248.96	2031.4–2646.2

details were given and the need for ‘more detailed study’ was recognised. In none of the four morphometric traits assessed did we detect statistical support for *petersi* being smaller. Applying both a ‘conservative’ (75% of 99%) and ‘liberal’ (75% of 75%) interpretation of the “75% rule” diagnosability test, in no character did *petersi* emerge as diagnosable from *phryganophilus*. Although five specimens of *petersi* were measured by a different person to the remainder of the dataset, introducing the possibility of inconsistency, removing these data did not change the results of our statistical or diagnosability tests. Parallel conclusions can be drawn from our bioacoustic data, where *petersi* emerged undifferentiated from nominate *phryganophilus*.

With the benefit of improved knowledge of the species’ distribution, these results are perhaps unsurprising. Although *petersi* was previously considered to represent a disjunct population of *phryganophilus*, recent observations have rendered it unclear where the line separating them would lie. Whether genuine range expansion has played a role in this change is unknown; across much of the same region, screaming cowbird *Molothrus rufoaxillaris* appears to have massively increased its distribution northwards in recent decades (D’Angelo Neto 2000; Kirwan et al. 2001; Lima 2021). Cracraft (1985) in his review of biogeography in South America did not mention *petersi*, presumably because its known distribution at the time (just two localities) appeared to span two different areas of endemism, namely the Caatinga and Campo Cerrado centres, but perhaps influenced by Vaurie’s (1980) then recent rejection of subspecific-level differences. With improved knowledge, several of Cracraft’s assignments to these two endemic centres appear questionable, e.g., caatinga black tyrant *Knipolegus aterrimus franciscanus* (now generally afforded species rank) and Minas Gerais tyrannulet *Phylloscartes roquettei* which he considered Campo Cerrado endemics, are clearly not confined to this region. Instead, as noted by Silva (1988), these taxa (and others generally restricted to mesophytic deciduous forests of the Brazilian Planalto) are ostensibly endemic to the region spanning the valleys of the Araguaia and São Francisco Rivers. Simultaneously, he noted that northeastern (Caatinga) avifaunal elements penetrate well south of this biome’s centre along the Rio São Francisco depression, a pattern that has acquired much additional support through subsequent fieldwork (e.g., Kirwan et al. 2001, 2004; Vasconcelos et al. 2006). Indeed, the latter river (the longest that flows entirely within Brazil) and its tributaries cross three major phytogeographical domains in the state of Minas Gerais: the Atlantic Forest (in its headwaters), Cerrado, and Caatinga.

As a result of this renewed interest in the dry forests of central and northeast Brazil, various taxonomic rearrangements were proposed by Silva and others in the final decades of the twentieth century. In addition to recognition

of *Knipolegus franciscanus* as a species apart from white-winged black tyrant *K. aterrimus* of southern and western South America (following Silva and Oren 1992), Jaramillo and Burke (1999) separated Southern Cone greyish bay-wing *Agelaioides badius* from pale baywing *A. fringillarius* which is endemic to the Caatinga, and Zimmer and Whitaker (2000) split rufous cacholote *Pseudoseisura unirufa* principally of the Chaco biome from Caatinga cacholote *P. cristata* in northeast Brazil. Silva (1991) also postulated that the two diagnosable subspecies of spot-backed puffbird *Nystalus maculatus*, *N. m. striatipectus* principally of the Chaco ecoregion and nominate *maculatus* of northeast and central Brazil should be accorded species rank. In contrast to the other now well-accepted revisions just mentioned, the last-named proposal has never acquired much support (Pacheco et al. 2021 is a notable exception), and the citizen science observational data now available (e.g., at www.ebird.org and www.wikiaves.com.br) reveal a continuous distribution, rather than two largely or completely segregated ranges equating to different biogeographical domains, as originally postulated by Silva (1991). In northern Minas Gerais, Vasconcelos et al. (2003) documented that juvenile *maculatus* have dark streaks, rather than spots, on the underparts, thus displaying one of the distinguishing characters of *striatipectus*.

With a distribution spanning central Argentina north to Bolivia, central Brazil, and more sparsely to northeast Brazil, the range of *Schoeniophylax* is not dissimilar to that of *Nystalus maculatus s.l.*, albeit apparently less continuous, especially in the north, and has probably been less obviously advantaged by partial deforestation than the buconid. In contrast to the *Nystalus*, however, which possesses reasonably obvious geographical variation in plumage, this paper provides no such evidence for Chotoy spinetail, for which there is even no definable clinal trend in morphometrics, indicating that variation within the species lacks geographic structure. As such, notwithstanding our relatively small sample size for *petersi* (which, however, is unlikely to be vastly improved in the near future without targeted collection efforts), on current knowledge *Schoeniophylax* is best considered monotypic.

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Declarations

Competing interests The authors declare no competing interests.

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