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ARTIGO

Mountaintop endemism in eastern Brazil: why some bird species from campos rupestres of the Espinhaço Range are not endemic to the Cerrado region?

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RESUMO: Endemismo nos topos de montanha do leste brasileiro: por que algumas espécies de aves dos campos rupestres da Cadeia do Espinhaço não são endêmicas do Cerrado? Quatro espécies de aves foram consideradas endêmicas dos campos rupestres da Cadeia do Espinhaço e da região do Cerrado em análises biogeográficas anteriores: *Augastes scutatus, Asthenes luizae, Polystictus superciliaris* e *Embernagra longicauda.* Duas outras espécies, *Augastes lumachella* e *Formicivora grantsaui,* são restritas aos campos rupestres do setor setentrional desta cadeia de montanhas. Neste estudo, eu apresento uma revisão da distribuição geográfica destas seis espécies e comento porque elas não deveriam ser consideradas endêmicas do Cerrado. Extensões nas áreas de distribuição geográfica de *A. scutatus* e *A. luizae* são também apresentadas. No caso particular de *P. superciliaris* e *E. longicauda,* existem registros históricos para as montanhas fora da região do Cerrado, no setor setentrional da Cadeia do Espinhaço (ambas espécies) e na Serra do Mar (*P. superciliaris*). Estas duas espécies, junto com *Oreophylax moreirae,* ocorrem tanto nos campos rupestres da Cadeia do Espinhaço, quanto nos campos de altitude das serras costeiras. Assim, elas seriam mais bem caracterizadas como endêmicas dos topos de montanha do leste brasileiro ao invés de qualquer domínio morfoclimático, já que considerá-las endêmicas do Cerrado acaba por obscurecer interessantes padrões biogeográficos entre as montanhas do leste brasileiro. Pelas mesmas razões, também proponho que as outras quatro espécies sejam consideradas endêmicas desses topos de montanha ou, simplesmente, dos campos rupestres da Cadeia do Espinhaço. Os campos rupestres ocorrem em diferentes regiões morfoclimáticas da América do Sul e análises de endemismo deste tipo de vegetação deveriam se concentrar nessas áreas ao invés das formações não-montanhosas adjacentes.

PALAVRAS-CHAVE: Aves, Cadeia do Espinhaço, Cerrado, campos rupestres, espécies endêmicas, Brasil.

ABSTRACT: Four bird species have been considered endemic to the campos rupestres of the Espinhaço Range, as well as to the Cerrado region in previous biogeographical analyses: *Augastes scutatus, Asthenes luizae, Polystictus superciliaris* and *Embernagra longicauda.* Two additional species, *Augastes lumachella* and *Formicivora grantsaui,* are restricted to the campos rupestres of the northern part of this mountain range. Here, I present a revision on the geographic distribution of these six species and also comment why they should not be considered endemic to the Cerrado region. Range extensions for *A. scutatus* and *A. luizae* are also presented. In the particular case of *P. superciliaris* and *E. longicauda,* there are historical records for mountains located outside the Cerrado region, in the northern Espinhaço Range (both species) and in the Serra do Mar (*P. superciliaris*). These two species, together with *Oreophylax moreirae,* occur both in the campos rupestres of the Espinhaço Range and in the campos de altitude of the coastal mountains. Thus, they would be better characterized as endemic to the eastern Brazilian mountaintops than to any specific morphoclimatic domain, since considering them endemic to the Cerrado region can obscure interesting biogeographical patterns among Brazilian mountains. For the same reason, I also propose that the other four species should also be treated as endemic of these mountaintops or, simply, to the campos rupestres of the Espinhaço Range. The campos rupestres occur in different morphoclimatic domains of South America and analyses of endemism of this vegetation type should be concentrated in these areas rather than in adjacent lowland domains.

KEY-WORDS: Birds, Espinhaço Range, Cerrado, campos rupestres, endemic species, Brazil.

The campos rupestres of the Espinhaço Range are considered an endemic bird area (Stattersfield *et al.* 1998) and also a sub-area of bird endemism in the Cerrado region (Silva 1997, 1998, Silva and Bates 2002). Silva (1995a, b, 1997) and Silva and Bates (2002) considered the following birds as endemic to the campos rupestres of the Espinhaço Range and also to the Cerrado: *Augastes scutatus, Asthenes luizae, Polystictus superciliaris* and *Embernagra longicauda.* They did not consider *Augastes lumachella,* another endemic to the campos rupestres of the Espinhaço Range, because this species ranges in the northern part of this mountain complex, which is an area located outside the limits of the Cerrado region used by these authors, as delimited by Ab'Sáber (1977). However, the authors overlooked important specimens of *P. superciliaris* and *E. longicauda* collected by E. Kaempfer in

May 1928 at one locality inside the range of *A. lumachella* (Morro do Chapéu, Bahia; deposited in the American Museum of Natural History). Furthermore, they also overlooked a specimen of *P. superciliaris* collected by J. L. Lima in February 1961 in the Atlantic Forest region (Serra da Bocaina, Serra do Mar Range; deposited in the Museu de Zoologia da Universidade de São Paulo). These specimens have also been mentioned in previous literature (Zimmer 1955, O'Brien 1968, Carnevalli 1982, Mattos and Sick 1985, Sick 1985a, Ridgely and Tudor 1989, 1994). These records would automatically exclude *P. superciliaris* and *E. longicauda* as endemic to the Cerrado as delimited by Ab'Sáber (1977), if Silva's criterium were to be followed. Later, Vasconcelos *et al.* (2003) presented a geographic revision on the distribution of these two species, including new records outside the Espinhaço Range. Importantly, they reported the occurrence of both bird species in the Atlantic Forest mountains covered by campos de altitude, another vegetation type present in southeastern Brazilian mountaintops (*see* Safford 1999). Recently, Silva and Santos (2005) published another revision on the endemic birds of the Cerrado, in which they overlooked the analysis of Vasconcelos *et al.* (2003) and proposed a 'new' rule for bird endemism in the Cerrado region. This rule includes all species with isolated populations in savanna-like habitats up to 430 km distant from the Cerrado limits as endemic to this region. This distance would correspond to the maximum width of the transitional zones between the Cerrado, the Atlantic Forest and the Amazon regions (Silva and Santos 2005). Again, *P. superciliaris* and *E. longicauda* were considered to be Cerrado endemics, despite records of both in the Caatinga transition zones (Morro do Chapéu) and in the Atlantic Forest region (records presented by Vasconcelos *et al.* 2003).

An additional endemic species to the campos rupestres of the Espinhaço Range, *Formicivora grantsaui,* was recently described from the Chapada Diamantina region (Gonzaga *et al.* 2007).

Here, I present a revision on the geographic distribution of these six bird species (*Augastes scutatus, Augastes lumachella, Asthenes luizae, Formicivora grantsaui, Polystictus superciliaris* and *Embernagra longicauda*) and show why they should not be considered endemic to the Cerrado.

METHODS

In the last 16 years, I have been collecting data on the geographic distribution of birds on the highlands of the Espinhaço Range and adjacent coastal mountains (Serras da Mantiqueira, do Caparaó and do Mar). This information is the main source for the revision and discussion that I present here. Specimens have been collected and deposited in the Coleção Ornitológica do Departamento de Zoologia da Universidade Federal de Minas Gerais, Belo Horizonte (DZUFMG). I also conducted a literature review (*see* the Appendix) and consulted specimens deposited in the following institutions: American Museum of Natural History, New York (AMNH); Museu de Zoologia da Universidade de São Paulo, São Paulo (MZUSP); Museu Paraense Emílio Goeldi, Belém (MPEG); Coleção Ornitológica do Departamento de Zoologia da Universidade Federal de Pernambuco, Recife (UFPE); Museu de Biologia Prof. Mello Leitão, Santa Teresa (MBML); Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre (MCP); Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte (MCN); Museu de História Natural de Taubaté, Taubaté (MHNT); and Coleção Rolf Grantsau, São Bernardo do Campo (SG). In addition, I considered specimens deposited in the Museu Nacional, Rio de Janeiro (MNRJ), mentioned in the literature (Mattos and Sick 1985, Vasconcelos *et al.* 2003, Abreu 2006, Gonzaga *et al.* 2007).

Doubtful localities, especially those presented by Ruschi (1962a, 1963a, b, 1982) for both species of *Augastes,* were not considered in this revision. In some cases, geographic coordinates in the Ornithological Gazetteers of Brazil (Paynter and Traylor 1991, Vanzolini 1992) fell in cities, villages or localities without suitable habitats for these endemic taxa. Thus, coordinates were approximated to the closest area with suitable habitats for these species, based on my field experience and on analysis of online satellite images (http://earth.google.com).

I plotted all of these records on maps of southeastern Brazilian mountains (above 1,000 m) and analyzed the range of these species. Finally, based on the geographic distribution patterns of these species, I discuss if they can be considered or not endemic to the Espinhaço Range and also to the Cerrado region.

RESULTS AND DISCUSSION

Geographic Distribution

Augastes scutatus

This species inhabits the southern and central mountains of the Espinhaço Range in Minas Gerais state (Figure 1). There are two old specimens collected by F. Sellow with a doubtful locality noted in the label. Both specimens are deposited in the Museum für Naturkunde, Berlim (ZMB). The locality ("Loc? Joan d. Rey" in the label) could be São João Del Rei (c. 90 km south of the Espinhaço Range, *see* Abreu 2006), but this locality cannot be considered valid because there are several problems concerning the labels of Sellow's specimens (*see* Pacheco and Whitney 2001), and further fieldwork in this area is still needed to confirm this species occurrence.

Ruschi (1962a, 1963a) mentioned the "Chapada Diamantina" as a site for *A. scutatus.* Nevertheless, there are no documented records for this species in this region, but only for *A. lumachella* (*e.g.,* Grantsau 1988, Sick 1997, Parrini *et al.* 1999). Ruschi was probably referring to the plateau around the town of Diamantina, in central Minas Gerais state, from where he analyzed specimens collected by E. Gounelle in 1903 (AMNH 484298-484300) and by himself (MBML 6700) (Ruschi 1962a). This last specimen was not mentioned in the catalogue of hummingbirds of the MBML (*see* Vielliard 1994). Later, Ruschi (1963b) corrected the name of this locality, specifying that *A. scutatus* is restricted to Minas Gerais state. Also, the locality mentioned by Sick (1997) as "Conselheiro Lafaiete" should be corrected to the nearby Serra de Ouro Branco, where specimens were recently collected by Abreu (2006).

Range extensions based on recent specimens taken in the isolated mountain massifs of Serra do Cabral and in the Serra do Pau D'Arco, the latter very close to the Bahia state border, are presented in the Appendix. It is also important to mention that the two subspecies of *A. scutatus,* described by Ruschi (1963b) and Grantsau (1967), were proven to be invalid by Abreu (2006).

Augastes lumachella

This species is restricted to the northern Espinhaço Range, in the Chapada Diamantina and adjacent mountains, state of Bahia (Figure 2). Several records presented by Ruschi (1962a) lack precise localities and some of them could represent mistakes. In the AMNH, there are two old specimens labeled from "Minas Geraes" (AMNH 38267, 38269), but since *A. scutatus* occurs from south-central Minas Gerais to the boundaries with the state of Bahia (*see* above), these old specimens were probably mislabeled. A revision of the records accepted for *A. lumachella* is presented in the Appendix.

Asthenes luizae

This is a species recently described from Serra do Cipó, Minas Gerais (Vielliard 1990). It was only known from its type locality for the next eight years after its description. Recently, new records were made in areas north of Serra do Cipó, all in the Espinhaço Range in Minas Gerais state (Andrade *et al.* 1998, Cordeiro *et al.* 1998, Vasconcelos 2002, Vasconcelos *et al.* 2002, 2008, Bencke *et al.* 2006 – *see* the Appendix). Its range is very similar to that of *A. scutatus,* except that it does not occur in the

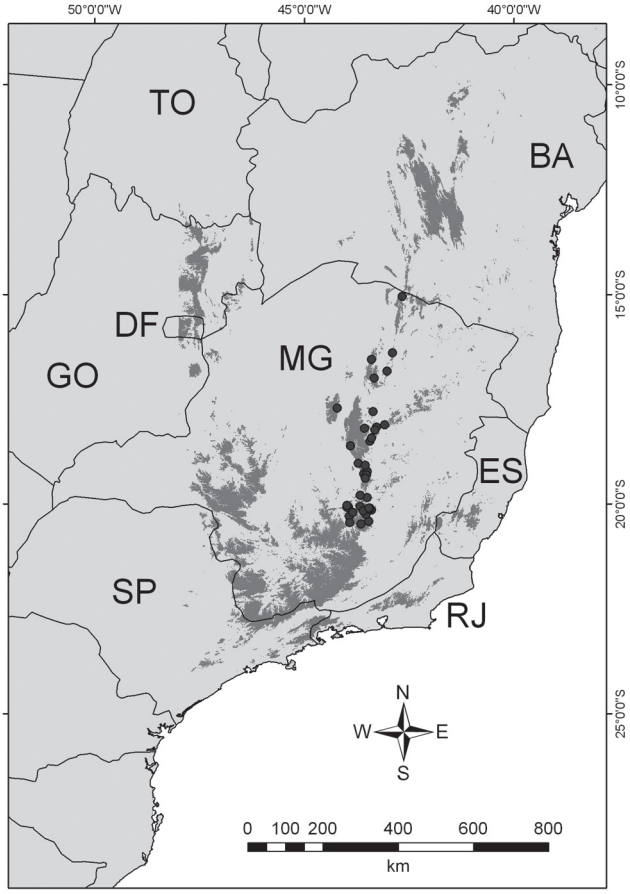

FIGURE 1: Range of *Augastes scutatus*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

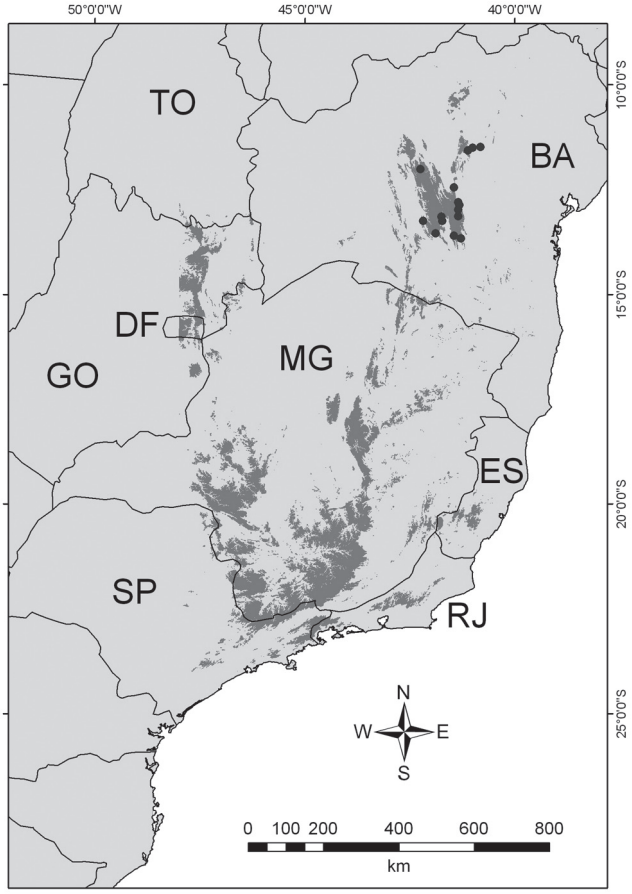

FIGURE 2: Range of *Augastes lumachella*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

southernmost Espinhaço Range (Quadrilátero Ferrífero) (Figure 3). The northern limit for this species (a range extension) is the region of the Serra da Formosa, Monte Azul municipality (Appendix).

Formicivora grantsaui

This recently described species is known only from a few localities in the Serra do Sincorá region, Chapada Diamantina (Gonzaga *et al.* 2007), part of the range of *A. lumachella* (Appendix, Figure 4).

Polystictus superciliaris

This species has been considered endemic to both the campos rupestres of the Espinhaço Range and to the Cerrado region (Silva 1995a, b, 1997, Silva and Bates 2002), despite previous records in the Morro do Chapéu and Serra da Bocaina (*see* Introduction). Further records in the Serra da Canastra and adjacent areas (including Chapadãozinho), and others in the Serra da Mantiqueira (Serras do Papagaio, do Ibitipoca and do Itatiaia) do not support the claim that this species is endemic to either the Espinhaço mountain complex or the Cerrado region (Silveira 1998, Vasconcelos 1999a, b, 2008, Vasconcelos *et al.* 2003, Pacheco *et al.* 2008) (Appendix, Figure 5).

Embernagra longicauda

This is another species that was considered endemic to both the campos rupestres of the Espinhaço Range and to the Cerrado region (Silva 1995a, b, 1997, Silva and Bates 2002). Nevertheless, old records from Morro do Chapéu and recent ones in the Serras da Mantiqueira and do Caparaó no longer support its endemism to both areas (O'Brien 1968, Carnevalli 1982, Mattos and Sick 1985, Ridgely and Tudor 1989, Sick 1997, Machado *et al.* 1998, Vasconcelos 2003, Vasconcelos *et al.* 2003) (Appendix, Figure 6).

Final Remarks and Conclusions

It is clear that *P. superciliaris* and *E. longicauda* cannot be considered endemic to either the Cerrado or to the campos rupestres of the Espinhaço Range, since they occur in mountain ranges in the Atlantic Forest domain (Serras do Mar, da Mantiqueira and do Caparaó). *Ember-*

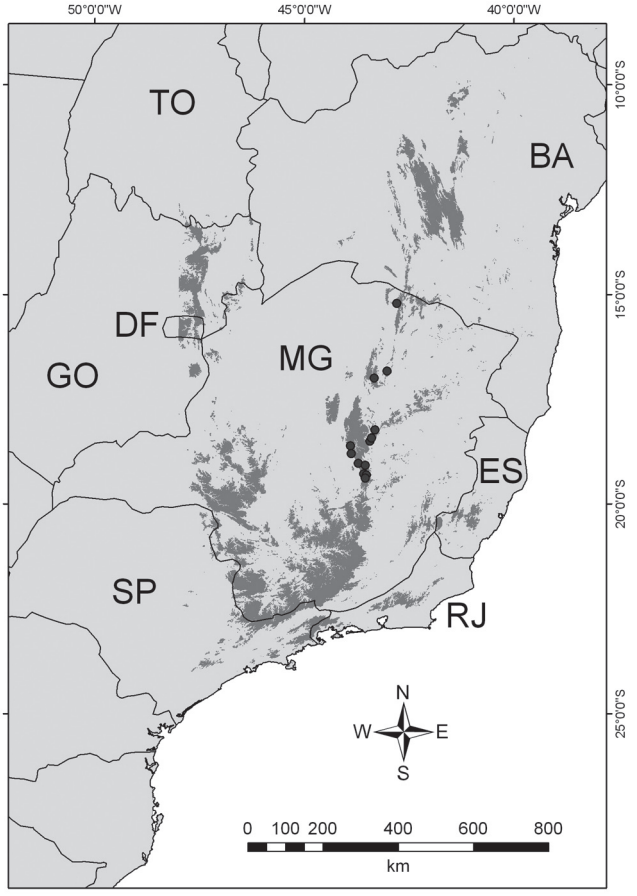

FIGURE 3: Range of *Asthenes luizae*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

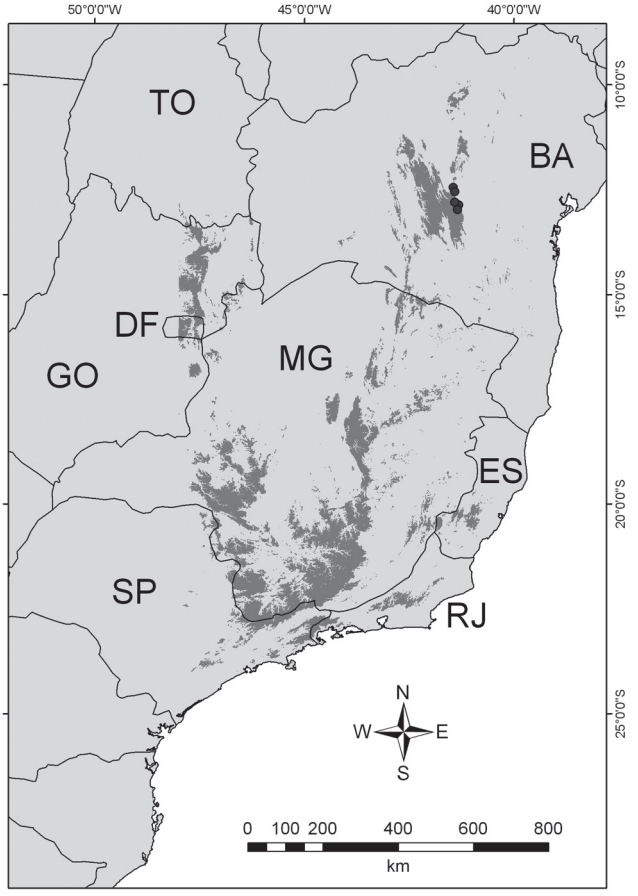

FIGURE 4: Range of *Formicivora grantsaui*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

nagra longicauda also occurs in isolated plateaus covered by cerrado vegetation ("gerais") east of and adjacent to the Espinhaço Range (Carnevalli 1982, Mattos and Sick 1985, Vasconcelos and D'Angelo-Neto 2007). It is noteworthy that this species seems to be expanding its range along the Rio Doce basin due to deforestation (Machado *et al.* 1998, Vasconcelos 2000a). Records of *A. scutatus* and *P. superciliaris* in cerrado vegetation in areas adjacent to serras covered by campos rupestres are also occasional (D'Angelo-Neto and Queiroz 2001, Rodrigues *et al.* 2005, Vasconcelos and D'Angelo-Neto 2007).

The '430 km rule' (Silva and Santos 2005) presented 10 years after the first analysis on the endemic birds of the Cerrado region (Silva 1995a, b) and shortly after the review published by Vasconcelos *et al.* (2003), appears to be an attempt to continue including *P. superciliaris* and *E. longicauda* as Cerrado endemics. Nevertheless, those authors did not realize that records (specimens) for both species in the Morro do Chapéu are more than 500 km distant from the Cerrado boundaries they used (following Ab'Sáber 1977), as recently demonstrated by Lopes (2008) for *P. superciliaris.* In this respect, I agree with Willis (2003) that the lack of specimen and literature checking is a recurrent problem in Neotropical Ornithology. If old specimens of *P. superciliaris* and *E. longicauda* from Morro do Chapéu and Serra da Bocaina (also mentioned in previous literature) had not been overlooked by Silva's analysis (Silva 1995a, b), these species would not have been considered as endemic to the Cerrado, whether or not applying the '430 km rule' (for the records from Morro do Chapéu). Ironically, Silva (1995a, b) mentioned that, in order to complete the first analysis, he visited the institutions where specimens of these two species were collected outside the Cerrado region (AMNH and MZUSP).

The '430 km rule' is inaccurate and biased and hence should be abandoned in future analyses. According to this rule, two other species endemic to the Espinhaço Range could not be considered endemic to the Cerrado: *A. lumachella* and *F. grantsaui* (*see* above). The two species that could be considered endemic to the Cerrado region by applying this rule would be *A. scutatus* and *A. luizae.* Moreover, the application of this rule can either create biogeographic patterns somewhat unrealistic or obscure other interesting ones. For example, an hypothetical species occurring in the entire Cerrado morphoclimatic domain of

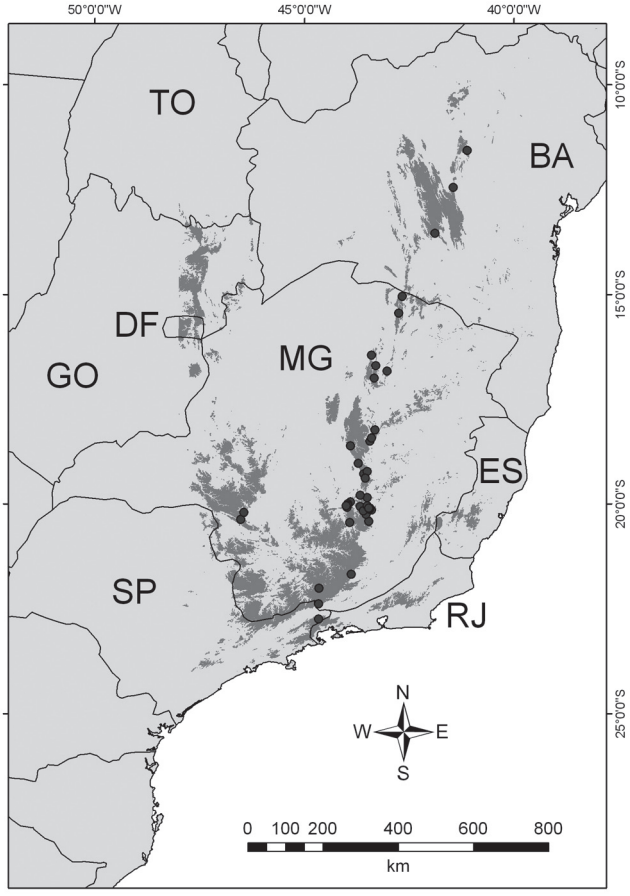

FIGURE 5: Range of *Polystictus superciliaris*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

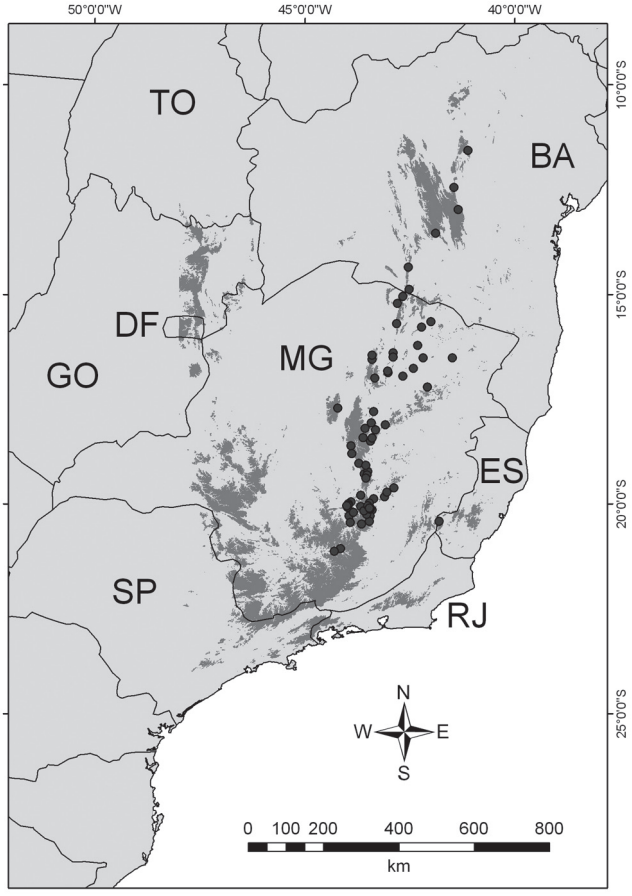

FIGURE 6: Range of *Embernagra longicauda*. Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

Ab'Sáber (1977) could also live in open vegetation types (savanna-like) along the Atlantic coast (up to 430 km from the Cerrado boundaries) and still be considered endemic to the Cerrado region of central South America! On the other hand, *P. superciliaris* and *E. longicauda* occur in the campos rupestres of the Espinhaço Range and also in the campos de altitude of the coastal mountains, a pattern of distribution shared with *Oreophylax moreirae* (Miranda-Ribeiro 1906, 1923, Peixoto-Velho 1923, Holt 1928, Sick 1970, 1985b, 1997, Melo-Júnior *et al.* 1998, Vasconcelos 2000b, Vasconcelos and Melo-Júnior 2001, Vasconcelos *et al.* 2007). It is well known that the campos rupestres of the Espinhaço Range and the campos de altitude of the coastal mountains have different geological histories and biogeographical affinities (King 1956, Segadas-Vianna 1965, Derby 1966, Joly 1970, Menezes and Giulietti 1986, 2000, Petri and Fúlfaro 1986, Giulietti and Pirani 1988, Eiten 1992, Alves and Kolbelk 1994, Harley 1995, Martinelli and Orleans e Bragança 1996, Giulietti *et al.* 1997, Caiafa and Silva 2005, Alves *et al.* 2007), although past-glacial climatic changes have been suggested as a mechanism of faunal and floral interchanges between both regions, based on the distribution patterns of several plant taxa (Rizzini 1979, Menezes and Giulietti 1986, Giulietti and Pirani 1988, Eiten 1992, Pirani *et al.* 1994, Harley 1995, Martinelli and Orleans e Bragança 1996, Giulietti *et al.* 1997, Safford 1999, 2007, Alves *et al.* 2007, Conceição *et al.* 2007, Furlan *et al.* 2007), bees (Silveira and Cure 1993) and of these three bird species (*see* also Vasconcelos *et al.* 2003). When one considers *P. superciliaris* and *E. longicauda* as endemic to the Cerrado, the biogeographic affinities induced by past-glacial climate fluctuations among eastern Brazilian mountains is obscured. Thus, I propose here to consider these species as endemic to the eastern Brazilian mountaintops.

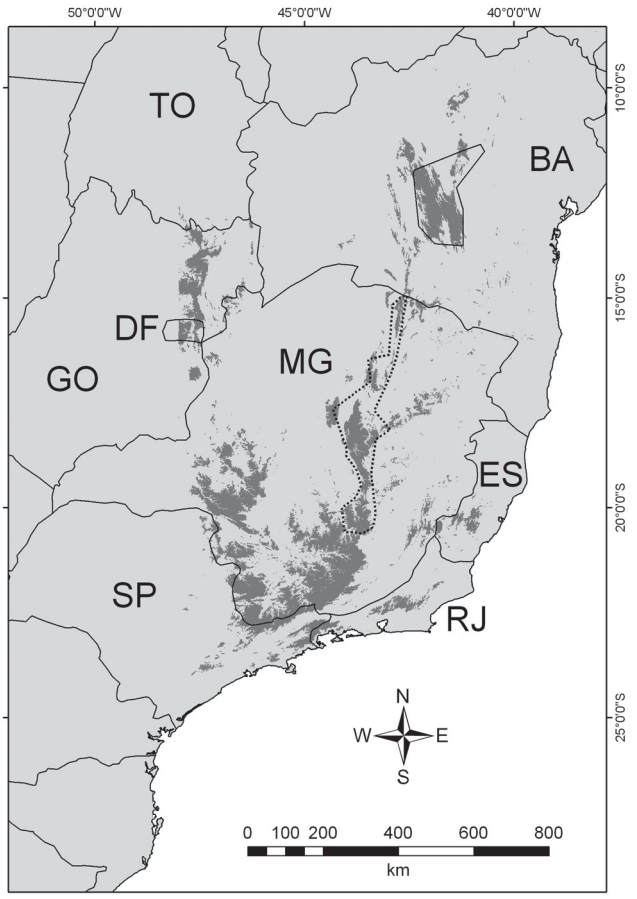

FIGURE 7: Areas of bird endemism in the campos rupestres of the Espinhaço Range: south-central portion (dotted line) and northern portion (continuous line). Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; DF = Distrito Federal; ES = Espírito Santo; GO = Goiás; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo; TO = Tocantins.

Another interesting biogeographical pattern obscured by Silva's (1995a, b) analysis was to consider *A. scutatus,* but not *A. lumachella,* as endemic to the Cerrado region. Both species are strongly associated to the campos rupestres vegetation, independent of the surrounding morphoclimatic domain (Cerrado or Caatinga) and they probably represent a vicariant pair of species (Sick 1985a, 1997). Again, by considering these species as endemic to the eastern Brazilian mountaintops or only endemic to the campos rupestres of the Espinhaço Range (as opposed to considering one endemic to the Cerrado and the other as endemic to the Caatinga – *see* also Cracraft 1985) would highlight a speciation process that may have occurred in the campos rupestres. Thus, I suggest that these six species and *O. moreirae* would be better characterized as endemic to the eastern Brazilian mountaintops rather than as endemic to any morphoclimatic domain (Cerrado, Caatinga or Atlantic Forest). Using a finer analytical scale, we can consider a subset represented by four species as endemic to the campos rupestres of the Espinhaço Range: *A. scutatus, A. lumachella , A. luizae* and *F. grantsaui.* In this respect, the campos rupestres of the Espinhaço Range have two areas of bird endemism (*see* Platnick 1991): the south-central portion (delimited by the ranges of *A. scutatus* and *A. luizae*) and the northern portion (delimited by the ranges of *A. lumachella* and *F. grantsaui*) (Figure 7). If we consider the arguments presented by Cracraft (1985) that an area of endemism is not necessarily defined ecologically on the basis of the habitat, then the recently described forest-dwelling Diamantina Tapaculo (*Scytalopus diamantinensis,* Bornschein *et al.* 2007) would be an additional species restricted to the northern Espinhaço Range area of endemism. Four bird subspecies could also be included in these areas of endemism: *Campylopterus largipennis diamantinensis* (south-central portion), *Phaethornis pretrei schwarti, Colibri delphinae greenewalti* and *Knipolegus nigerrimus hoflingi* (northern portion), but their taxonomic status still require to be evaluated (Ruschi 1962b, 1963c, 1975, Grantsau 1988, Vielliard 1994, Lencioni-Neto 1996,

Stiles 1999, Vasconcelos 2001c, Brammer 2002, Farnsworth and Langham 2004).

Finally, despite the fact that the campos rupestres of the Espinhaço Range have been considered as part of the Cerrado domain by some botanists (Eiten 1992, Ribeiro and Walter 1998, Gottsberger and Silberbauer-Gottsberger 2006) and ornithologists (Silva 1995a, b, 1997, 1998, Silva and Bates 2002, Lopes 2008), I question if they should be considered part of the Cerrado or as an unique biome (*see* Joly 1970, Por 2005). First, the campos rupestres of the Espinhaço Range does not occur entirely inside the Cerrado region, but in contact zones between the Cerrado and the Atlantic Forest (southern Espinhaço) as well as in transition zones of the Caatinga, the Cerrado and the Atlantic Forest (central and northern Espinhaço) (Giulietti and Pirani 1988, Ab'Sáber 1990, Harley 1995, Giulietti *et al.* 1997, Vasconcelos and D'Angelo-Neto 2007). Second, the campos rupestres have a typical flora, with many endemic taxa (Menezes and Giulietti 1986, Giulietti and Pirani 1988, Giulietti *et al.* 1997) and with different pollination syndromes (*see* discussion in Vasconcelos and Lombardi 2001). The flora of the campos rupestres of the Espinhaço Range has biogeographical affinities with those from the Tepuis, coastal restingas, central Brazilian serras and campos de altitude of the coastal mountains (Giulietti *et al.* 1987, 1997, Giulietti and Pirani 1988, Giulietti and Hensold 1990, Pirani *et al.* 1994, Harley 1995, Lohmann and Pirani 1996, Safford 1999, Menezes and Giulietti 2000, Nonato 2005, van den Berg and Azevedo 2005, Alves *et al.* 2007). Furthermore, areas of campos rupestres also occur in different morphoclimatic domains, such as in the Amazonia (*e.g.,* Serra dos Carajás – *see* Porto and Silva 1989, Silva *et al.* 1996), Chiquitano Dry Forest (*e.g.,* Serranía de Santiago – *see* Parker *et al.* 1993), and in the Cerrado (*e.g.,* Chapada dos Veadeiros – *see* Eiten 1992). The campos rupestres thus seems to represent a biological unit with a long and independent evolutionary history that has to be singled out from both ecological and biogeographical perspectives. In doing this we will be making an important advance towards clarifying the historical relationships of the biota of these South American serras and plateaus, including the old Tepuis from northern South America.

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APPENDIX

Localities of records of *Augastes scutatus*, *Augastes lumachella*, *Asthenes luizae*, *Formicivora grantsaui*, *Polystictus superciliaris* and *Embernagra longicauda*. Brazilian states: BA = Bahia; ES = Espírito Santo; MG = Minas Gerais; RJ = Rio de Janeiro; SP = São Paulo. Acronymous of institutions are presented in Methods.

Locality	State	Coordinates	Sources
Augastes scutatus			
Serra do Pau D'Arco, Santo Antônio do Retiro	MG	15°03'S-42°40'W	DZUFMG
Serra do Barão, Grão Mogol	MG	16°24'S-42°54'W	Ruschi (1962a, 1963a, b), Vielliard (1994), Sick (1997), Abreu (2006), Vasconcelos and D'Angelo-Neto (2007), MBML
Sítio Recanto, Grão Mogol	MG	16°33'S-43°24'W	Vasconcelos and D'Angelo-Neto (2007)
Campina do Bananal, Botumirim	MG	16°50'S-43°02'W	Abreu (2006), Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Serra Resplandecente, Itacambira	MG	17°00'S-43°20'W	Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Serra do Cabral, Joaquim Felício	MG	17°43'S-44°13'W	DZUFMG
Posto Seabra and surroundings	MG	17°48'S-43°22'W	Vasconcelos and D'Angelo-Neto (2007)
Serra do Ambrósio, Pedra Menina	MG	18°06'S-43°02'W	DZUFMG
APA Felício, Felício dos Santos	MG	18°10'S-43°17'W	Alves *et al.* (2007)
Diamantina and surroundings	MG	18°12'S-43°34'W	Gounelle (1909), Ruschi (1951, 1962a, 1963a, b, 1982), Pinto (1952), Sick (1997), Abreu (2006), AMNH, MNRJ
Rio Preto State Park, São Gonçalo do Rio Preto	MG	18°14'S-43°19'W	Abreu (2006), DZUFMG
Pico do Itambé State Park, Serro	MG	18°24'S-43°22'W	Vasconcelos (2002), Bencke *et al.* (2006)
Serra do Gavião, Capivari, Serro	MG	18°26'S-43°25'W	Cordeiro *et al.* (1998), Vasconcelos (1999b), Bencke *et al.* (2006)
Três Barras, Serro	MG	18°30'S-43°26'W	DZUFMG
Serra do Barro Preto, Gouveia	MG	18°37'S-43°54'W	Pers. obs.
Brumas do Espinhaço, Santana do Riacho	MG	19°02'S-43°43'W	DZUFMG
Serra do Intendente, Conceição do Mato Dentro	MG	19°05'S-43°33'W	Cordeiro *et al.* (1998)
Serra do Cipó, Santana do Riacho/Jaboticatubas	MG	Between 19°02'S-43°25'W and 19°25'S-43°43'W	Ruschi (1962a, 1963a, b, 1982), Grantsau (1967, 1968), Sazima (1977), Sazima and Sazima (1990), Pearman (1990), Willis and Oniki (1991), Vielliard (1994), Sick (1997), Andrade *et al.* (1998), Cordeiro *et al.* (1998), Vasconcelos (1999b), Melo-Júnior *et al.* (2001), Vasconcelos and Lombardi (2001), Vasconcelos *et al.* (2001), Abreu (2006), Costa and Rodrigues (2007), AMNH, DZUFMG, MBML, MNRJ
Rio Cipó Valley, Santana do Riacho	MG	19°22'S-43°35'W	Rodrigues *et al.* (2005)
Serra da Piedade, Caeté/Sabará	MG	19°48'S-43°40'W	Ruschi (1962a, 1963b, 1982), Vielliard (1994), Vasconcelos (1999b), Vasconcelos *et al.* (1999), Vasconcelos and Lombardi (2001), Willis (2002), Abreu (2006), MBML
Serra da Água Limpa, Barão de Cocais	MG	19°51'S-43°30'W	F. F. Vasconcelos (pers. com. 2005)
Serra do Rola-Moça, Brumadinho/Nova Lima	MG	20°02'S-43°59'W	Pers. obs.
Serra da Gandarela, Rio Acima	MG	20°04'S-43°40'W	DZUFMG
Morro do Chapéu, Nova Lima	MG	20°05'S-43°57'W	Abreu (2006)
Retiro das Pedras, Nova Lima	MG	20°05'S-43°59'W	Vasconcelos *et al.* (1999)
Serra do Caraça, Catas Altas/Santa Bárbara	MG	Between 20°03'S-43°26'W and 20°08'S-43°31'W	Gounelle (1909), Ruschi (1951, 1962a, 1963b, 1982), Grantsau (1967, 1968, 1988), Vielliard (1994), Sick (1997), Melo-Júnior *et al.* (1998), Vasconcelos (1999b, 2000b, 2001a), Vasconcelos and Lombardi (2001), Vasconcelos and Melo-Júnior (2001), Abreu (2006), Alves *et al.* (2007), AMNH, DZUFMG, MBML, MNRJ, MPEG, MZUSP, SG
Fazenda Alegria, Mariana	MG	20°09'S-43°24'W	Ruschi (1963b), Vielliard (1994), Abreu (2006), AMNH, MBML
Pico do Monge, Serra do Capanema, Itabirito	MG	20°10'S-43°36'W	Pers. obs.

Locality	State	Coordinates	Sources
Serra Santa, Itabirito	MG	20°12'S-43°51'W	Grantsau (1967, 1968), Abreu (2006), SG
Serra do Batatal, Ouro Preto	MG	20°15'S-43°32'W	Pers. obs.
Serra da Moeda, Moeda	MG	20°18'S-43°56'W	Vasconcelos (1999b), Vasconcelos *et al.* (1999)
Pico do Itacolomi, Ouro Preto	MG	20°25'S-43°28'W	Gounelle (1909), Ruschi (1951, 1962a, 1963a, b, 1982), Pinto (1952), Andrade (1998), Vasconcelos *et al.* (1999)
Serra do Mascate, Congonhas	MG	20°27'S-43°55'W	DZUFMG
Serra de Ouro Branco, Ouro Branco	MG	20°29'S-43°39'W	Abreu (2006), MNRJ
Augastes lumachella			
Dias Coelho	BA	11°29'S-40°49'W	Ruschi (1962a)
Izabel Dias	BA	11°30'S-41°00'W	Ruschi (1962a)
Morro do Chapéu	BA	11°34'S-41°07'W	Ruschi (1962a, 1963a, b), Mattos and Sick (1985), Vielliard (1994), Sick (1997), Almeida and Raposo (1999), Funch (1999), Parrini *et al.* (1999), Abreu (2006), AMNH
Paramirim	BA	12°01'S-42°15'W	Ruschi (1962a, 1963b), Almeida and Raposo (1999)
Chapada Diamantina National Park, Palmeiras/Lençóis	BA	12°27'S-41°27'W	Almeida and Raposo (1999), Funch (1999), Parrini *et al.* (1999), Machado *et al.* (2003), Machado (2005)
Andaraí	BA	12°48'S-41°21'W	Ruschi (1962a, 1963a, b), Sick (1997), Almeida and Raposo (1999)
Catinguiba	BA	12°50'S-41°20'W	Ruschi (1962a)
Beiçudo	BA	12°51'S-41°22'W	Ruschi (1962a)
Igatu	BA	12°52'S-41°19'W	Ruschi (1962a, 1963a, b), Grantsau (1967, 1968), Vielliard (1994), MZUSP
Mucugê and surroundings	BA	12°59'S-41°21'W	Ruschi (1962a, 1963a, b), Vielliard (1994), Almeida and Raposo (1999), Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Machado (2005), Machado *et al.* (2007)
Roncador/Gerais de Cascavel	BA	13°08'S-41°21'W	Ruschi (1962a)
Piatã	BA	13°09'S-41°45'W	Ruschi (1962a, 1963b), Vielliard (1994), Almeida and Raposo (1999)
Morro do Ouro	BA	13°15'S-42°11'W	Ruschi (1962a)
Serra do Cocal	BA	13°15'S-41°44'W	Ruschi (1962a)
Serra das Almas, Rio de Contas	BA	13°33'S-41°53'W	Almeida and Raposo (1999), Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001)
Espigão do Taquari	BA	13°36'S-41°27'W	Ruschi (1962a)
Barra da Estiva	BA	13°40'S-41°17'W	Ruschi (1962a, 1963a, b), Vielliard (1994), Sick (1997), Almeida and Raposo (1999), Abreu (2006)
Asthenes luizae			
Serra da Formosa, Monte Azul	MG	15°13'S-42°48'W	Pers. obs.
Campina do Bananal, Botumirim	MG	16°50'S-43°02'W	Vasconcelos *et al.* (2002, 2008), Vasconcelos and D'Angelo-Neto (2007), DZUFMG, MHNT
Serra Resplandecente, Itacambira	MG	17°00'S-43°20'W	Vasconcelos and D'Angelo-Neto (2007), Vasconcelos *et al.* (2008), DZUFMG
Rio Preto State Park, São Gonçalo do Rio Preto	MG	18°14'S-43°19'W	Bencke *et al.* (2006)
Pico do Itambé State Park, Serro	MG	18°24'S-43°22'W	Vasconcelos (2002), Bencke *et al.* (2006)
Serra do Gavião, Capivari, Serro	MG	18°26'S-43°25'W	Cordeiro *et al.* (1998), Vasconcelos *et al.* (2002), Bencke *et al.* (2006)
Três Barras, Serro	MG	18°30'S-43°26'W	Vasconcelos *et al.* (2008), DZUFMG
Serra do Barro Preto, Gouveia	MG	18°37'S-43°54'W	Vasconcelos *et al.* (2008), DZUFMG
Serra Talhada, Santana do Pirapama	MG	18°48'S-43°53'W	Cordeiro *et al.* (1998)
Brumas do Espinhaço, Santana do Riacho	MG	19°02'S-43°43'W	Pers. obs.
Serra do Intendente, Conceição do Mato Dentro	MG	19°05'S-43°33'W	Cordeiro *et al.* (1998)
Alto da Boa Vista, Serra do Cipó, Santana do Riacho	MG	19°17'S-43°35'W	Pearman (1990), Vielliard (1990), Melo-Júnior *et al.* (2001), Vasconcelos *et al.* (2008), DZUFMG, MZUSP
Travessão waterfalls, Serra do Cipó National Park	MG	19°19'S-43°31'W	Andrade *et al.* (1998)
Ribeirão da Farofa, Serra do Cipó, Jaboticatubas	MG	19°23'S-43°33'W	Cordeiro *et al.* (1998)

Locality	State	Coordinates	Sources
Formicivora grantsaui			
Chapada Diamantina National Park, Palmeiras/Lençóis	BA	12°27'S-41°27'W	Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Gonzaga *et al.* (2007)
Serra do Ribeirão, Lençóis	BA	12°33'S-41°25'W	Gonzaga *et al.* (2007)
Vale do Paty	BA	12°48'S-41°25'W	Gonzaga *et al.* (2007)
Igatu	BA	12°52'S-41°19'W	Gonzaga *et al.* (2007)
Vale do Rio Cumbuca, Mucugê	BA	12°58'S-41°21'W	Gonzaga *et al.* (2007), MNRJ, MPEG, MZUSP
Polystictus superciliaris			
Morro do Chapéu	BA	11°34'S-41°07'W	Zimmer (1955), Ridgely and Tudor (1994), Sick (1997), Funch (1999), Vasconcelos *et al.* (2003), AMNH
Chapada Diamantina National Park, Palmeiras/Lençóis	BA	12°27'S-41°27'W	Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Vasconcelos *et al.* (2003)
Serra das Almas, Rio de Contas	BA	13°33'S-41°53'W	Pers. obs.
Serra do Pau D'Arco, Santo Antônio do Retiro	MG	15°03'S-42°40'W	Pers. obs.
Campos Geraes	MG	15°27'S-42°45'W	Wied (1831), AMNH
Chapada do Catuni, Francisco Sá/Grão Mogol	MG	16°27'S-43°24'W	D'Angelo-Neto and Queiroz (2001), Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Rio Congonhas, Grão Mogol	MG	16°42'S-43°18'W	Vasconcelos and D'Angelo-Neto (2007)
Campina do Bananal, Botumirim	MG	16°50'S-43°02'W	Vasconcelos and D'Angelo-Neto (2007)
Serra Resplandecente, Itacambira	MG	17°00'S-43°20'W	Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Rio Preto State Park, São Gonçalo do Rio Preto	MG	18°14'S-43°19'W	DZUFMG
Pico do Itambé State Park, Serro	MG	18°24'S-43°22'W	Vasconcelos (2002), Bencke *et al.* (2006)
Serra do Gavião, Capivari, Serro	MG	18°26'S-43°25'W	Cordeiro *et al.* (1998), Vasconcelos (1999b), Vasconcelos *et al.* (2003), Bencke *et al.* (2006)
Três Barras, Serro	MG	18°30'S-43°26'W	Pers. obs.
Serra do Barro Preto, Gouveia	MG	18°37'S-43°54'W	DZUFMG
Brumas do Espinhaço, Santana do Riacho	MG	19°02'S-43°43'W	Pers. obs.
Serra do Cipó, Santana do Riacho/Jaboticatubas	MG	Between 19°02'S-43°25'W and 19°25'S-43°43'W	Mattos and Sick (1985), Pearman (1990), Ridgely and Tudor (1994), Sick (1997), Willis and Oniki (1991), Cordeiro *et al.* (1998), Vasconcelos (1999b), Melo-Júnior *et al.* (2001), Vasconcelos *et al.* (2003), DZUFMG
Serra da Piedade, Caeté/Sabará	MG	19°48'S-43°40'W	Sick (1997), Vasconcelos (1999b), Vasconcelos *et al.* (1999, 2003), DZUFMG
Serra da Água Limpa, Barão de Cocais	MG	19°51'S-43°30'W	Pers. obs.
Serra do Curral, Belo Horizonte/Nova Lima	MG	19°57'S-43°54'W	Vasconcelos and Lombardi (1996), Vasconcelos (1999b, 2007), Vasconcelos *et al.* (1999, 2003)
APE Barreiro, Belo Horizonte	MG	20°00'S-43°58'W	Vasconcelos *et al.* (1999, 2003), DZUFMG
APE Mutuca, Nova Lima	MG	20°02'S-43°58'W	Vasconcelos *et al.* (1999, 2003)
Estrada de Quebra Ossos, Santa Bárbara	MG	20°03'S-43°30'W	Vasconcelos *et al.* (2003), DZUFMG
Serra do Rola-Moça, Brumadinho/Nova Lima	MG	20°03'S-44°00'W	Hoffmann *et al.* (2007)
Serra da Gandarela, Rio Acima	MG	20°04'S-43°40'W	Sick (1997), Vasconcelos *et al.* (2003), DZUFMG
Retiro das Pedras, Nova Lima	MG	20°05'S-43°59'W	Vasconcelos *et al.* (1999, 2003)
Serra do Caraça, Catas Altas/Santa Bárbara	MG	Between 20°03'S-43°26'W and 20°08'S-43°31'W	Carnevalli (1980), Sick (1997), Vasconcelos (1999b, 2000b), Vasconcelos and Melo-Júnior (2001), Vasconcelos *et al.* (2003), AMNH, DZUFMG, MZUSP
Fazenda Alegria, Mariana	MG	20°09'S-43°24'W	DZUFMG
Pico do Monge, Serra do Capanema, Itabirito	MG	20°10'S-43°36'W	Vasconcelos *et al.* (2003), DZUFMG
Serra da Canastra, São Roque de Minas	MG	20°12'S-46°27'W	Silveira (1998), Vasconcelos (1999b), Vasconcelos *et al.* (2003)
Serra do Batatal, Ouro Preto	MG	20°15'S-43°32'W	Sick (1997), Vasconcelos *et al.* (2003), DZUFMG, MNRJ
Chapadãozinho, São José do Barreiro	MG	20°22'S-46°31'W	Vasconcelos *et al.* (2003), MHNT
Pico do Itacolomi, Ouro Preto	MG	20°25'S-43°28'W	Andrade (1998), Vasconcelos *et al.* (1999, 2003)
Serra do Mascate, Congonhas	MG	20°27'S-43°55'W	DZUFMG

Locality	State	Coordinates	Sources
Serra do Ibitipoca, Lima Duarte	MG	21°41'S-43°53'W	Vasconcelos *et al.* (2003), Pacheco *et al.* (2008)
Serra do Papagaio, Aiuruoca	MG	22°01'S-44°39'W	Vasconcelos (1999a, 2008), Vasconcelos *et al.* (2003)
Campos do Itatiaia, Itatiaia	MG/RJ	22°23'S-44°40'W	Vasconcelos *et al.* (2003)
Serra da Bocaina	SP/RJ	22°45'S-44°40'W	Ridgely and Tudor (1994), Sick (1997), Vasconcelos *et al.* (2003), MZUSP
Embernagra longicauda			
Morro do Chapéu	BA	11°34'S-41°07'W	O'Brien (1968), Carnevalli (1982), Mattos and Sick (1985), Ridgely and Tudor (1989), Sick (1997), Machado *et al.* (1998), Funch (1999), Vasconcelos *et al.* (2003), AMNH
Chapada Diamantina National Park, Palmeiras/Lençóis	BA	12°27'S-41°27'W	Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Vasconcelos (2001b), Vasconcelos *et al.* (2003)
Mucugê and surroundings	BA	12°59'S-41°21'W	Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Vasconcelos *et al.* (2003)
Serra das Almas, Rio de Contas	BA	13°33'S-41°53'W	Funch (1999), Parrini *et al.* (1999), Carvalhaes (2001), Vasconcelos *et al.* (2003)
Brejinho das Ametistas, Caetité	BA	14°21'S-42°32'W	Pers. obs.
Jacaraci	BA	14°53'S-42°31'W	Pers. obs.
Serra do Pau D'Arco, Santo Antônio do Retiro	MG	15°03'S-42°40'W	Vasconcelos *et al.* (2003), DZUFMG
Serra da Formosa, Monte Azul	MG	15°13'S-42°48'W	Pers. obs.
Serra da Mombuca, Divisópolis	MG	15°39'S-42°00'W	Carnevalli (1982), Mattos and Sick (1985), Machado *et al.* (1998)
Gerais de Santana, Porteirinha	MG	15°42'S-42°49'W	Pers. obs.
Chapada de Taiobeiras	MG	15°47'S-42°13'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Chapada de Salinas	MG	16°13'S-42°19'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Grão Mogol and surroundings	MG	16°24'S-42°54'W	Vasconcelos and D'Angelo-Neto (2007)
Chapada do Catuni, Francisco Sá/Grão Mogol	MG	16°27'S-43°24'W	D'Angelo-Neto and Queiroz (2001), Vasconcelos *et al.* (2003), Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Serra do Barão, Grão Mogol	MG	16°30'S-42°54'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003), Vasconcelos and D'Angelo-Neto (2007)
Coronel Murta	MG	16°31'S-42°11'W	Carnevalli (1982), Vasconcelos *et al.* (2003)
Itaobim	MG	16°31'S-41°29'W	Carnevalli (1982), Vasconcelos *et al.* (2003)
Sítio Recanto, Grão Mogol	MG	16°33'S-43°24'W	Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Chapada de São Domingos	MG	16°46'S-42°25'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Campina do Bananal, Botumirim	MG	16°50'S-43°02'W	Vasconcelos *et al.* (2003), Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Botumirim and surroundings	MG	16°52'S-43°01'W	Vasconcelos and D'Angelo-Neto (2007)
Berilo	MG	16°57'S-42°40'W	Carnevalli (1982), Vasconcelos *et al.* (2003)
Serra Resplandecente, Itacambira	MG	17°00'S-43°20'W	Carnevalli (1982), Vasconcelos *et al.* (2003), Vasconcelos and D'Angelo-Neto (2007), DZUFMG
Minas Novas	MG	17°13'S-42°05'W	Carnevalli (1982), Vasconcelos *et al.* (2003)
Serra do Cabral, Joaquim Felício	MG	17°43'S-44°13'W	Vasconcelos *et al.* (2006), DZUFMG
Posto Seabra and surroundings	MG	17°48'S-43°22'W	Vasconcelos and D'Angelo-Neto (2007)
Serra dos Poções, Couto de Magalhães	MG	18°04'S-43°25'W	Carnevalli (1982), Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Pedra Menina	MG	18°06'S-43°08'W	DZUFMG
Diamantina and surroundings	MG	18°12'S-43°34'W	Carnevalli (1982), Mattos and Sick (1985), Vasconcelos *et al.* (2003)
Rio Preto State Park, São Gonçalo do Rio Preto	MG	18°14'S-43°19'W	DZUFMG
Pico do Itambé State Park, Serro	MG	18°24'S-43°22'W	Vasconcelos (2002), DZUFMG
Datas	MG	18°25'S-43°37'W	Carnevalli (1982), Vasconcelos *et al.* (2003)

Locality	State	Coordinates	Sources
Serra do Gavião, Capivari, Serro	MG	18°26'S-43°25'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Três Barras, Serro	MG	18°30'S-43°26'W	Pers. obs.
Serra do Barro Preto, Gouveia	MG	18°37'S-43°54'W	Pers. obs.
Serra Talhada, Santana do Pirapama	MG	18°48'S-43°53'W	Cordeiro *et al.* (1998)
Brumas do Espinhaço, Santana do Riacho	MG	19°02'S-43°43'W	DZUFMG
Serra do Intendente, Conceição do Mato Dentro	MG	19°05'S-43°33'W	Cordeiro *et al.* (1998), Vasconcelos *et al.* (2003)
Serra do Cipó, Santana do Riacho/Jaboticatubas	MG	Between 19°02'S-43°25'W and 19°25'S-43°43'W	Carnevalli (1982), Mattos and Sick (1985), Ridgely and Tudor (1989), Pearman (1990), Willis and Oniki (1991), Andrade *et al.* (1998), Cordeiro *et al.* (1998), Machado *et al.* (1998), Melo-Júnior *et al.* (2001), Vasconcelos (2001b), Vasconcelos *et al.* (2003), Freitas and Rodrigues (2008), DZUFMG
Antônio Dias	MG	19°37'S-42°53'W	Machado and Lamas (1996), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Nova Era	MG	19°43'S-43°03'W	Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Serra da Piedade, Caeté/Sabará	MG	19°48'S-43°40'W	Sick (1997), Machado *et al.* (1998), Vasconcelos *et al.* (1999, 2003)
Bela Vista de Minas	MG	19°50'S-43°06'W	Machado *et al.* (1998), Vasconcelos *et al.* (2003)
EPDA-Peti, Santa Bárbara/São Gonçalo do Rio Abaixo	MG	19°53'S-43°22'W	Machado *et al.* (1998), Vasconcelos (2001b), Vasconcelos *et al.* (2003), DZUFMG
Serra do Curral/Mangabeiras Park, Belo Horizonte/Nova Lima	MG	19°57'S-43°54'W	Vasconcelos and Lombardi (1996), Machado *et al.* (1998), Vasconcelos (1999b, 2001b, 2007), Vasconcelos *et al.* (2003)
Fazenda Bocaina, Santa Bárbara	MG	19°59'S-43°28'W	Vasconcelos (2000a), DZUFMG, UFPE
APE Barreiro, Belo Horizonte	MG	20°00'S-43°58'W	Vasconcelos *et al.* (1999, 2003), Vasconcelos (2001b), MCN
APE Mutuca, Nova Lima	MG	20°02'S-43°58'W	Vasconcelos *et al.* (1999, 2003), Vasconcelos (2001b), MCN
Estrada de Quebra Ossos, Santa Bárbara	MG	20°03'S-43°30'W	Vasconcelos *et al.* (2003), DZUFMG
Serra do Rola-Moça, Brumadinho/Nova Lima	MG	20°03'S-44°00'W	Pers. obs.
Serra da Gandarela, Rio Acima	MG	20°04'S-43°40'W	Mattos and Sick (1985), Sick (1997), Machado *et al.* (1998), Vasconcelos *et al.* (2003), DZUFMG
Retiro das Pedras, Nova Lima	MG	20°05'S-43°59'W	Vasconcelos *et al.* (1999, 2003), DZUFMG
Serra do Caraça, Catas Altas/Santa Bárbara	MG	Between 20°03'S-43°26'W and 20°08'S-43°31'W	Carnevalli (1980, 1982), Mattos and Sick (1985), Sick (1997), Machado *et al.* (1998), Melo-Júnior *et al.* (1998), Vasconcelos (2000b, 2001b), Vasconcelos and Melo-Júnior (2001), Vasconcelos *et al.* (2003), Vasconcelos and Silva (2003), DZUFMG, MCP
Fazenda Alegria, Mariana	MG	20°09'S-43°24'W	Pers. obs.
Pico do Monge, Serra do Capanema, Itabirito	MG	20°10'S-43°36'W	Vasconcelos *et al.* (2003), DZUFMG
Serra Santa, Itabirito	MG	20°12'S-43°51'W	Vasconcelos *et al.* (2003), MZUSP
Serra do Batatal, Ouro Preto	MG	20°15'S-43°32'W	Mattos and Sick (1985), Vasconcelos *et al.* (2003)
Fazenda Taveira, Mariana	MG	20°17'S-43°27'W	Mattos and Sick (1985), Sick (1997), Machado *et al.* (1998), Vasconcelos *et al.* (2003), MNRJ
Serra da Moeda, Moeda	MG	20°17'S-43°57'W	Mattos and Sick (1985), Sick (1997), Machado *et al.* (1998), Vasconcelos *et al.* (1999, 2003)
Pico do Itacolomi, Ouro Preto	MG	20°25'S-43°28'W	Mattos and Sick (1985), Andrade (1998), Vasconcelos (2001b), Vasconcelos *et al.* (1999, 2003)
Serra do Caparaó	MG/ES	20°25'S-41°48'W	Vasconcelos (2003), Vasconcelos *et al.* (2003)
Serra do Mascate, Congonhas	MG	20°27'S-43°55'W	DZUFMG
Serra de Ouro Branco, Ouro Branco	MG	20°29'S-43°39'W	Mattos and Sick (1985), Machado *et al.* (1998), Vasconcelos *et al.* (2003)
Serra de São José, Tiradentes	MG	21°04'S-44°09'W	Machado *et al.* (1998), Vasconcelos (2001b), Vasconcelos *et al.* (2003)
Serra do Lenheiro, São João Del Rei	MG	21°08'S-44°18'W	Machado *et al.* (1998), Vasconcelos *et al.* (2003)