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ARTIGO/ARTICLE

First record of *Augastes scutatus* for Bahia refines the location of a purported barrier promoting speciation in the Espinhaço Range, Brazil

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ABSTRACT: First record of *Augastes scutatus* for Bahia refines the location of a purported barrier promoting speciation in the Espinhaço Range, Brazil. We present the first records of *Augastes scutatus* for the state of Bahia, whose range now is only 150 km away from that of its purported allospecies (*A. lumachella*). Based on geological evidence and vegetation cover, we suggest that the possible vicariant barrier that led to the speciation of these allospecies would be represented by the Caetité plateau (covered mainly by Cerrado) and the lowland areas of the Contas river valley (covered mainly by Caatinga), both in southern Bahia. Possibly, the isolation of those two species in different sectors of the Espinhaço Range (northern and southern parts) is related to climatic changes of the Plio-Pleistocene, which should led populations of an ancestral lineage to take refuge in these higher areas during one or more interglacial periods.

KEY-WORDS: *Augastes*; biogeography; *campos rupestres*; geographical barrier; vicariance.

INTRODUCTION

The genus *Augastes* Gould, 1849 is represented by three species: *A. scutatus* (Temminck, 1824), *A. lumachella* (Lesson, 1838) and *A. geoffroyi* (Bourcier, 1843) (Schuchmann 1999). *Augastes scutatus* and *A. lumachella* are considered possible allospecies, both restricted to the *campos rupestres* vegetation in the highlands of the Espinhaço Range, eastern Brazil (Silva 1995, Sick 1997, Vasconcelos 2008). *Augastes scutatus* is known to be restricted to the central and southern portions of the Espinhaço Range (in Minas Gerais state), while *A. lumachella* is distributed in the northern section of this mountain range (Chapada Diamantina region and northern mountains in Bahia state; Ruschi 1962, 1963, Grantsau 1967, 1988, Silva 1995, Sick 1997, Schuchmann 1999, Vasconcelos 2008, Souza *et al*. 2009). Both species of *Augastes* endemic to the Espinhaço Range are tightly linked to the *campos rupestres* flora (see Vasconcelos 2011), feeding on nectar and using material to build nests from various plant species endemic or typical of this vegetation type (Ruschi 1962, Grantsau 1967, 1988, Vasconcelos & Lombardi 2001, Vasconcelos *et al*. 2001, Machado *et al.* 2003, 2007, Rodrigues 2011). *Augastes geoffroyi* ranges in the Andean region, from Bolivia to Colombia and Venezuela (Ruschi 1963, Fjeldså & Krabbe 1990, Schuchmann 1999). Nevertheless, there are doubts whether this species should be considered a representant of the genus *Augastes* or the genus *Schistes* (Schuchmann 1999), thus its evolutionary affinities still needs to be better studied under a phylogenetic perspective (see Abreu 2006).

The mountains of the Espinhaço Range consist of an ancient unit belonging to the predominantly quartzitic Espinhaço Supergroup, which was deposited in a continental rift (starting around 1,752 million years ago) and later metamorphosed and uplifted in the Brasiliano orogeny, between 650 and 550 million years ago (Schobbenhaus 1996, Barbosa *et al*. 2003, Pedreira & De Waele 2008). With the tectonic events that resulted in the fragmentation of Gondwanaland in the Mesozoic, the region suffered differential movement and sag, with uplift of neighboring blocks. This movement was continued, but with less intensity, throughout the Cenozoic (Saadi 1993, 1995, Uhlein *et al.* 1995, Horn *et al.* 1996, Potter 1997, Ab'Sáber 2000, Cruz & Alkmim 2007, Knauer 2007, Caxito *et al*. 2008).

Considering both putative allospecies in eastern Brazilian mountains (*A. scutatus* and *A. lumachella*), Silva

(1995) suggested that a vicariant event in the Espinhaço Range region would be the responsible for their speciation. Meanwhile, until recently, there was a gap of more than 300 km between the ranges of these two species of *Augastes* in the Espinhaço Range (between Grão Mogol, Minas Gerais, and the southern Chapada Diamantina, Bahia). Thus, it was not possible to infer what would be the geographical barrier that led to this probable vicariant event. Later, Vasconcelos (2008) collected specimens of *A. scutatus* in the extreme northern Minas Gerais (Serra do Pau D'Arco), and this gap was reduced to 180 km. Here, we report on the northernmost record to date for *A. scutatus*, which provides insights on the purported vicariant barrier responsible for the speciation of both *Augastes* species in eastern Brazil.

MATERIAL AND METHODS

Between 4 and 7 January 2011, we collected bird specimens at Morro do Chapéu (between 14°52'44"S/ 42°30'15"W and 14°54'11"S / 42°31'33"W), a mountain located in Jacaraci municipality, southern Bahia state. Specimens were collected with air-compressed carbines, prepared as study skins and deposited at the ornithological collections of the Department of Zoology of the Universidade Federal de Minas Gerais (DZUFMG) and of the Museu de Ciências Naturais da Pontifícia Universidade Católica de Minas Gerais (MCNA), both in Belo Horizonte, Minas Gerais, Brazil.

RESULTS AND DISCUSSION

On 5 January, a male of *A. scutatus* (DZUFMG 6668) was collected in a *campo rupestre* area at Morro do Chapéu (14°53'44"S; 42°30'59"W; elevation: 1,325 m). On the next day, another male (MCNA 1314) was collected on the mountain-top (14°54'00"S; 42°31'05"W; elevation: 1,430 m). These are the first records of this species in Bahia state, narrowing the gap between its range and that of its northern supposed allospecies (*A. lumachella*) to only about 150 km (Figure 1).

Other species of plants and amphibians also share a similar pattern of distribution of these two putative hummingbird allospecies, whereby a species occurs in the central-southern portion (in Minas Gerais state) while the other is distributed in the northern section (in Chapada Diamantina region, Bahia state) of the Espinhaço Range (Harley 1995, Lugli & Haddad 2006a, b, Leite *et al.* 2008). Some authors (e.g., Rapini *et al.* 2008, Ribeiro *et al.* 2008) admit that the disjunction between the *campos rupestres* of Minas Gerais and Bahia would be of 300 km, with a lowland barrier imposed by the valleys of the Contas, Pardo and Jequitinhonha rivers, all covered with xerophytic Caatinga and other semi-deciduous forest vegetations. These dry valleys would promote the vicariance of these taxa inside the Espinhaço Range and also prevent floristic and faunistic exchange between the central-southern (Minas Gerais) and northern (Bahia) sections of this mountain range (e.g., Harley 1988, Borba *et al.* 2001, Lugli & Haddad 2006a, b, Rapini *et al.* 2008, Ribeiro *et al.* 2008). Nevertheless, the recent records of *A. scutatus* in southern Bahia show that this possible disjunction is only half (c. 150 km) of the original presumed distance, and would include only the Contas River valley.

It is also important to stress that there is a small plateau in the Caetité region (between 800 and 1,100 m), north of Jacaraci, which could represent a stepping-stone linking both sections of the Espinhaço highlands (Figure 1). Meanwhile, this plateau is predominantly covered by typical Cerrado (savannah), and there are only small patches of rocky outcrops around the village of Brejinho das Ametistas (with less than 3 ha each) with several typical Caatinga plants (including several cacti), but only a few typical montane plant species, such as *Vellozia* sp. (M. F. V. *pers. obs.*). A survey conducted in this area by M. F. V. (between 29 April and 5 May 2008) failed to record any *Augastes*. Thus, these small patches of rocky outcrops in the Caetité plateau probably do not represent suitable habitat for any species of *Augastes*, especially because they lack several plants typical of the habitats used by those two hummingbirds. Also, the lithology of the Caetité plateau is completely different from that of the Espinhaço Range. It is predominantly composed by Cenozoic sedimentary rocks of the last 60 million years that have been deposited in topographically lower areas in relation to the adjacent Espinhaço mountains (Schobbenhaus 1996, Barbosa *et al.* 2003, Cruz & Alkmim 2007, Caxito *et al.* 2008). Thus, during the Cenozoic, the plateau in the Caetité region was not represented by high mountains, and, even with present altitudes above 1,000 m, it does not have any representative area of *campos rupestres* typical of the Espinhaço Range that could maintain viable populations of plants and animals associated to this vegetation type (see Vasconcelos 2011). Thus, this region, together with the Contas lowland river valley, originally covered by Caatinga vegetation, is not suitable for the modern occurrence and dispersal of both species of *Augastes* in the Espinhaço Range, as well as several other typical *campo rupestre* plants and amphibians from central-southern (Minas Gerais) and northern (Bahia) sections of this mountain range.

The possible vicariance between the two species of *Augastes* may be related to climate changes during the Pio-Pleistocene. In this context, it is possible that during global cooling events, taxa of plants and animals typical of the *campos rupestres*, which are currently restricted to the mountain-tops, may have survived at lower altitudes (see Harley 1988, Safford 2007). In this case, an ancestral lineage of the two species of *Augastes* would be formerly distributed in a wider area. During one or more warming cycles, this

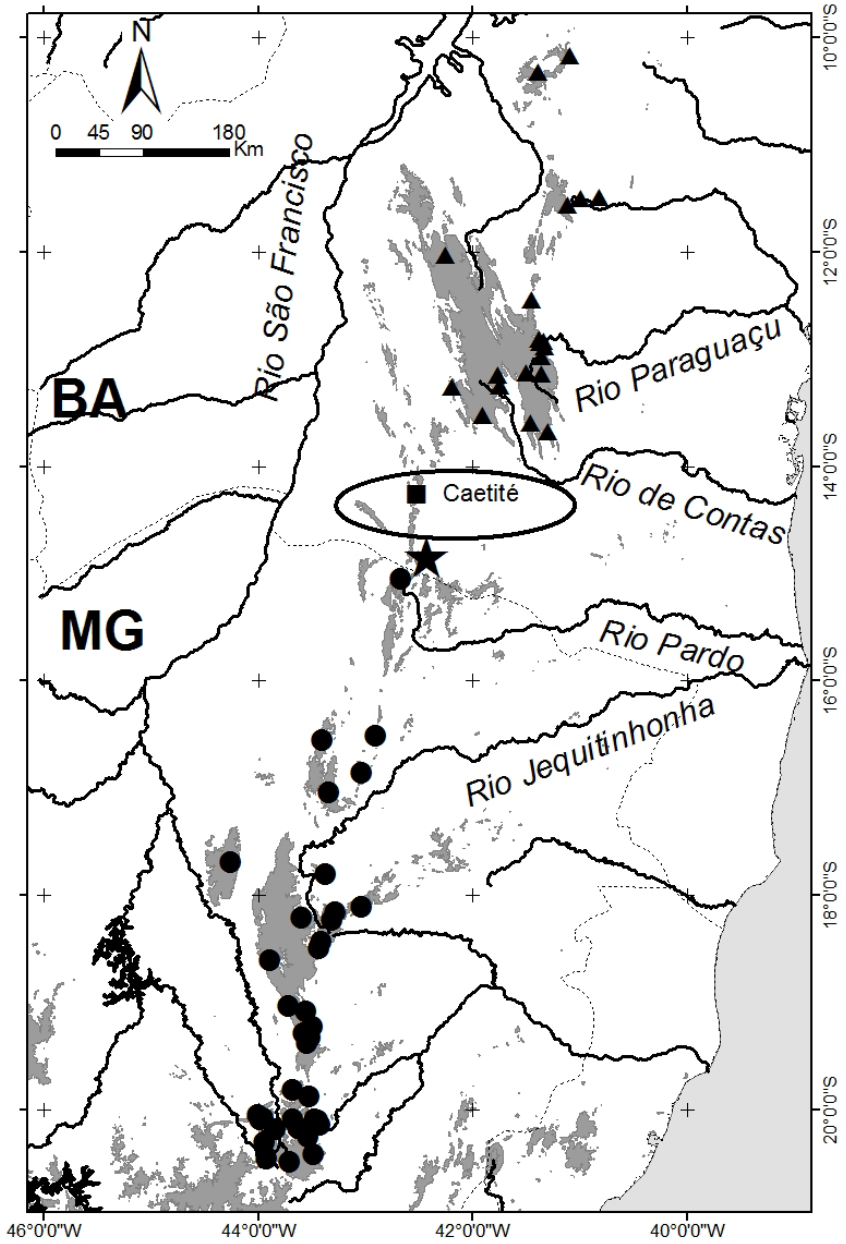

FIGURE 1: Occurrence of *Augastes scutatus* (circles) and *Augastes lumachella* (triangles), showing the first record of *A. scutatus* for Bahia (star) and a gap of 150 km between the ranges of both species. The plateau around Caetité, represented by Cenozoic sedimentary rocks, together with the lowlands of the Contas river hydrographic basin are the possible vicariant barrier for the genus in the Espinhaço Range (ellipse). Areas above 1,000 m are shaded. Brazilian states: BA = Bahia; MG = Minas Gerais.

lineage would have been forced to accompany the retraction of the *campos rupestres* palaeovegetation toward the summit and ridges of the Espinhaço mountains. Thus, ancestral populations would have been trapped in "islands" of *campos rupestres* on the Espinhaço Range mountain-tops, with one population isolated in a southern area and another in the northern region, respectively originating *A. scutatus* and *A. lumachella*. Even if we consider potential dispersal among ridges located in the southern and northern portions of Espinhaço Range, these two populations would have been unable to cross areas of unsuitable habitats, such as those represented by the Caetité plateau and the Contas River lowlands. All these hypotheses can be evaluated once a phylogeography /phylogeny is available for *A. scutatus* and *A. lumachella* and the genus *Augastes* as a whole, as well as other *campo rupestre* bird species with wider distributions throughout the Espinhaço Range, such as *Polystictus superciliaris* and *Embernagra longicauda*.

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