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First record of the Mexican-M hairstreak
Parrhasius moctezuma (Clench, 1971)
(Lepidoptera: Lycaenidae) in Texas, USA, and possible
sighting of the tequila giant skipper *Aegiale hesperiaris*
(Walker, 1856) (Lepidoptera: Hesperiiidae)

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First record of the Mexican-M hairstreak
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Abstract. We report two significant butterfly sightings in the United States, observed during an opportunistic photographic survey conducted in south Texas between December 2022 and January 2023. *Parrhasius moctezuma* (Clench, 1971) (Lepidoptera: Lycaenidae) was sighted at the National Butterfly Center in Mission, Texas, on January 5, 2023, marking the first documented record of the species in Texas and only the second in the United States, as confirmed by photographic evidence. Additionally, *Aegiale hesperiaris* (Walker, 1856) (Lepidoptera: Hesperiiidae) was potentially observed at the same location on December 4, 2022, although lacking photographic documentation or a collected specimen, highlighting the need for further observations in south Texas. These extralimital records enhance our understanding of the distributions and potential range expansions of these two taxa.

Key words. Butterflies, maguey worm, Neotropical species, photographic evidence, range extension, Wallacean shortfall.

ZooBank registration. urn:lsid:zoobank.org:pub:88F08FB8-4284-4E64-B73A-FFCAD5634038

Introduction

Butterflies are considered exemplary ecological indicators owing to their mobile nature and ectothermic physiology, rendering them highly responsive to climate change and habitat modifications (Brown 1991). Their biology and characters are well-documented, making them easier to sample, monitor, and identify compared to most other insect taxa (Ehrlich 1994; Braby 2004; Thomas 2005). However, the Wallacean shortfall, which refers to the gap in knowledge of species' geographic distributions, is a significant challenge in accurately assessing the population trends of species, including butterflies, and making informed conservation decisions (Whittaker et al. 2005). This can be particularly difficult for species that migrate great distances and thus have wide geographic distributions, such as the monarch butterfly, *Danaus p. plexippus* (Linnaeus, 1758) (Nymphalidae), which migrates between 774 km and 4,430 km (Flockhart et al. 2017), and the painted lady, *Vanessa cardui* (Linnaeus, 1758) (Nymphalidae), which has been recorded traveling at least 4,200 km (Suchan et al. 2024). Moreover, their geographical distribution provides valuable insights into the biotic (Niemi and Baur 1998; Kerr et al. 2000) and abiotic (Kula and Kralicek 1995; Fleishman and Murphy 2009) conditions of an area, as butterflies are often intimately tied to specific host plants and environmental conditions (van Nouhuys and Hanski 2005). This host specificity and narrow

tolerance for environmental factors make butterflies a proxy for assessing the ecological integrity of a region (De Benedictis et al. 1990; Nelson and Andersen 1994; Hermy and Cornelis 2000; Nelson 2007).

New butterfly records frequently occur in regions proximal to international borders (see KC and Sapkota 2022). According to Pelham (2023), the United States and Canada are home to 890 known species of butterflies. Following recent taxonomic revisions, such as those by Zhang et al. (2023), the expected update is likely to exceed 900 species in the near future; however, the validity of these revisions remains a topic of debate. With approximately 90% of American butterfly species being Neotropical (Bonebrake et al. 2010), it is not surprising to encounter occasional stray records of these species in the US, particularly in southern states such as Arizona and Texas. The lower Rio Grande Valley has long been a focal point for lepidopterists seeking new US records. The butterfly fauna of the region was first illustrated by Bordelon and Knudson (2003), including mentions of vagrant species expected to be found in the Valley in the future. Since that time, many of those species have indeed been documented (see Pelham 2023). Likewise, Glassberg (2017) included stray species discovered in the US and those expected to occur in the future based on their distribution in neighboring Mexican states. This paper documents the presence of two possibly vagrant butterfly species in the US, providing valuable insights into potential range expansion, previously unknown populations, and their dispersal capabilities.

Parrhasius moctezuma (Clench, 1971) (Lycaenidae), also known as the Mexican-M hairstreak, is a thecline butterfly typically found from Mexico to Nicaragua (Nicolay 1979; Warren et al. 2024). It has only one prior US record, from “high point on road E of Ruby”, Santa Cruz County, Arizona, on 27 February 2016 (Davenport 2017). In contrast, its sole US congener, *P. m-album* (Boisduval and LeConte, 1833), commonly known as the white-M hairstreak, has a wide range in the US, stretching from New Hampshire and Wisconsin in the north to Texas in the south (Nicolay 1979; Warren et al. 2024).

Aegiale hesperiaris (Walker, 1856) (Hesperiidae), commonly known as the tequila giant skipper or gusano de maguey, is a megathymine skipper primarily distributed throughout northern and central Mexico (Maza-Elvira 1976; Maza 1987; Warren et al. 2024). It has been reported to rely on several agave species (Asparagaceae) as host plants, including *Agave americana* L., *A. atrovirens* Karw. ex Salm-Dyck, *A. lehmannii* Jacobi, *A. mapisaga* Trel., *A. salmiana* Otto ex Salm-Dyck (Jaimes-Rodríguez et al. 2020), and *A. tequilana* F.A.C.Weber (Molina-Vega et al. 2021). The larvae, referred to as ‘white maguey worms’, are considered a delicacy in Mexico and are enjoyed raw or cooked in various ways, including roasting, toasting, or being used as a flavorful condiment (Molina-Vega et al. 2021). Although the species has been recorded as far north as Coahuila and Nuevo León, Mexico (Warren et al. 2024), its larval host plants, including *Agave americana*, *A. salmiana*, and *A. tequilana*, are cultivated as ornamentals in south Texas (iNaturalist 2024). This suggests potential occasional importation of the species with plants from Mexico (Bordelon and Knudson 2006) or a possible range extension in the region.

Materials and Methods

The authors conducted a photographic survey of butterflies in Mission, Texas, from December 2, 2022, to January 10, 2023. Daily observations were made opportunistically in natural habitats from 9:00 am to 4:00 pm CT (Central Time), using Canon 7D Mark II cameras equipped with Canon EF-S 18–135 mm f/3.5–5.6 IS USM, Canon EF 180 mm f/3.5L Macro USM, and Sigma 150 mm f/2.8 AF APO EX DG OS HSM lenses. The resulting images were geotagged by the cameras with spatial and temporal metadata, including elevation and date. The primary study area was the National Butterfly Center (26.179849, -98.366490), which also attracts numerous butterfly enthusiasts, facilitating collaborative observations and real-time communication about notable findings. Identification of the species was done using Glassberg (2017, 2018), Warren et al. (2024), and seeking advice from the experts (see Acknowledgments). The map of the study area (Fig. 1) was produced using a combination of QGIS software (version 3.32.3 ‘Lima’, 2024) and Google Earth imagery (<https://earth.google.com>). The specimen of *Aegiale hesperiaris* used in this article belongs to the following collection:

MGCL McGuire Center for Lepidoptera and Biodiversity, Gainesville, FL, USA.

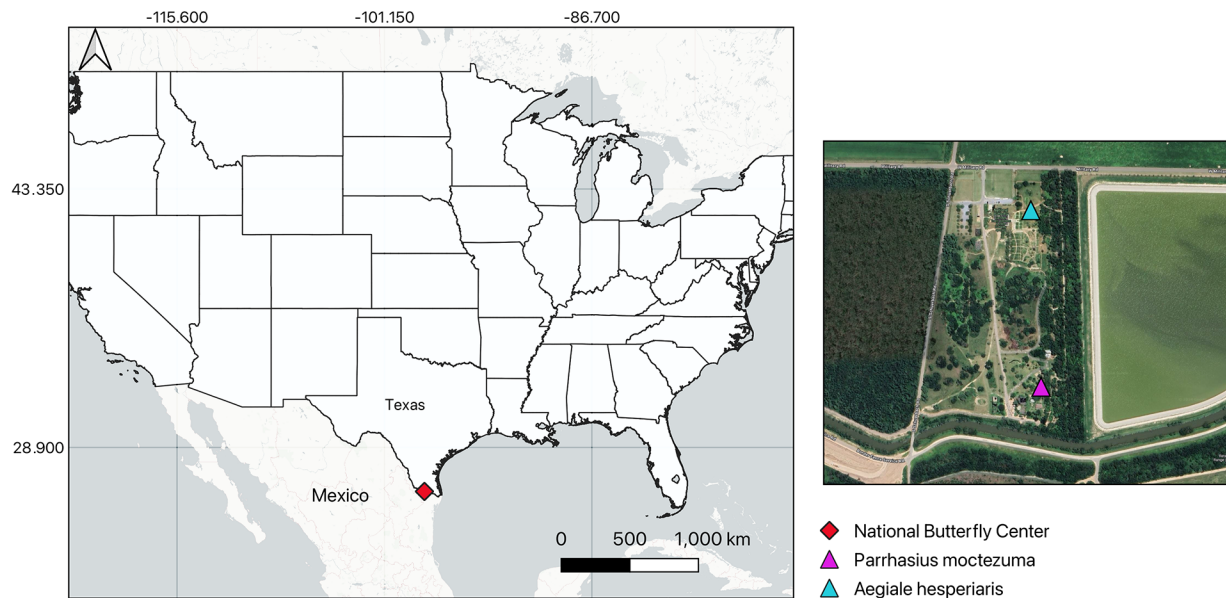


Figure 1. Study area and butterfly observation locations.

Results and Discussion

Parrhasius moctezuma (Clench, 1971)

Material examined. Photographic evidence. 1 ♀, USA, National Butterfly Center, Mission, Hidalgo County, Texas (26.176583, -98.365750, 38 m), 05-I-2023.

Diagnosis. Morphologically, *P. moctezuma* (Fig. 2a–b) can be distinguished from its sole U.S. congener, *P. m-album* (Fig. 2c), by its fainter blue area and an additional red spot on the margin of space 1 (anal region) on the ventral hindwing; the blue area is more intense in *P. m-album* (Bordelon and Knudson 2006). Furthermore, there is a prominent black spot at the base of the tornal orange spot on the ventral hindwing of *P. moctezuma*, which is usually subdued in *P. m-album* (see Warren et al. 2024). Geographically, the recorded range of *P. m-album* typically reaches its western limit in central Texas, creating allopatry between the two species.

Remarks. On the specified date and location, a female *Parrhasius moctezuma* (Fig. 2a–b) was observed actively foraging on flowers of *Chromolaena odorata* (L.) R.M.King and H.Rob. (Asteraceae) between 12:35 pm and 12:43 pm CT. Initially identified as *P. m-album*, the individual was later confirmed as *P. moctezuma* using Glassberg



Figure 2. Adults of *Parrhasius moctezuma* (Clench, 1971) and *P. m-album* (Boisduval and LeConte, 1833). a) *Parrhasius moctezuma* observed at the National Butterfly Center, Mission, TX on 5-I-2023. b) Same individual. c) *P. m-album* observed at the University of Florida, Gainesville, FL on 5-IV-2024 for comparison. Scale bars = 10 mm.

(2018). Despite an extensive search by numerous enthusiasts at the National Butterfly Center, the butterfly was not seen again after its initial sighting. Bordelon and Knudson (2006) speculated that *P. moctezuma* might eventually appear in the lower Rio Grande Valley. Although Nuevo León, Mexico, is a plausible origin as suggested by Mike Rickard (pers. comm. 2023), the individual's fresh condition suggests perhaps a more local provenance, likely in south Texas. The species' apparent tolerance to freezes, such as those occasionally experienced in south Texas, as reported by Andrew Warren (pers. comm. 2024), further supports the likelihood of its establishment in the region.

Distribution. Mexico to Nicaragua (Nicolay 1979; Warren et al. 2024), Arizona (Davenport 2017), Texas (**New state record**).

Aegiale hesperiaris (Walker, 1856)

Material examined. Observation (no photograph or specimen). 1, sex unknown, USA, National Butterfly Center, Mission, Hidalgo County, Texas (26.179889, -98.366167, 35 m), 04-XII-2022.

Diagnosis. *Aegiale* is a monotypic genus, but it resembles most species of *Agathymus* H. Freeman, 1959 (Hesperiidae), with which it is sympatric in parts of Mexico. Morphologically, *Aegiale hesperiaris* is characterized by its distinctive white antennae bearing apiculi, that extend to or beyond the forewing cell (Freeman 1969); the overall size is generally larger than that of *Agathymus*; the dorsal fore- and hindwings showcase broad orange patches, providing a notable contrast against the dark background (Fig. 3a), whereas the ventral hindwing surface features grey overscaling with dark-lined, muted spots (Fig. 3b; see Warren et al. 2024).

Remarks. On the given date and location, at approximately 3:00 pm CT, a potential individual of *Aegiale hesperiaris* was observed perched on a *Duranta erecta* L. (Verbenaceae) twig with its wings half-open and dorsal orange bands well-visible; it possessed white antennae. The sighting was made by the first author, who was alone in the area. Unfortunately, the individual flew away when the author attempted to take a photo, leaving no visual record. Later discussions with butterfly enthusiasts at the National Butterfly Center suggested possible identifications as *Megathymus yuccae* (Boisduval and Le Conte, [1837]) (Hesperiidae) or *Stallingsia maculosus* (H. Freeman, 1955) (Hesperiidae), but neither of these species has broad orange patches on their dorsal wings. The author recalls the butterfly with wings as long as those of a “giant grasshopper”, orange patches on the dorsal side, and white antennae. It was not until sharing the anecdote with Jeffrey Glassberg (pers. comm. 2023) six months later that the possibility of *A. hesperiaris* was proposed. Although adults are reported from April to May (Jaimes-Rodríguez et al. 2020) and August to November (Freeman 1969) in Mexico, there are two observations from December on iNaturalist (2024). Following a thorough examination of online specimens and those at the MGCL, the author is confident in the identification, although regretful that a photograph was not obtained, which would have represented the first documented record of this species in the US. Owing to the lack of photographic evidence or

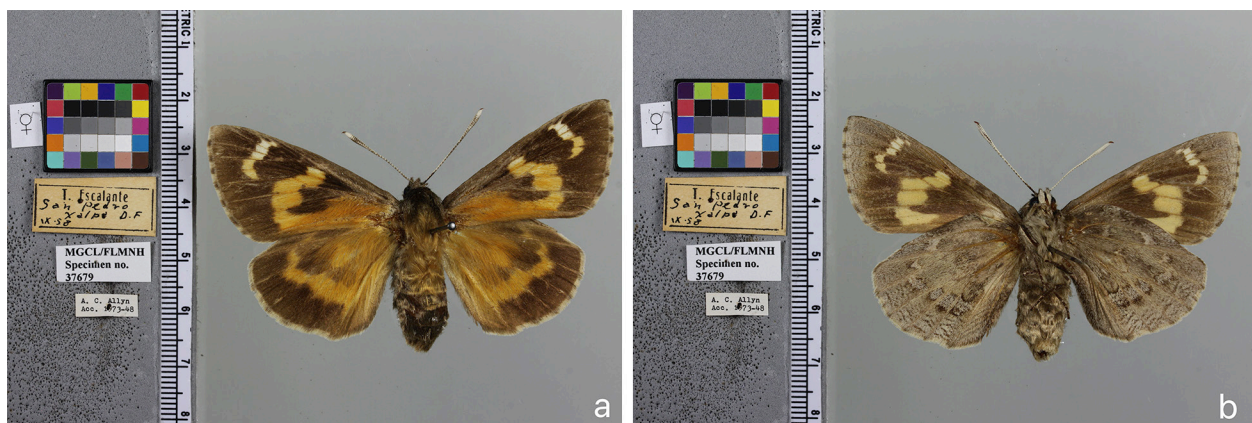


Figure 3. Spread specimen of *Aegiale hesperiaris* (Walker, 1856) from Mexico, currently deposited in the MGCL. **a)** Dorsal view. **b)** Same specimen, ventral view.

a specimen, this sighting will remain unconfirmed; however, there remains a possibility of rediscovery in the vicinity of the study area or elsewhere in south Texas, as species of the subtribe Megathymina are known to be non-migratory and are often found near their host plants (Freeman 1967, 1969; Quinn 2020). Additionally, Bordelon and Knudson (2006) reported a potential sight record of *A. hesperiaris* near Sinton, Texas, suggesting that the species may be sporadically present in south Texas or occasionally introduced through plant imports from Mexico, a possibility that cannot be ruled out. Given the species' typical habitat at higher elevations (usually above 1200 m), the likelihood of a sustainable population establishing itself in south Texas is, however, low (Andrew Warren pers. comm. 2024).

Distribution. In addition to the preliminary evidence presented here suggesting a Texas distribution, this species is found in arid regions of the Mexican Altiplano south to Oaxaca (see Warren et al. 2024).

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