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Original article

Range extension and distribution update of *Hsunycteris cadenai* (Chiroptera: Phyllostomidae)

Extensión del rango y mapa de distribución actualizado de *Hsunycteris cadenai* (Chiroptera: Phyllostomidae)

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Abstract

We report the northernmost collecting locality for the nectar-feeding bat *Hsunycteris cadenai* in the Colombian Biogeographic Chocó. This record extends the range of the species to 224 km north of the species type locality in Zabaletas river, department of Valle del Cauca, and 75 km west of Santa Cecilia, Risaralda. The specimen was collected on May 5, 2010, in a primary forest in Pacurita, Central Chocó. Our specimen of *H. cadenai* (CMCH 883) exhibits all the diagnostic characteristics of the species including the lateral projections on the postorbital region, a skull length greater than 20.0 mm, and a forearm shorter than 34.5 mm. We also present an updated distribution map for the species.

Keywords: Bats; Biogeographic Chocó; Lonchophyllinae; primary forest.

Resumen

Reportamos la localidad más norte conocida para *Hsunycteris cadenai* en el Chocó biogeográfico de Colombia. Este registro extiende el área de distribución de la especie hasta 224 km al norte de la localidad tipo en el río Zabaletas, departamento del Valle del Cauca, y 75 km al occidente de la localidad de reporte de la especie más cercana en Santa Cecilia, Risaralda. El espécimen de *H. cadenai* (CMCH 883) fue recolectado el 5 de mayo de 2010 en un bosque primario y presenta las características diagnósticas de la especie (proyecciones laterales en la región postorbital, una longitud máxima del cráneo mayor a 20,0 mm y un antebrazo menor de 34,5 mm). Se presenta, además, un mapa actualizado de la distribución de *H. cadenai*.

Palabras claves: bosque primario; Chocó biogeográfico; distribución; murciélagos; Lonchophyllinae.

Introduction

Hsunycteris (**Parlos *et al.*,** 2014) is a Neotropical genus of nectarivorous bat belonging to the subfamily Lonchophyllinae (Phyllostomidae). This genus is distributed from Panama southward into South America where it occurs in Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Ecuador, Perú, and Bolivia (**Parlos *et al.*,** 2014; **Velazco *et al.*,** 2017). Four species are currently recognized within the genus: *H. cadenai* (**Woodman & Timm,** 2006), *H. pattoni* (**Woodman &Timm,** 2006), *H. thomasi* (**Allen,** 1904), and *H. dashe* (**Velazco *et al.*,** 2017). Except *H. dashe*, the other three species of the genus occur in Colombia (**Mantilla-Meluk *et al.*,** 2010; **Ramírez-Chaves & Suárez-Castro,** 2014; **Velazco *et al.*,** 2017).

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Bats of the genus *Hsunycteris* can be distinguished from the other genera in the subfamily Lonchophyllinae *(Lionycteris, Lonchophylla, Platalina*, and *Xeronycteris)* by the following combination of morphological characteristics: small size (greatest length of skull excluding the incisors (**GLS**): 19.5–22.5 mm, mandibular toothrow length (**MANDL**): 6.2–7.0 mm), the proximal section of the dorsal fur paler than the tips, absence of hairs on the dorsal region of the uropatagium, rostrum shorter than braincase, infraorbital foramen above the anterior root of the second upper premolar, first and second upper premolars elongated, and the central cusp of lower premolars not deflected labially (**Velazco *et al.*,** 2017).

Hsunycteris cadenai is known only from a few records in museum collections of specimens recovered from some localities on the Colombian Pacific Coast and foothills of the Cordillera Occidental, and from northwestern Ecuador (**Table 1**). Here, we present the northernmost collecting locality for *H. cadenai* in the hyper-humid rainforest of the Colombian Central Chocó, as well as an updated map of the species distribution.

Materials and methods

On May 5, 2010 at 5:40 am, a male specimen of the genus *Hsunycteris* was collected in the site Quebrada Los Puercos (5º40’04” N, 76º34’12.1” W) (**Figure 1**) within the Área de Importancia para la Conservación de Murciélagos (Area of Importance for Bat

Table 1. Localities where *Hsunycteris cadenai* has been recorded

Specimens	Map	Locality	Coordinates	Reference
QCAZ 9095, 9096, 9564, 9565; TTU 85448, 85451, 85459	5	Ecuador: Esmeraldas, San Lorenzo; 53 m.	1° 15’ N, 78° 46’ W	**Tirira** (2012)
QCAZ 9094, 9567; TTU 102942	6	Ecuador: Esmeraldas, Estación Biológica la Chiquita; 53 m.	1° 13’ N, 78° 45’ W	**Tirira** (2012)
TTU 103183, 103195; QCAZ 9097, 9098	7	Ecuador: Esmeraldas, San Francisco de Bogotá; 63 m.	1° 5’ N, 78° 42’ W	**Tirira** (2012)
QCAZ M17030	8	Ecuador: Esmeraldas, Playa de Oro. Culo de Negra	0° 52’ 16.32” N, 78° 47’ 33.07” W	**Romero & Vallejo** (2018)
QCAZ M16601	9	Ecuador: Pichincha, Cantón de San Miguel de los Bancos, Monterreal Rainforest Ecolodge. Coop. Ganaderos Orenses; 720 m.	0° 4’ 52.45” N, 78° 59’ 1.06” W	**Romero & Vallejo** (2018)
ICN 12210	2	Colombia: Risaralda, Santa Cecilia, Pueblo Rico; 2430 m.	5° 14’ N, 76° 2’ W	**Mantilla-Meluk *et al.*** (2010)
USNM 338726	4	Colombia: Valle del Cauca, Bajo Calima	4° 1’ N, 77° 0’ W	**Woodman & Timm** (2006)
ICN 9169; USNM 446481, 446482, 483359, 483363–483365	3	Colombia: Valle del Cauca, 29 km SE Buenaventura; 75 m.	3° 44’ N, 76° 57’ W	**Mantilla-Meluk *et al.*** (2010); **Woodman & Timm** (2006)
CMCH 883	1	Colombia: Chocó, Pacurita, Quebrada Los Puercos; 113 m.	5º 40’ 4” N, 76º 34’ 12.1” W	This study

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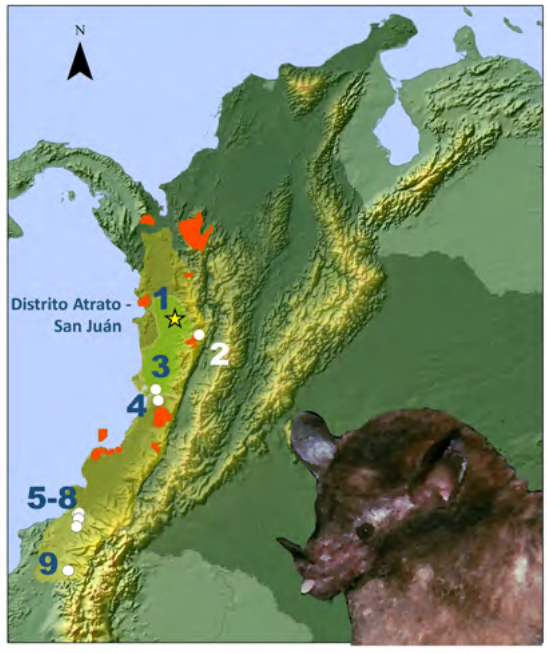

Figure 1. Geographical distribution of *Hsunycteris cadenai*. Previous records are represented by circles and the new report by a star. Locality and coordinates of the numbers on the map are presented in table 1.

Conservation) in Pacurita, Central Chocó (AICOM; A-CO-001), located in the Atrato-San Juan biogeographic district (**Hernández-Camacho, *et al.,*** 1992), in the central portion of the Tumbes-Chocó-Magdalena Priority Terrestrial Ecoregion (**Figure 1**). The specimen was collected with a 12-meter-long mist net installed 12 meters above the ground in a well-stratified primary forest. The night before the capture, the temperature was 24.7 ºC and the relative humidity was 100%.

The specimen was preserved as a dry skin and a clean skull and deposited in the *Colección Mastozoológica del Chocó*, at *Universidad Tecnológica del Chocó* (CMCH 883). The fieldwork was part of the collecting efforts of the project: "Role of secondary forests (established through traditional selective logging) on bat diversity conservation at the Central Biogeographic Chocó Rainforest".

The taxonomic determination of the specimen was based on the verification of the diagnostic characters described for the species in **Velazco, *et al.*** (2017). Additionally, ten measurements were taken (nine craniodental and one external) also following **Velazco *et al.*** (2017): greatest length of skull excluding the incisors (**GLS**); condyle incisive length (**CIL**); braincase breadth (**BB**); mastoid process width (**MPW**); maxillary toothrow length (**MTRL**); width at M2 (**M2–M2**): greatest width of palate across labial margins of the M2s; mandibular toothrow length (**MANDL**); dentary length (**DENL**); coronoid height (**COH**), and forearm length (**FA**). The craniodental and external measurements were taken in millimeters (mm) with a digital caliper (0.05 mm of accuracy) (**Table 2**). To develop the updated distribution map of the species, we used georeferenced records from the literature (**Woodman & Timm,** 2006; **Mantilla-Meluk *et al.,*** 2010; **Tirira,** 2012; **Romero & Vallejo,** 2018).

Results

The specimen reported herein (CMCH 883) was identified as *Hsunycteris cadenai* based on the cranial, dental, and external morphological diagnostic characters of the species. Our specimen (CMCH 883) exhibits the lateral projections on the postorbital region (**Figure 2**),

as well as a maximum length of the skull greater than 20.0 mm and a forearm length less than 34.5 mm (**Table 2**). The pelage of the specimen is short between the shoulders (6.7 mm); the dermal papillae on the chin are V-shaped and appear separated by a narrow basal cleft; it exhibits small outer upper incisors; the lingual cusp is developed in the second upper premolar; it has a weakly developed parastyle in the first upper molar, large and wide lower incisors, a well-developed notch in the paracristid of the first lower molar, and a wide hypoconid in the second lower molar.

In **table 2** we present the comparisons of the external and cranial measurements of our specimen (CMCH 883). Two of the cranial measurements of our specimen fall outside the range reported for the species (braincase breadth 9.13 mm and mastoid process width 9.62 mm); all the other measurements fall within the reported range documented for the species. Other external measurements of our specimen not presented in **table 2** are total

Table 2. Craniodental and external measurements of *Hsunycteris cadenai.* Measurements were taken from: a) this study, b) **Woodman & Timm** (2006), c and d) **Mantilla-Meluk *et al.*** (2010), and e) **Tirira** (2012).

	H. cadenai				
	CMCH 883$_a$ male	**USNM Holotype 483359$_b$ male**	**ICN 12210$_c$ male**	**ICN9169$_d$ male**	**QCAZ$_e$ (5 male and 2 females**
GLS	21.29	21.70	21.73	21.52	21.5 (21.2–21.9)
CIL	20.43	20.00	20.14	20.00	20.4 (20.0–20.9)
BB	9.13	8.45	8.38	8.45	8.4 (8.1–8.7)
MPW	9.62	9.20	8.09	9.10	9.1 (8.9–9.3)
MTRL	6.73	6.90	6.95	6.97	6.9 (6.7–7.3)
M2–M2	5.17	5.23	5.12	5.23	5.1 (4.7–5.2)
MANDL	13.44	13.70	14.26	14.00	14.0 (13.3–14.4)
DENL	7.03	7.30	7.53	7.62	7.2 (7.0–7.4)
COH	4.07	–	–	–	4.2 (4.0–4.6)
FA	31.04	31.90	32.06	32.00	30.5 (29.7–32.3)

Figure 2. Dorsal and ventral views of the skull and lateral view of the skull and mandible of *Hsunycteris cadenai* (CMCH 883). The red arrow indicates the lateral projection in postorbital region, a diagnostic characteristic of the species. Scale bar = 5mm

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body length (53.43 mm), tail length (6.87 mm), ear length (10.36 mm), foot length (5.07 mm), tibia length (17.72 mm), tragus length (4.45 mm); length of the third metacarpus (31.38 mm), calcaneus length (6.19 mm), wingspan (225 mm), and weight (6.9 gr).

Hsunycteris cadenai is only known from five localities in Ecuador and four in Colombia (**Table1**) including Pacurita (Chocó), as reported here, which constitutes the northernmost record for the species. In Colombia, the species ranges from 50 to 2,430 m while in Ecuador it occurs at elevations below 1,000 m. The species is distributed across different types of habitats including evergreen lowland forests in northwestern Ecuador (**Tirira,** 2012), mountainous sub-Andean forests above 2,000 m (**Mantilla Meluk *et al*.,** 2010), and tropical and hyper-humid forests in Central Chocó, Colombia. This portion of the species distribution encloses some of the rainiest areas of the Colombian Biogeographic Chocó with precipitations above 12,000 mm/yr which are considered a hot spot of biodiversity and species endemism (**Rangel *et al*.,** 2004). Interestingly, *H. cadenai* appears to be an endemic species of the Biogeographic Chocó with all known localities for the species within this biogeographic unit (**Figure 1**).

Our specimen was captured along with the following species: *Artibeus lituratus* (Olfers, 1818); *Artibeus phaeotis* (Miller, 1902); *Artibeus watsoni* Thomas, 1901; *Carollia castanea* Allen, 1890; *Carollia perspicillata* (Linnaeus, 1758); *Carollia brevicauda* (Schinz, 1821); *Platyrrhinus helleri* (Peters, 1866); *Platyrrhinus dorsalis* (Thomas, 1900); *Rhinophylla alethina* Handley, 1966; *Uroderma convexum* Lyon, 1902; *Vampyressa thyone* Thomas, 1909, and *Vampyriscus nymphaea* (Thomas, 1909).

Discussion

Bat nectivore forms provide important contributions to nature since they are responsible for the pollination of many unique Neotropical plant species, some of them with nocturnal flowering. In this context, the knowledge regarding pollinator agents of Chocó's vegetation, characterized by high levels of richness and endemism, is important for the design and implementation of conservation measurements. This new record of *H. cadenai* also represents an ecological extension for the species confirming its presence in the hyper-humid tropical rainforest (bp-T) of Chocó, which is characterized by precipitations above 12,000 mm/yr (**Figure 1**). The new record extends the distribution of the species to 224 km north of the type locality in Zabaletas River, Valle del Cauca (**Woodman & Timm,** 2006), and 75 km west of the nearest collecting locality in Santa Cecilia, Risaralda (**Mantilla-Meluk, *et al.*,** 2010) (**Figure 1**).

Regarding its conservation status, the International Union for Conservation of Nature (IUCN) has classified *H. cadenai* as Data Deficient (DD) (**Solari,** 2018). Based on our intensive chiropteran sampling efforts in the region, we consider *H. cadenai* as a rare species, an observation also supported by **Tirira** (2012) for Ecuador. After more than ten years of continuous sampling in the area, here we introduce a record of the first *H. cadenai* specimen documented in the area. Given the high anthropogenic pressure in Chocó's forests in Colombia and in Ecuador forests and the apparent preference of *H. cadenai* for well-preserved primary forests, we recommend re-evaluating its conservation status. Additionally, *H. cadenai* should be considered as a focal species within the Pacurita Area of Importance for Bat Conservation (AICOM; A-CO-001), along with *Rhinophylla alethina* Handley, 1966; *Choeroniscus periosus* Handley, 1966, and *Lionycteris spurrelli* Thomas, 1913.

Although Colombia has one of the best-established systems of protected areas, its Pacific region is still underrepresented. An analysis of known museum records of *H. cadenai* in Colombia shows that only one collecting locality falls within an established protected area: the Tatamá National Natural Park, in the Atrato-San Juan biogeographic district (**Figure 1**). Biogeographic Chocó holds an extraordinary diversity of landscapes and ecosystems with an associated high environmental heterogeneity including a clinal variation of environmental variables such as temperature, relative humidity, evapotranspiration, and average annual precipitation, determining different types of vegetation covers and bat assemblages.

The AICOM Pacurita Chocó-Central is a key area for the protection of these bat species since the surrounding areas are under a high anthropogenic pressure, particularly mining and selective logging (**Ramírez-Moreno & Ledezma-Rentería,** 2007; **Andrade-C,** 2011; **Valois-Cuesta & Martínez-Ruiz,** 2016; **UNODC,** 2016; **Mosquera-Andrade,** 2014). However, AICOM lacks technical support under the Colombian legislation. It is urgent, therefore, to establish a protected area at the central portion of the Colombian Biogeographic Chocó. The *Corporación Autónoma Regional para el Desarrollo del Chocó* (CODECHOCÓ), which is the local government institution in charge of environmental surveillance and control, has promoted the creation of a regional conservation area in Chocó's Central Rainforest, the Cabí-Ichó Biological Corridor, which includes the town of Pacurita, i.e., the collecting locality where we recorded the presence of *H. cadenai*.

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Author contributions

LPM: Manuscript writing, literature review, specimen diagnosis, measurement, metric morphological analysis of specimens, figures, georeferencing, and updated distribution map of the species; VDPM: Manuscript writing, specimen diagnosis, literature review, specimen measurement; YCCM: Revision of literature and manuscript writing; AMJO: Manuscript writing, literature review, and editorial process; HMM: Specimen diagnosis, manuscript writing, and preparation of the updated distribution map of the species; PMV: Figure preparation, specimen diagnosis, and manuscript writing

Conflicts of interest

The authors declare no conflict of interest.

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