



New Locality and Elevational Range Extension of the Montane Lichen Anole, *Anolis fungosus* Myers 1971 (Squamata: Dactyloidae), in Central Costa Rica: Conservation of a Near-threatened Species

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The Montane Lichen Anole (*Anolis fungosus*) (Fig. 1) is an uncommon Central American endemic represented by few specimens collected in scattered localities at elevations of 1,200–1,600 m asl in northern and southwestern areas of the Talamanca Mountain Range in Costa Rica and Panama (Myers 1971; Savage 2002; Köhler 2008, 2010; Phillips et al. 2015; Leenders 2019; Acosta Chaves et al. 2021). The type locality is at Cerro Pando, Cordillera de Talamanca, Bocas del Toro, Panamá, elev. 1,450 m asl (Myers 1971) and additional populations in Panama have been found recently (Phillips et al. 2015; Leenders 2019). Only a few localities have been documented in Costa Rica (Table 1). We herein report a new locality for the species in the Central Mountain Range of Costa Rica and reevaluate the distribution and the elevational range of the species.

At 2200 h on 28 January 2022, we encountered and photographed an adult female *A. fungosus* (Fig. 1) perched on vegetation approximately 1 m above the ground in a pristine forest near the Bonilla River, Santa Cruz, Turrialba, Cartago Province, Costa Rica (10.015833°N, 83.691944°W; WGS 84; elev. 1,500 m asl; Fig. 2). This locality (Fig. 3) is classified as Premontane Rainforest (P-rf) (Holdridge 1967) and is partially protected by the Cordillera Volcánica Central Forest Reserve (CVCFR). Climate is variable due to the elevational variation (240–3,266 m asl) and its location in the depression between the Atlantic and Pacific Slopes. Average annual rain-

fall is 2,000–7,000 mm and average annual temperature is 5–27 °C. The CVCFR is a main aquifer recharge area of the Central Valley and is an important area for drainage toward the plains of the North Atlantic Region (SINAC 2016).

The individual was identified based on descriptions in Savage (2002) and Köhler (2008). The dorsum is dark brown with irregular white lichen-like markings; dewlaps of males are red and those of females pale yellow (Phillips et al. 2015; Fig. 1). Small size, the distinctive lichen-like pattern, and a pair of small parietal knobs distinguish this species from other members of the *Anolis* (*Norops*) *pentaprion* group (Myers 1971). *Anolis salvini* Boulenger 1885 lacks bony knobs on the head; the male dewlap is red and female dewlap orange to blue; *A. charlesmyersi* Köhler 2010, a larger species with a brick red dewlap, occurs at lower elevations on the Pacific Slope; *A. pentaprion* Cope 1863, which is larger than *A. fungosus* and has a bright pink dewlap, generally occurs at lower elevations on the Caribbean Slope; and *A. laevis* Wiegmann 1834 has a white dewlap (Leenders 2019). Photographic vouchers have been deposited in the Digital Catalog of the Museum of Zoology of the National University of Costa Rica (UNAMZR: 00003–4) and the identity of the species was confirmed from the photographs by Gerardo Chávez, University of Costa Rica (UCR).

The new locality is 7.3 km in a straight line NNW of the nearest known locality at Sitio Mata (LACM 149466;



Figure 1. An adult male Montane Lichen Anole (*Anolis fungosus*) from Bonilla, Santa Cruz, Turrialba, Cartago Province, Costa Rica (left) and the characteristic yellow dewlap of a female (right). Photographs by Raby Nuñez (left) and Álvaro A. Zamora (right).

GBIF 2022). According to collection data in the Museum of Zoology of the University of Costa Rica (UCR), additional populations were recorded in 2008 to the south of the Talamanca Mountain Range in Tres Colinas and Potrero Grande (elev. 1,800–2,100 m asl). These reports extend the upper limits of the species’ elevational range from 1,200–1,600 m asl (Savage 2002) to 2,100 m asl (Fig. 2) and document an extent of occurrence (minimum convex polygon) (Fig. 2) according to IUCN Red List Categories and Criteria (IUCN 2001).

These data indicate that the species is more widely distributed than indicated in Acosta Chaves et al. (2021) and suggest that new populations of *A. fungosus* could be found in

similar ecosystems, including those in northern Costa Rica. Although the species occurs in undisturbed premontane wet forests and rainforest (Savage 2002; Fig. 3), the habitat in most known localities is subject to deforestation (Acosta Chaves et al. 2021). For example, the historical locality at Sitio Mata is deforested and is used for sugar cane production (Fig. 4). The new locality at Turrialba has been little studied by herpetologists; however, recent reports of species of importance indicate a need for developing conservation strategies (Zamora-Roda et al. 2021; Valverde and Abarca 2022).

Anolis fungosus was assessed in 2008 and listed as Near Threatened (NT) on the IUCN Red List of Threatened Species based on an extent of occurrence less than 20,000

Table 1. Specimens of the Montane Lichen Anole (*Anolis fungosus*) in Costa Rica. LACM = Vertebrate Collections of the Natural History Museum of Los Angeles County, UCR = University of Costa Rica Museum of Zoology.

Locality and Specimen(s)	Source
El Silencio, Sitio Mata, Turrialba, Cartago Province (LACM 149466)	GBIF 2022
Chirripó Grande, San José Province (male) (UCR 11942)	Savage 2002
Tapantí, Cartago Province (male & juvenile) (UCR 9477 & 11367)	Savage 2002

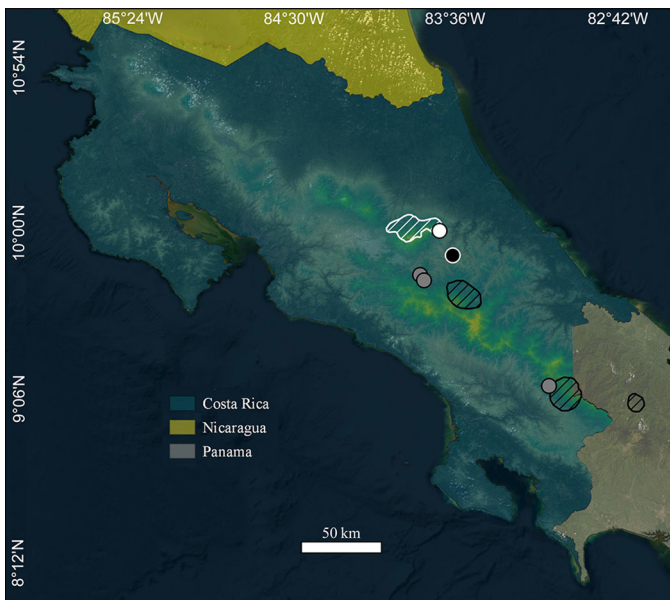


Figure 2. Map showing the distribution of the Montane Lichen Anole (*Anolis fungosus*) in Costa Rica. Previously documented records are indicated by black (GBIF 2022) and gray dots (UCR). The new record is marked by the white dot. Black areas with transverse lines represent the distribution illustrated in the IUCN Red List (Acosta Chaves et al. 2021). White areas with transverse lines represent the expanded geographic distribution of the species. Geographic coordinate system WGS84. Map by Christian G. Herrera using QGIS 3.4.15 with shape files Costa Rica 2014 v.1.2. and ESRI satellite images (©2022 ESRI).

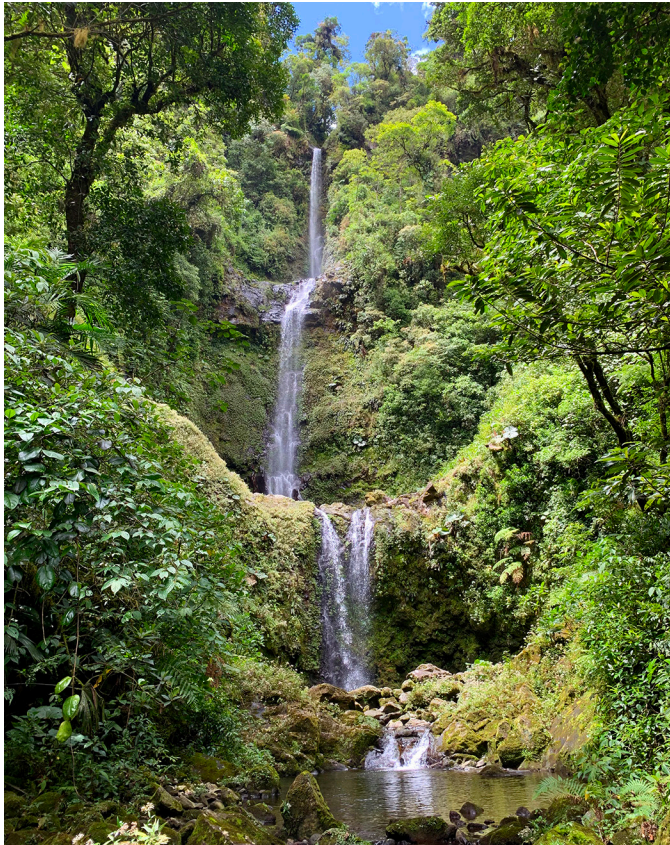


Figure 3. Habitat at the new locality of the Montane Lichen Anole (*Anolis fungosus*) in Bonilla, Santa Cruz, Turrialba, Cartago Province, Costa Rica. Photograph by Álvaro A. Zamora.

km², an unknown population trend, and the species' habitat being subjected to ongoing deforestation (Acosta Chaves et al. 2021). The species was more recently included in a list of conservation priorities focusing on Central American herpetofaunal endemics (Mata-Silva et al. 2019). Threats include habitat loss and fragmentation by agricultural expansion, logging (Acosta Chaves et al. 2021), and cattle ranching (CGH-M, pers. obs.).

More studies are needed on the natural history of this poorly-known species to better understand how human-mediated effects on the ecosystems affect the use and availability of habitat and other resources (e.g., Cortés-Suárez and Díaz-Gutiérrez 2013; Herrera-Martínez et al. 2022; Herrera-Martínez and Gómez-Lépiz 2023). Essential conservation strategies for this species include habitat protection, ecosystem management and restoration, and development of a monitoring program to generate more information on local population trends, distribution, ecology, and threats.

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Figure 4. Habitat at the historical locality of the Montane Lichen Anole (*Anolis fungosus*) in Sitio Mata, La Suiza, Turrialba, Cartago Province, Costa Rica. Photograph by Anthony J. Abarca.

(UNA). This work followed the guidelines for conducting biodiversity research in Costa Rica and the provisions of the Wildlife Conservation Law 7317 and Biodiversity Law 7788.

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