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PENSOFT

Extension of the distribution of Townsend's Big-eared Bat, *Corynorhinus townsendii* (Cooper, 1837) (Chiroptera, Vespertilionidae), to Chiapas, Mexico

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Abstract

We report the first record of Townsend's Big-eared Bat, *Corynorhinus townsendii* (Cooper, 1837) from Chiapas, Mexico, based on three females collected on 29 September 1979 near Ocozocoautla de Espinosa and stored in the Colección Nacional de Mamíferos of the Instituto de Biología at Universidad Nacional Autónoma de México. The Chiapas locality is ~180 km east of the closest previously known occurrence in Tehuantepec, Oaxaca, Mexico. This extends the distribution of *C. townsendii* through tropical areas of southeastern Mexico and corroborates the capacity of this species to inhabit a diversity of ecosystems.

Keywords

Biotic interchange, Chiapas, *Corynorhinus mexicanus*, Isthmus of Tehuantepec, Mammalia, Mexico, plecotine bats

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Introduction

Townsend's Big-eared Bat, *Corynorhinus townsendii* (Cooper, 1837), is a medium-sized vespertilionid bat characterized by its long ears and by two large glands on either side of the muzzle (Kunz and Martin 1982). While *C. townsendii* has the greatest morphological variation within the genus *Corynorhinus* H. Allen, 1865, it is clearly distinguishable from the other two congeneric species, *C. rafinesquii* (Lesson, 1827) and *C. mexicanus* G.M. Allen, 1916. *Corynorhinus townsendii* has tips of the ventral hair brownish or buff, while *C. rafinesquii* has whitish tips (Handley 1959; Kunz and Martin 1982). In comparison to *C. mexicanus*, which often

occurs in sympatry, *C. townsendii* shows the tips of the dorsal hair brownish or paler; the superior incisors are usually simple, the tragus is usually more than 13 mm long, the interfemoral membrane has nine or more cross ribs, and there is no hair on the base of the uropatagium (Handley 1959; Kunz and Martin 1982; Tumlison 1991). In contrast, *C. mexicanus* has greyish or dark-brownish tips of the dorsal hair; the superior incisors usually have two cuspids; the tragus is usually 11–12 mm long, the interfemoral membrane has fewer than nine interfemoral cross ribs, and there is hair at the base of uropatagium (Handley 1959; Tumlison 1991, 1992).

Corynorhinus townsendii is distributed in western North America from British Columbia, Canada southward to the Isthmus of Tehuantepec, Mexico, with isolated populations located in the eastern United States of America (Fig. 1), and its altitudinal range is from sea level to 3160 m (Goodwin 1969; Hall 1981; Kunz and Martin 1982). Five subspecies, which are linked to geographic distribution, are recognized within *C. townsendii* (Piaggio and Perkins 2005): *Corynorhinus t. townsendii* (Cooper, 1837) occurs from British Columbia, including Vancouver Island (Canada), and Montana (USA), southward to the Sonora Desert and the Baja California Peninsula (Mexico); *C. t. pallescens* Miller, 1897 occurs in New Mexico, Oklahoma, and Colorado (USA); *C. t. australis* Handley, 1955 occurs in Kansas and Texas (USA) to the Isthmus of Tehuantepec, including the Chihuahua desert and the Central Mexican Plateau. The remaining subspecies are geographically isolated; *C. t. ingens* Handley, 1955 occurring in Arkansas and Oklahoma (USA) and *C. t. virginianus* Handley, 1955 which is restricted to Virginia, West Virginia, and Kentucky (USA) (Goodwin 1969; Sanchez-Hernandez 1986; Tumlison 1991; Piaggio and Perkins 2005; Lee et al. 2015; Moratelli and Burgin 2019).

Corynorhinus townsendii inhabits a wide variety of habitats, from semi-arid ecosystems and shrub grasslands to coniferous and semideciduous forests, including riparian vegetation communities and agricultural fields (Kunz and Martin 1982). The geographic range of *C. townsendii* is one of the largest within plecotine bats, and despite that this species is mainly of Nearctic affinity, it also extends to tropical areas (Kunz and Martin 1982; Tumlison 1991). To date, the southern limit of geographic range is Tehuantepec, in Oaxaca state in tropical southeastern Mexico. Here, we report the first known occurrence of *C. townsendii* from Chiapas, Mexico, which expands southward in Mexico the known geographic range by ~180 km.

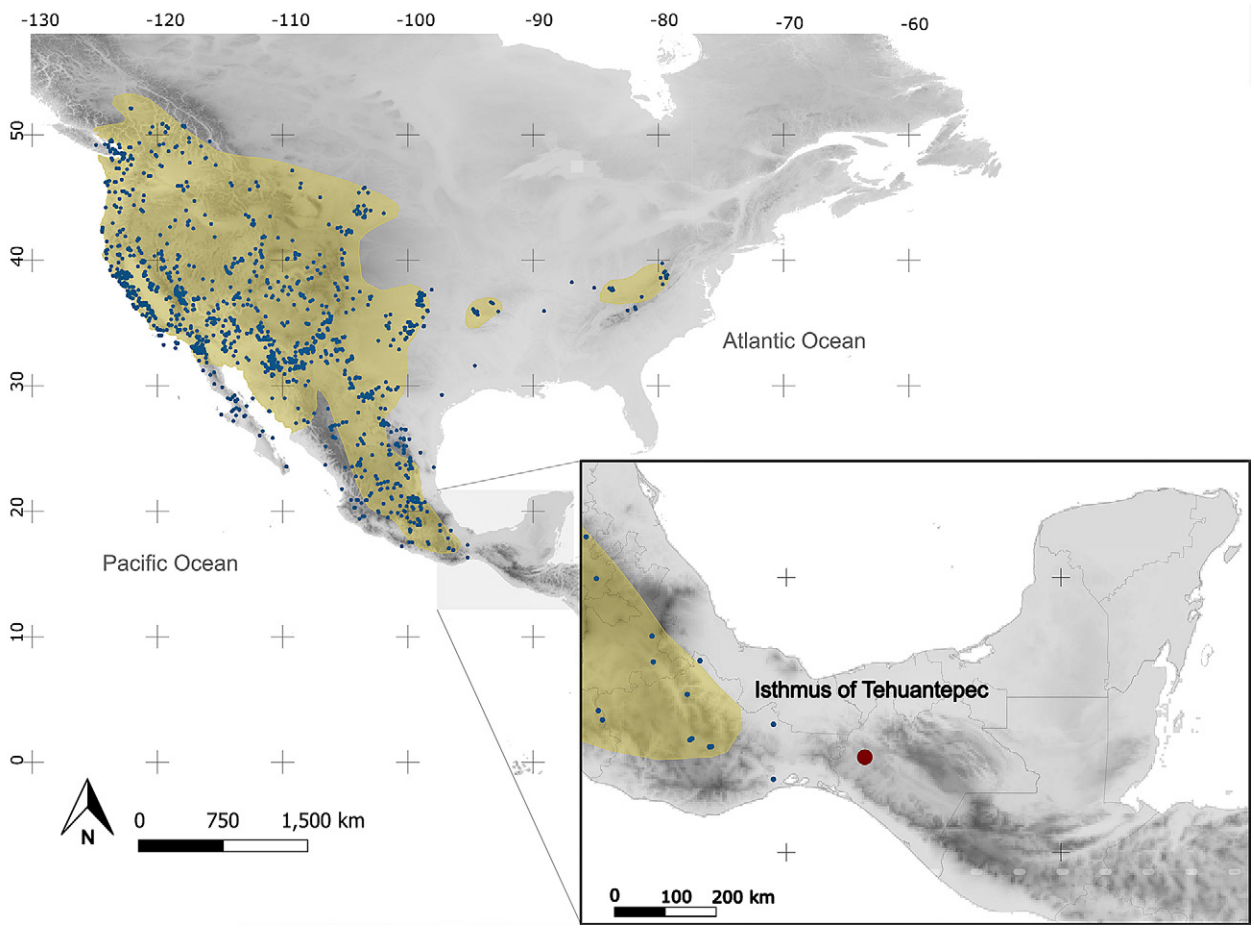

Figure 1. Extension of the distribution of *Corynorhinus townsendii* in southeastern Mexico. Yellow area shows potential distribution according to IUCN (Arroyo-Cabrales and Álvarez-Castañeda 2017), and blue dots represent the records of occurrence obtained from GBIF (2022). The red dot shows the new record occurring in Ocozocoautla, Chiapas, Mexico.

Methods

During our review of specimen in the Colección Nacional de Mamíferos of the Instituto de Biología at Universidad Nacional Autónoma de México (Mexico City, Mexico), we found three female individuals (CNMA 26580, CNMA 26581 and CNMA2 6582) preserved in ethanol and labelled as *Corynorhinus mexicanus* but the morphological characters did not match those of that species.

We compared some morphological measurements and teeth characteristics taken from these individuals with information available in the literature on both *C. mexicanus* and *C. townsendii* (Handley 1959; Kunz and Martin 1982; Tumlison 1991; Tumlison 1992). We measured the forearm length, total length, length of tail, tibia length, length of hindfoot including nails, length of the tragus, and ear length with an analog caliper (Mitutoyo, ± 0.05 mm accuracy). We also measured the length of some wing bones: metacarpus of fingers III, IV, and V; first and second phalanges of the fingers mentioned above, third phalange of the finger III, the total length of the thumb, and length of finger II. We counted the number of interfemoral cross ribs and checked the presence or absence of hair at the of uropatagium, as well as observed the pattern of hair color in the dorsal pelage and the shape of the superior incisors. We obtained the sex, date, locality, and name of the collector from labels with these specimens.

Results

***Corynorhinus townsendii* (Cooper, 1837)**

Plecotus townsendii is a synonym commonly found in scientific literature.

Material examined. MEXICO – **Chiapas** • Ocozocoautla de Espinosa; 16.7122°N, 093.5528°W; 600 m a.s.l.; 29.IX.1979; V.G. Urbano leg.; 1 ♀ (CNMA26580), 1 ♀ (CNMA26581), 1 ♀ (CNMA26582), spec. in ethanol.

Identification. We identified individuals by the length of tragus and forearm, the color pattern of dorsal hair, and the shape of the upper incisors. The values of the morphological measurements of the specimens are presented in Table 1. The tragus lengths in the individuals were ~13 mm except in specimen CNMA25682, which was shorter (Fig. 2). These values resemble the tragus length reported for *C. townsendii* (>13 mm) which is usually larger than in C. *mexicanus* (~11 mm). The average forearm length reported for females of *C. townsendii* (42.81 mm) is larger than females of *C. mexicanus* (41.53 mm). In the three Chiapas specimens, the forearms were larger than the average reported for both species. The dorsal hair coloration of the three specimens had bases darker than the tips, which aligns more closely with *C. townsendii* than *C. mexicanus*. This contrasting color between the bases and tips of hairs was most conspicuous in specimen CNMA25680 and less so in the others. The interfemoral cross ribs in specimens CNMA25680 and CNMA25682 were 10, with no hair, two characteristics usually found in *C. townsendii*. Specimen CNMA25681 had eight cross ribs with shallow hair (Fig. 2). The shape of the superior incisors in CNMA25680 resembled *C. townsendii* in being simple, but the two other Chiapas specimens had a tiny accessory cuspid. Based on our morphological comparisons, the three individuals had more characteristics of *C. townsendii* than *C. mexicanus.*

Discussion

Although specimens CNMA25681 and CNMA25682 exhibited more traits resembling *C. townsendii*, they both shared some traits of *C. mexicanus* which leads to uncertainty in their identity. Handley (1959) had reported that some individuals of *C. townsendii* share morphological traits with *C. mexicanus*, particularly the number of cross ribs and the shape of superior incisors. In the subspecies *C. townsendii ingens*, the presence of the accessory cuspid on the upper incisors has been commonly reported (Handley 1959; Kunz and Martin 1982). Possible hybridization among species has been proposed as the reason of these shared traits (Handley 1959). However, the Chiapas species are not from a hybridization zone, as the southernmost limit of *C. mexicanus* is the Mexican Trans-Volcanic Belt (Tumlison 1991, 1992) and *C. rafinesquii* is not present in Mexico (Jones 1977). As a possible explanation, we suggest that this phenomenon

Table 1. Summary of morphological measurement taken from specimen CNMA25680, CNMA25681, and CNMA25682. Abbreviations: forearm length (FA), total length (TL), length of the tail (TAL), tibia length (TIL), length of hindfoot including nails (FL), length of the tragus (TRL), ear length (EL), metacarpus of fingers III (M3), IV (M4) and V (M5); first phalanges of finger III (P13), IV (P14), and V (P15), second phalanges of finger III (P23), IV (P24), and V (P25); third phalange of the finger III (P33), the total length of the thumb (THL) and finger II (F2). All measurements are given in millimeters.

Morphological measurement	CNMA25680	CNM25681	CNMA25682
FA	45.09	43.82	44.45
TL	93.35	90.17	83.19
TAL	49.53	44.45	39.37
TIL	21.59	23.16	20.96
FL	10.16	8.89	9.53
TRL	13.34	13.00	12.07
EL	32.39	32.39	25.91
M3	41.91	40.94	42.42
M4	40.01	40.01	41.28
M5	40.64	40.94	42.55
P13	15.49	13.59	13.97
P14	12.19	10.80	10.46
P15	11.43	9.53	10.16
P23	20.32	18.42	19.05
P24	13.46	13.97	12.70
P25	10.80	10.16	10.16
P33	7.62	6.35	6.35
THL	6.35	6.99	6.35
F2	38.10	36.83	38.86

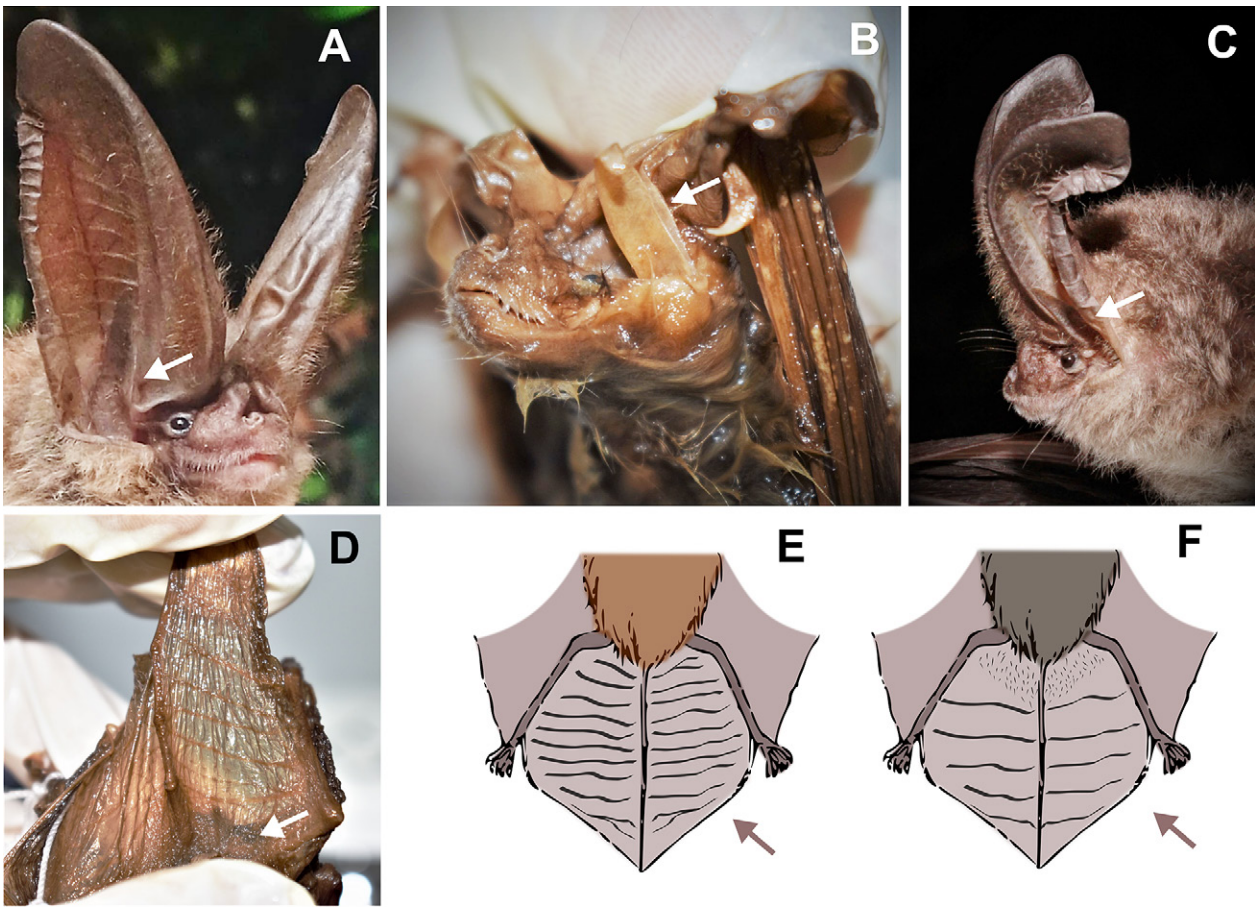

Figure 2. Diagnostics characters used for identifying specimens. The upper panel shows the tragus dimensions among *Corynorhinus* species and specimens from Chiapas. The lower panel shows diagnostic characters in the uropatagium (presence of hair and number of interfemoral cross ribs). **A.** *Corynorhinus townsendii*. **B.** Specimen CNMA25680. **C.** *Corynorhinus mexicanus*. **D.** Uropatagium with no hair of specimen CNMA25680. **E.** Diagram of the number of interfemoral cross ribs present in *C. townsendii*. **F.** Diagram of the number of interfemoral cross ribs present in *C. mexicanus*.

is a retrogression to ancestral characters, as *C. rafinesquii* is the oldest lineage of extant *Corynrohinus* species (Piaggio and Perkins 2005) and its superior incisor are bifid (Jones 1977). As our review did not include molecular data, further molecular analyses would be necessary to support the identification of CNMA25681 and CNMA25682 based on morphological evidence.

Specimen CNMA25680 clearly matches the morphological characteristics described for *C. townsendii* and supports the extension of this species geographic range south of the Isthmus of Tehuantepec (Fig. 1). The record from Ocozocoautla, Chiapas, occurs ~180 km east of the closest occurrence in Tehuantepec, Oaxaca (Goodwin 1969; Tumlison 1992; Briones and Sanchez-Cordero 2004). Our finding supports the fact that *C. townsendii* occurs in a wide variety of ecosystems and possesses the largest geographic distribution within its genus (Hall 1981; Kunz and Martin 1982). The Chiapas record highlights the great biodiversity present in southeastern Mexico, where Nearctic and Neotropical faunas converge, and suggests that bat communities are more species rich than previously assumed. Based on morphology (Handley 1959) and geography (Handley 1959; Piaggio and Perkins 2005), CNMA25680 belongs to the subspecies *C. t. australis*, but a phylogenetic analysis is needed to confirm this assumption.

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Author's Contributions

Conceptualization: ILL, MCMG, JO, SMOG, GZ, YHM. Funding Acquisition: JO, MCMG. Investigation: ILL, MCMG. Resources: ILL, YHM. Writing – original draft: ILL. Writing – review and editing: MCMG, JO, GZ, SMOG, YHM.

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