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New record of *Cryptotis mayensis* in the Gulf of México coastal plains

Nuevo registro de *Cryptotis mayensis* en la Planicie Costera del Golfo de México

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The Yucatán small-eared shrew, *Cryptotis mayensis* (Merriam, 1901), is a little-known shrew that inhabits lowlands covered by tropical forests in the Yucatán Peninsula in México, as well as in Guatemala and Belize. As part of a study evaluating rodent populations in oil palm plantations (*Elaeis guineensis*), a specimen of *C. mayensis* was captured within a young palm plantation located in the Gulf of México coastal plains on the borders of Tabasco and Campeche. The species record is located 60 km north of the nearest species records, which extends its distribution area. Furthermore, since the specimen was captured in a monoculture surrounded by pastures for livestock farming, it could indicate that *C. mayensis* can inhabit sites with high disturbance.

Key words: Campeche; mammal survey; oil palm; shrew; Tabasco.

La musaraña de orejas pequeñas de Yucatán, *Cryptotis mayensis* (Merriam, 1901), es una musaraña poco conocida que habita en tierras bajas cubiertas por bosques tropicales en la Península de Yucatán en México, así como en Guatemala y Belice. Como parte de un estudio de evaluación de poblaciones de roedores en plantaciones de palma de aceite (*Elaeis guineensis*), se capturó un ejemplar de *C. mayensis* al interior de una plantación joven de palma que está localizada en la Planicie costera del Golfo de México en los límites de Tabasco y Campeche. El registro de la especie se encuentra a 60 km al norte de los registros más cercanos de la especie, lo que extiende el área de distribución de ésta; además, debido a que el ejemplar fue capturado en un monocultivo rodeado de pastizales para la ganadería, podría indicar que *C. mayensis* tiene capacidad de habitar en sitios con alta perturbación.

Palabras clave: Campeche; listado mamíferos; musaraña; palma de aceite; Tabasco.

The Yucatán small-eared shrew, *Cryptotis mayensis* (Merriam, 1901), is a species of small to medium size within its genus; it possesses short fur, ranging from silver-gray to dark silver-gray, albeit lighter in comparison to other species in the *C. nigrescens* group (Woodman and Timm 1993; Carraway 2007). The ventral coloration is silver-gray, and the dorsal coloration is lighter gray. The tail is notably short (approximately 33 % of head-body length) and covered in short silver-gray fur. The eyes are minuscule, and the ears are small and barely visible beneath the hair (Woodman and Timm 1993; Reid 2006). The species' range extends from México, encompassing the states of Yucatán and Quintana Roo, to the eastern and central regions of Campeche, as well as reaching into Guatemala and Belize (Carraway 2007; Cuarón *et al.* 2016; see Figure 1). *Cryptotis mayensis* appears to have a disjunct geographical distribution, as it has been reported in barn owl *Tyto alba* pellets in the state of Guerrero (Choate 1970; Carraway 2007; see discussion on these records in Monroy-Gamboa 2021; Figure 1).

The shrew *Cryptotis mayensis* inhabits lowlands covered by deciduous and semi-deciduous tropical forests, as well as dry scrublands on the Yucatán Peninsula. It is typically found at altitudes that generally do not exceed 100 m (Álvarez and Martínez 1967; Woodman and Timm 1993; Cuarón *et al.* 2016). Despite limited knowledge regarding its ecology, it is classified as a nocturnal carnivore that preys on insects, snails, and earthworms (Carreón-Arroyo and Ceballos 2005). According to the International Union for Conservation of Nature (IUCN), it is considered a species of least concern (Cuarón *et al.* 2016), and it is listed as a species subject to special protection under the Official Mexican Legislation NOM-059-SEMARNAT-2010 (SEMAR-

NAT 2010).

As part of a study aimed at identifying rodent species responsible for damage in oil palm plantations (*Elaeis guineensis*), we captured 1 individual of *C. mayensis* on May 4, 2023. The capture was made using a Sherman trap (H. B. Sherman Traps Inc.; Tallahassee, Florida) placed within a cultivated area in the boundary between Emiliano Zapata, Tabasco, and Carmen in Campeche, México (Figure 1). The capture site was located within the Caballitos plantation, owned by Uumbal Agroforestal (17° 55' 58" N, 91° 46' 12" W; Figure 2d). The Caballitos plantation is situated in the Coastal Plain of the Gulf of México, at an elevation of approximately 10 m.

The climate in the region is warm and humid, characterized by abundant summer rains, with an average annual temperature ranging from 26°C to 28°C and an average annual precipitation between 1,500 to 2,000 mm (INEGI 2015). Originally, the region was predominantly covered by semi-deciduous tropical forests (Rzedowski 2006), which, like a significant portion of the Coastal Plain of the Gulf of México, has largely been converted into pastures for livestock and agricultural areas for over 50 years (Tudela 1989). Currently, most of the site is covered by induced pastures for livestock (Kolb and Galicia 2012) and secondary woody vegetation in various stages of succession. In the past 10 years, a significant portion of the induced pastures has been converted into oil palm plantations (Hernández-Rojas *et al.* 2018).

The *C. mayensis* record occurred within a 2-year-old plantation where the palm trees reached a height of approximately 2 m. We placed 100 Sherman traps (7.62 x 8.89 x 22.86 cm) within a 100 x 100 m quadrant for 2 consecutive nights. The traps were baited with oat flakes, activated in the late afternoon (around 16:00 to 18:00 hr), and checked between 7:00 and 9:00 hr the following day. After the first day, the traps were removed and placed back in the exact locations for the second night of sampling. The captured rodents included the toltec cotton rat (*Sigmodon toltecus*) and the fulvous pygmy rice rat (*Oligoryzomys fulvescens*). Captured individuals were sexed and released at the capture site immediately after processing. The capture and handling of the organisms followed the criteria established by Sikes *et al.* (2016) and were conducted under collecting permit No. SGPA/DGVS/O392O/22 issued by the Secretariat of Environment and Natural Resources (SEMARNAT).

During the second night of sampling, a shrew was captured with the following measurements: total length = 75 mm, tail length = 15 mm, hind leg length = 10 mm, and

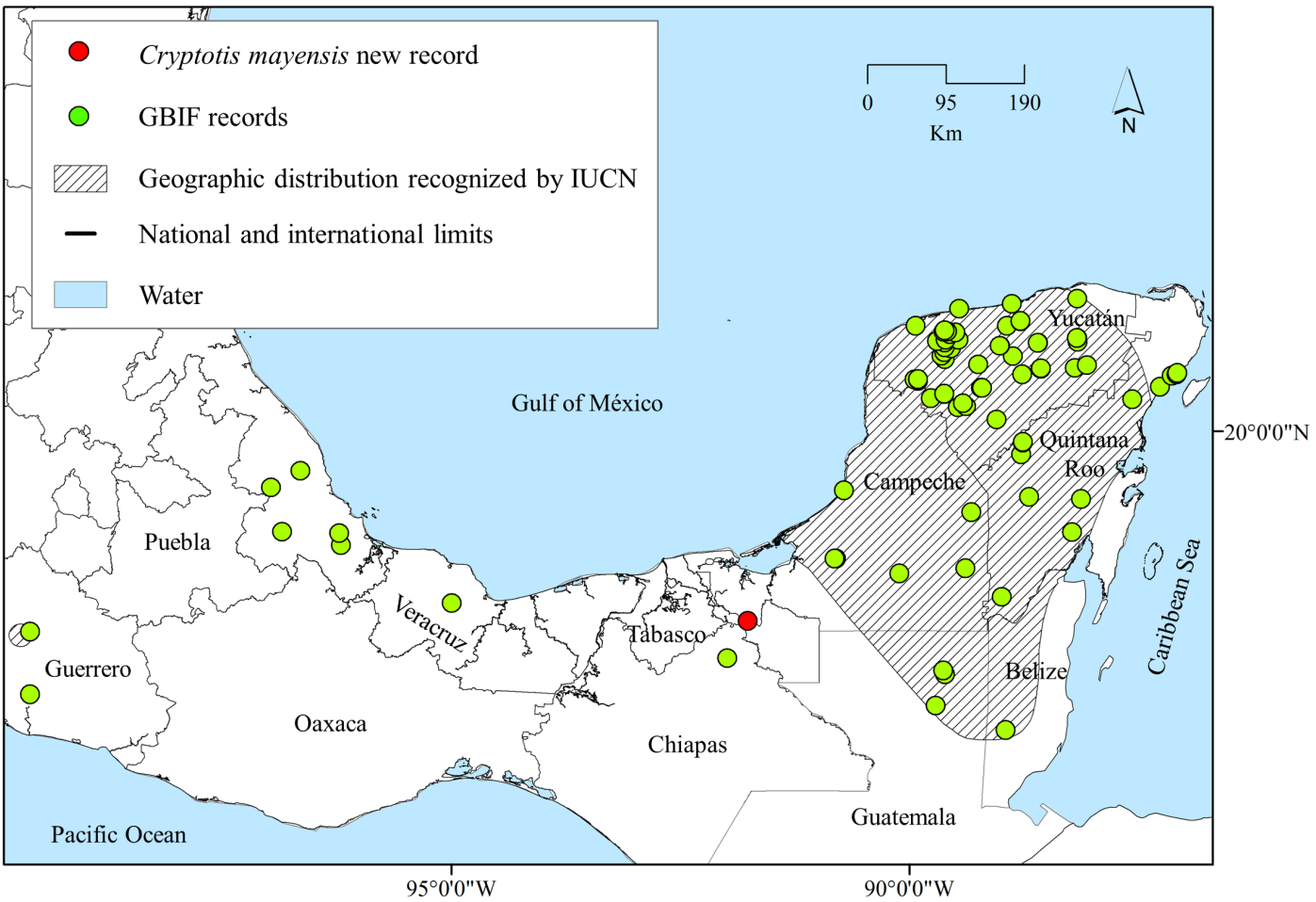

Figure 1. Geographic location of the new record of *Cryptotis mayensis* according to the distribution recognized by the International Union for Conservation of Nature (IUCN; Cuarón *et al.* 2016) and records from the Global Biodiversity Information Facility (GBIF 2023; green points).

ear length = 0 mm (Figure 2a-c). Due to the need for rapid processing to minimize handling effects, we were unable to obtain its weight and determine its sex. The specimen was identified as belonging to the *Cryptotis* genus based on its very short tail, tiny ears, and eyes. Further, it was identified as *C. mayensis* because its fur was short and dark gray on the dorsum and lighter on the ventral side, with no distinct bicolored tail (Figures 2a and b). This distinguishes it from its sympatric relatives like the small-eared shrew (*C. pueblensis*), which could also potentially inhabit the area. Unlike the specimen captured in this report, the small-eared shrew has brown dorsal fur and a slightly bicolored tail (Carraway 2007).

The *C. mayensis* specimen was photographed and subsequently released. The photographs were deposited in the "Alvar González Christen" Photographic Collection at the Instituto de Investigaciones Biológicas from Universidad Veracruzana with catalog numbers IIB-UVMam 0103f and IIB-UVMam 0103f bis (Figure 2a, and b, respectively).

To locate the records of *C. mayensis* closest to the one we obtained in the Caballitos plantation, as well as to identify records of presence beyond the reported distribution area for the species (Cuarón *et al.* 2016), we consulted the Global Biodiversity Information Facility (GBIF) using the species name "*Cryptotis mayensis*" as our search criterion. We obtained 237 records, of which 202 had reported coordinates (GBIF 2023). We projected these records onto a topographic map of the region using QGIS ver. 3.22.2 (QGIS Development Team 2021).

We found that the nearest *C. mayensis* points to the Caballitos plantation record were 3 records from the Palenque locality in Chiapas, México (GBIF ID 1895683219, 1895683206, and 1895683159), located 60 linear km to the south from this new record, and 2 records in the El Tormento locality in the municipality of Escárcega, Campeche, at 125.5 km to the east (GBIF ID 2630401870 and 2804487581; Figure 1). Additionally, we found 9 records outside the distribution area reported by Cuarón *et al.* (2016): those 3 from Palenque in Chiapas and 6 in the state of Veracruz (GBIF ID 2630469924, 2630470258, 2630470002, 2630482618, 2630482618, and 2630482983).

The record of the *C. mayensis* individual captured in the Caballitos plantation is located outside the reported distribution area for the species (Cuarón *et al.* 2016), at distances of 60 km to the north and 125.5 km to the southwest of the nearest known records. This record constitutes the first formal record of the species in the state of Tabasco (Hidalgo-Mihart *et al.* 2016). It also represents the second shrew species reported for the state. The only previously known specimen was *C. parva pueblensis* (= *C. pueblensis*), captured in Balancán, Tabasco, and deposited in the Museum of Natural Sciences at Louisiana State University (catalog number LSUMZ 8882).

Reviewing the validity of records near the *C. mayensis* record obtained in this study in the Caballitos plantation, we found that the 3 records originating from Palenque, Chiapas, can be traced back to Ocaña-Marín (1997). In his original text, Ocaña-Marín reported remains of *C. nigrescens* found during excavations at the "Templo Olvidado" in Palenque (archaeological site), Chiapas. These remains were likely derived from the regurgitations of owls and barn owls that inhabited the site while it was abandoned. Subsequently, these 3 records were reported as *C. mayensis* in reviews conducted on records of mammals at archaeological and Pleistocene sites (Arroyo-Cabrales *et al.* 2005), as well as records of mammals in the state of Chiapas (Muñoz-Alonso 2021). Despite initially being designated as *C. nigrescens*, these records are listed as *C. mayensis* in GBIF. It is important to note that since the specimens reported by Ocaña-Marín (1997) originate from archaeological samples, it is impossible to determine a specific timeframe during which the species inhabited the Palenque area.

In the case of the specimens from Escárcega, Campeche, 1 was initially determined as *C. nigrescens mayensis* (GBIF_ID 2630401870; Dowler and Engstom 1988), and the other as *C. mayensis* (GBIF_ID 280448758, deposited in the Natural History Collection of Angelo State University in Texas; ASNHC:Mamm:1286). The records of *C. mayensis* from Veracruz, as recorded in GBIF, were reported by Ceballos (2002), who cited Hall and Dalquest (1963) as the source. However, upon reviewing the original publication, we found that these authors did not mention the presence of *C. mayensis* in the state. A search in Hall and Dalquest (1963) revealed that the locations listed in the GBIF results (Teocelo, Las Vigas, Cerro Gordo, Jalapa, El Brinco, and Mecauyucan; GBIF 2023) correspond to what the authors determined as *C. micrura*, a species that, according to Choate (1970), could be synonymous with *C. parva orophila, C. parva tropicalis*, or even *C. nigrescens mayensis*. The review of historical records highlights inconsistencies between the original reports and those in GBIF for the records from Veracruz and Palenque, Chiapas. Recent studies have pointed out that these inconsistencies are primarily due to a lack of nomenclatural updating and emphasize the need for data cleaning in mammal databases, especially for poorly studied taxa like shrews (Sánchez-Cordero and Guevara 2016).

Cryptotis mayensis is a relatively poorly known species and is considered under Special Protection according to Mexican regulations (SEMARNAT 2010), likely due to gaps in knowledge regarding its biology and ecology. Historically, the species has been associated with deciduous and semi-deciduous forests (Álvarez and Martínez 1967; Woodman and Timm 1993). However, the individual in this report was captured in an oil palm plantation and induced pastures for livestock. The remaining natural vegetation in the region consists of secondary forests smaller than 10 ha, with regeneration ages ranging from 10 to 20 years. The nearest patch of natural vegetation to the capture site is approximately 800 m away. Therefore, it is quite possible that the captured individual could inhabit the oil palm plantations, suggesting that *C. mayensis* may tolerate changes in its natural habitat.

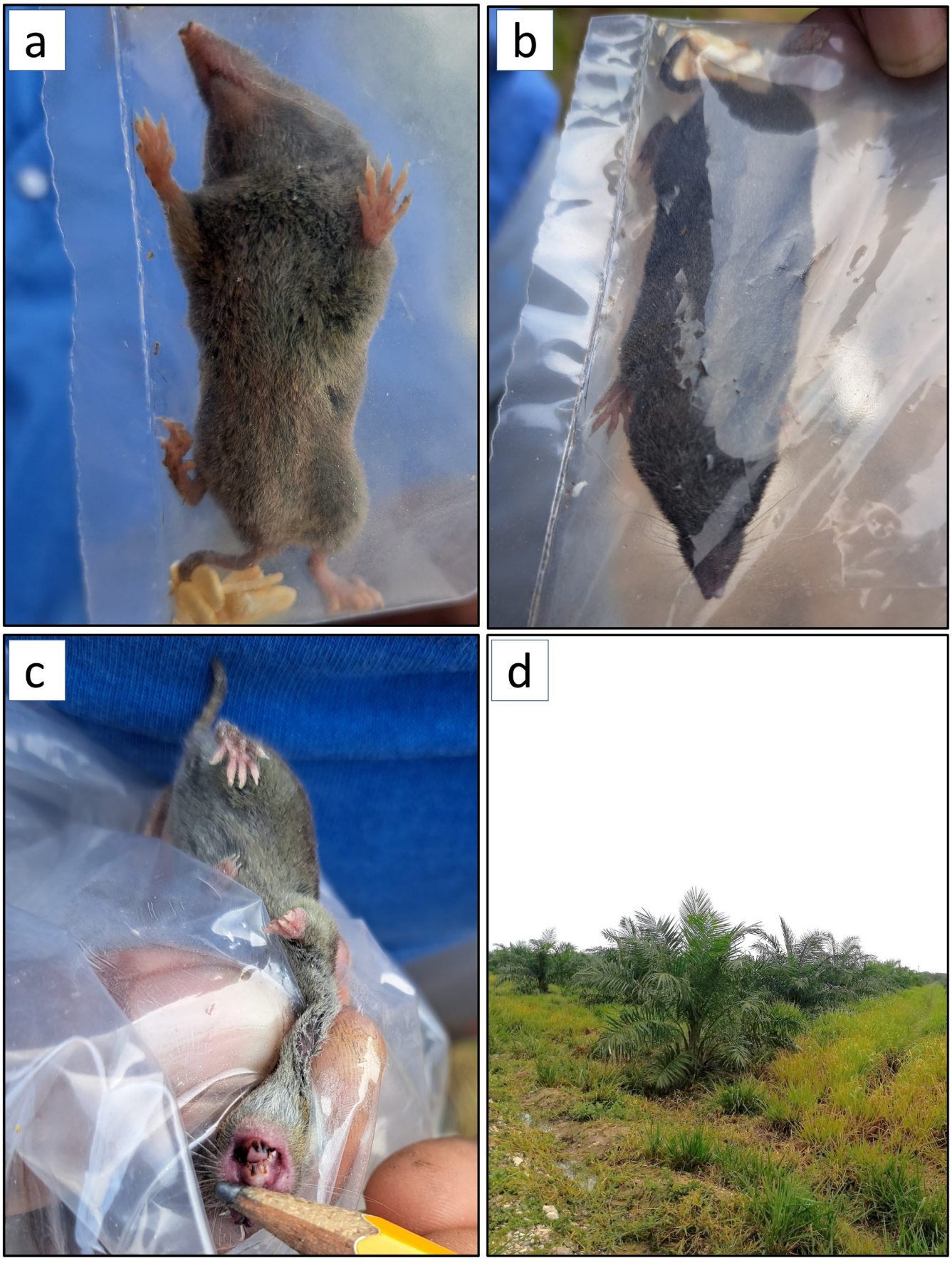

Figure 2. Characteristics of the *Cryptotis mayensis* specimen captured in the Caballitos plantation, Emiliano Zapata, Tabasco, México. a) Ventral view; b) dorsal view; c) frontal view showing dentition; d) photograph illustrating the features of the Caballitos oil palm plantation, where *C. mayensis* was captured.

The significant lack of information on Mexican shrew species has hindered a proper assessment of their conservation status and the threats facing this group in México (Guevara *et al.* 2015). Future studies in highly modified environments within the Coastal Plain of the Gulf of México region should consider the possible presence of *C. mayensis*. Therefore, sampling in these environments should include appropriate techniques for capturing shrews, such as pitfall traps (McCleery *et al.* 2022). Generally, traps designed for rodents (*e.g.*, Sherman traps) are unsuitable for capturing animals with such low body weight, making the presence of shrews easy to overlook. Appropriate techniques would help generate information to determine fundamental aspects of the species' ecology and conservation status in this region.

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