Zootaxa 3746 (3): 401–421
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3746.3.1
http://zoobank.org/urn:lsid:zoobank.org:pub:52938026-61EF-43C5-8159-3859A07139DB

An integrative appraisal of the diagnosis and distribution of *Allobates sumtuosus* (Morales, 2002) (Anura, Aromobatidae)

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Abstract

We describe the advertisement calls and color in life of *Allobates sumtuosus* (Morales 2002) based on specimens recorded and collected at its type locality in Reserva Biológica do Rio Trombetas, Brazilian Amazonia. We also improve the species diagnosis by adding information on states of characters frequently used in current *Allobates* taxonomy. Finally, we analyze genetic distances and the evolutionary relationships between typical *A. sumtuosus* and other *Allobates* species distributed in Brazil and along the Guiana Shield region using a fragment of the 16S rDNA mitochondrial gene. Based on this integrative analysis, we propose the synonym of *Allobates spumaponens* Kok & Ernst 2007 with *A. sumtuosus* and provide an updated geographic distribution of the species.

Key words: Advertisement calls, *Allobates spumaponens*, Amazonia, Dendrobatoidea, color in life, mtDNA

Resumo

Nós descrevemos as vocalizações de anúncio e a coloração em vida de *Allobates sumtuosus* (Morales 2002) com base em espécimes registrados e coletados na localidade tipo da espécie na Reserva Biológica do Rio Trombetas, Amazônia brasileira. Também aprimoramos a diagnose da espécie ao adicionar informações sobre estados de caracteres frequentemente utilizados na taxonomia de *Allobates*. Por fim, analisamos distâncias genéticas e relações evolutivas entre *A. sumtuosus* típico e outras espécies de *Allobates* distribuídas no Brasil e ao longo da região do Escudo das Guianas usando um fragmento do gene mitocondrial 16S DNAr. Baseados nesta análise integrativa, propomos a sinonímia de *Allobates spumaponens* Kok & Ernst 2007 com *A. sumtuosus* e fornecemos a distribuição geográfica atualizada da espécie.

Palavras-chave: Vocalizações de anúncio, *Allobates spumaponens*, Amazônia, Dendrobatoidea, cor em vida, DNAmt

Introduction

Allobates Zimmermann & Zimmermann 1988 is a species-rich genus of leaf litter frogs widely distributed in tropical forests of South and Central America. More than 45 species of *Allobates* have been described (Frost 2013) and the discovery of new species have progressed at a somewhat steady pace since the start of the 21st century (*e.g.* Lima & Caldwell 2001; Caldwell & Lima 2003; Kok & Ernst 2007; Lima *et al*. 2007; 2010; Barrio-Amorós & Santos 2009; Simões *et al.* 2013). One major reason for the steady rate of detection and description of *Allobates* species is due to increased sampling and the inclusion of additional sources of data in recent publications. In the past, the traditional and limited array of morphological characters applied to *Allobates* taxonomy resulted in unequivocal diagnoses, however newly acquired information related to advertisement calls, color of live specimens, DNA sequences, and larval traits have increased our diagnostic abilities.

Most *Allobates* species are conservative in relation to external morphology and color patterns, and accurate species assignment is usually not trivial when only preserved specimens are available for identification (Kaefer *et*

Accepted by J. Brown: 21 Nov. 2013; published: 12 Dec. 2013

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APPENDIX I. Origin and accession numbers of 16S rDNA sequences of *Allobates* species occurring in Brazil and across the Guiana Shield region obtained in this study or available in GenBank.

Species	Locality	Coordinates	16S	Reference
Allobates sumtuosus	REBio Trombetas, Pará, Brazil	01°22'12" S, 56°51'08" W	KF250500	This study
Allobates sumtuosus	REBio Trombetas, Pará, Brazil	01°22'12" S, 56°51'08" W	KF250499	This study
Allobates sumtuosus	REBio Trombetas, Pará, Brazil	01°22'12" S, 56°51'08" W	KF250498	This study
Allobates sumtuosus	REBio Trombetas, Pará, Brazil	01°22'12" S, 56°51'08" W	KF250497	This study
Allobates sumtuosus	Reserva Ducke, Manaus, Amazonas, Brazil	02°55'–03°01'S, 59°53'–59°59'W	KF250503	This study
Allobates sumtuosus	Reserva Ducke, Manaus, Amazonas, Brazil	02°55'–03°01'S, 59°53'–59°59'W	KF250502	This study
Allobates sumtuosus	Reserva Ducke, Manaus, Amazonas, Brazil	02°55'–03°01'S, 59°53'–59°59'W	KF250501	This study
Allobates sumtuosus	São João da Baliza, Roraima, Brazil	00°57'10" N, 59°55'43" W	KF250495	This study
Allobates sumtuosus	São João da Baliza, Roraima, Brazil	00°57'10" N, 59°55'43" W	KF250496	This study
Allobates sumtuosus	Sítio Tamaga, BR 174, km 80, Amazonas, Brazil	02°13'23" S, 60°03'55" W	KF250494	This study
Allobates algorei	Road to Rio Negro, Tachira, Venezuela		HQ290950	Santos & Cannatella 2011
Allobates caeruleodactylus	Castanho, Amazonas, Brazil	03°37'10" S, 59°86'78" W	DQ502100	Grant *et al.* 2006
Allobates caeruleodactylus	Castanho, Amazonas, Brazil	03°37'10" S, 59°86'78" W	DQ502212	Grant *et al.* 2006
Allobates conspicuus	Porto Walter, Rio Juruá, Acre, Brazil	08°15'31" S, 72°46'37" W	DQ502135	Grant *et al.* 2006
Allobates conspicuus	Porto Walter, Rio Juruá, Acre, Brazil	08°15'31" S, 72°46'37" W	DQ502134	Grant *et al.* 2006
Allobates crombiei	Cachoeira do Espelho, Altamira, Pará, Brazil	03°39'00" S, 52°22'33" W	KF250508	This study

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APPENDIX 1. (Continued)

Species	Locality	Coordinates	16S	Reference
Allobates crombiei	Cachoeira do Espelho, Altamira, Pará, Brazil	03°39'00" S, 52°22'33" W	KF250509	This study
Allobates gasconi	Porto Walter, Rio Juruá, Acre, Brazil	08°15'31" S, 72°46'37" W	EU342561	Santos *et al*. 2009
Allobates gasconi	Porto Walter, Rio Juruá, Acre, Brazil	08°15'31" S, 72°46'37" W	EU342562	Santos *et al*. 2009
Allobates gasconi	Madereira Scheffer, Rio Ituxi, Amazonas, Brazil		EU342565	Santos *et al*. 2009
Allobates granti	Lely Mountain, Suriname		JN690923	Fouquet *et al.* 2012
Allobates granti	Lely Mountain, Suriname		JN690924	Fouquet *et al.* 2012
Allobates granti	Saul, French Guiana		JN690927	Fouquet *et al.* 2012
Allobates granti	Haut Marwini, French Guiana		JN690928	Fouquet *et al.* 2012
Allobates granti	Haute Wanapi, French Guiana		JN690929	Fouquet *et al.* 2012
Allobates grillisimilis	Nova Olinda do Norte, Amazonas, Brazil	05°52'05" S, 61°17'13" W	KF250506	This study
Allobates grillisimilis	Nova Olinda do Norte, Amazonas, Brazil	05°52'05" S, 61°17'13" W	KF250507	This study
Allobates grillisimilis	Borba, Amazonas, Brazil	04°26'03" S, 59°37'25" W	KF250504	This study
Allobates grillisimilis	Borba, Amazonas, Brazil	04°26'03" S, 59°37'25" W	KF250505	This study
Allobates masniger	Parque Nacional da Amazônia, Pará, Brazil	4°32'51" S, 56°18'13" W	JQ966888	Kaefer *et al.* 2013
Allobates nidicola	Autazes Road Km 12, Amazonas, Brazil	03°28'02" S, 59°49'09" W	JQ966864	Kaefer *et al.* 2013
Allobates paleovarzensis	Careiro, Amazonas, Brazil	03°22'26" S, 59°52'06" W	JQ966835	Kaefer *et al.* 2013
Allobates spumaponens	Mabura Hill Forest Reserve, Guyana		KC520682	Fouquet *et al*. 2013
Allobates subfolionidificans	Rio Branco, Acre, Brazil	09°57' S, 67°57' W	KF250492	This study
Allobates subfolionidificans	Rio Branco, Acre, Brazil	09°57' S, 67°57' W	KF250493	This study
Allobates trilineatus	Panguana, Rio Llullapichis, Huanuco, Peru		DQ502118	Grant *et al.* 2006
Allobates undulatus	Cerro Yutaje, Amazonas, Venezuela	05°46' N, 66°08' W	DQ502028	Grant *et al.* 2006
Allobates undulatus	Cerro Yutaje, Amazonas, Venezuela	05°46' N, 66°08' W	DQ502029	Grant *et al.* 2006
Allobates undulatus	Cerro Yutaje, Amazonas, Venezuela	05°46' N, 66°08' W	DQ283044	Grant *et al.* 2006