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## Phylogenetic relationships of Semaphore geckos (Squamata: Sphaerodactylidae: *Pristurus*) with an assessment of the taxonomy of *Pristurus rupestris*

ARNAUD BADIANE<sup>1#</sup>, JOAN GARCIA-PORTA<sup>1#</sup>, JAN ČERVENKA<sup>2</sup>, LUKÁŠ KRATOCHVÍL<sup>2</sup>, ROBERTO SINDACO<sup>3</sup>, MICHAEL D. ROBINSON<sup>4</sup>, HERNAN MORALES<sup>5</sup>, TOMÁŠ MAZUCH<sup>6</sup>, THOMAS PRICE<sup>7</sup>, FÈLIX AMAT<sup>8</sup>, MOHAMMED Y. SHOBRAK<sup>9</sup>, THOMAS WILMS<sup>10</sup>, MARC SIMÓ-RIUDALBAS<sup>1</sup>, FARAHAM AHMADZADEH<sup>11</sup>, THEODORE J. PAPPENFUSS<sup>12</sup>, ALEXANDRE CLUCHIER<sup>13</sup>, JULIEN VIGLIONE<sup>13</sup> & SALVADOR CARRANZA<sup>1,14</sup>

# Both authors contributed equally to this work

<sup>1</sup>Institute of Evolutionary Biology (CSIC-Universitat Pompeu Fabra), Passeig Marítim de la Barceloneta 37-49, 08003, Barcelona, Spain

<sup>2</sup>Faculty of Science, Charles University in Prague, Department of Ecology, Viničná 7, 128 44 Praha 2, Czech Republic

<sup>3</sup>Museo Civico di Storia Naturale, via San Francesco di Sales, 88 – 10022 Carmagnola (TO), Italy

<sup>4</sup>8935 E. Michigan Ave, Sun Lakes, AZ 85248, USA

<sup>5</sup>School of Biological Sciences, Monash University, Australia

<sup>6</sup>Dřiteč 65, 53305, Czech Republic

<sup>7</sup>St. Gallen, Switzerland

<sup>8</sup>Àrea d'Herpetologia, Museu de Granollers-Ciències Naturals, Francesc Macià 51, 08400 Granollers, Catalonia, Spain

<sup>9</sup>Biology department, Faculty of Science, Taif University 888, Taif, Saudi Arabia

<sup>10</sup>Zoologischer Garten Frankfurt, Bernhard-Grzimek-Allee 1, Frankfurt am Main, Germany

<sup>11</sup>Department of Biodiversity and Ecosystem Management, Environmental Sciences Research Institute, Shahid Beheshti University, Tehran, Iran

<sup>12</sup>Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720, USA

<sup>13</sup>ECO-MED, Tour Méditerranée, 65 avenue Jules Cantini, 13298 Marseille cedex 20, France

<sup>14</sup>Corresponding author. E-mail: salvador.carranza@ibe.upf-csic.es

### Abstract

A molecular phylogeny of the sphaerodactylid geckos of the genus *Pristurus* is inferred based on an alignment of 1845 base pairs (bp) of concatenated mitochondrial (*12S*) and nuclear (*acm4*, *cmos*, *rag1* and *rag2*) genes for 80 individuals, representing 18 of the 23–26 species, and the three subspecies of *P. rupestris*. The results indicate that *P. rupestris* is polyphyletic and includes two highly divergent clades: the eastern clade, found in coastal Iran and throughout the Hajar Mountain range in northern Oman and eastern UAE; and the western clade, distributed from central coastal Oman, through Yemen, Saudi Arabia and north to southern Jordan. Inferred haplotype networks for the four nuclear genes show that the eastern and western clades of “*P. rupestris*” are highly differentiated and do not share any alleles. Moreover, although the two clades are differentiated by a morphological multivariate analysis, no one character or set of characters was found to be diagnostic. Based on the molecular analysis of specimens from the type locality of *P. rupestris rupestris*, the name *P. rupestris* is applied to the eastern clade. The name that should apply to the western clade cannot be clarified until morphological and genetic data for “*P. rupestris*” is available from the vicinity of Bosaso, Somalia, and therefore we refer to it as *Pristurus* sp. 1. The phylogenetic tree of *Pristurus* supports the hypothesis that *P. celerrimus* is sister to all the other species in the analyses and that the Socotra Archipelago was independently colonized a minimum of two times.

**Key words:** gecko, Arabia, phylogeny, taxonomy, systematics, Socotra Archipelago, mitochondrial DNA, nuclear DNA.

### Introduction

The sphaerodactylid geckos of the genus *Pristurus* Rüppell, 1835, also known as Semaphore geckos, comprise 23–26 species (Arnold 2009; Sindaco & Jeremčenko 2008; Uetz 2013), characterized by being mostly diurnal,

species of the same genus now present in Samha, Darsa and Socotra Islands (which were merged into a single island during the sea level fluctuations that occurred during the Pleistocene). This is very unusual and contrasts with what has been found in other archipelagoes. For instance, in the Canary and Cape Verde Islands, species usually colonized one of the islands of the archipelago and, from there, spread to neighboring islands (Arnold *et al.* 2008; Carranza & Arnold 2006; Carranza *et al.* 1999, 2000, 2001; Maca-Meyer *et al.* 2003; Miralles *et al.* 2011; Vasconcelos *et al.* 2010). According to Arnold (2009), *P. obsti* and *P. samhaensis* are very similar in their morphology to *P. guichardi* and *P. sokotranus*, respectively. Our molecular data indicates that the two arboreal Socotran endemics, *P. obsti* and *P. guichardi*, are genetically well differentiated. Razzetti *et al.* (2011), state that these two species segregate altitudinally within Socotra Island, with *P. obsti* being distributed at lower altitudes than *P. guichardi*. The taxonomy of *P. sokotranus* is more complicated. According to our molecular results, including three specimens from three different localities within Socotra Island, *P. samhaensis* is more closely related to one of the specimens, making *P. sokotranus* paraphyletic. Analyses with more samples from across the distribution range of *P. sokotranus* and *P. samhaensis*, including their type localities will be necessary to clarify the taxonomy of these two species (work in progress).

Relationships between members of the subgenus *Spatalura* are very similar to those recovered by Papenfuss *et al.* (2009). In both phylogenies, *P. minimus* is sister to all the other members of *Spatalura* and *P. somalicus* and *P. crucifer* are sister taxa. Moreover, like the morphological phylogeny by Arnold (2009), our results support the close relationship between *P. carteri* and *P. collaris*. The nested position of *P. adraensis* within the clade formed by the 12 species (Fig. 2), suggests that this 4700 km range extension occurred from east to west, after the first colonization of the Socotra Archipelago. However, until more samples are included in a calibrated phylogeny of the genus, we prefer not to hypothesize about the possible causes of the presence of this isolated species in Mauritania, or the biogeography and evolution of this interesting genus of diurnal geckos.

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