

**First Record of *Megachile*
(*Pseudocentron*) *luctifera*
(Hymenoptera: Megachilidae)
in Puerto Rico**

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First Record of *Megachile (Pseudocentron) luctifera* (Hymenoptera: Megachilidae) in Puerto Rico

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and Julissa Rojas-Sandoval^{5,6,*}

Abstract - We report the first record of *Megachile (Pseudocentron) luctifera* (Hymenoptera: Megachilidae) in Puerto Rico, based on specimens of both sexes. Previously known only from the Lesser Antilles, this finding represents the first documentation for an island in the Greater Antilles. The first male specimen from Puerto Rico was collected in Coamo in October 2021, followed by females collected in the Guánica State Forest in May 2022. We confirmed species identification through morphological analysis and DNA sequencing. Repeated observations of this species in Coamo and Guánica suggest an established presence in these areas. Additionally, potential but unconfirmed records from other locations in Puerto Rico indicate that the species may have a broader Caribbean distribution than previously recognized. Preliminary data on its nesting behavior, spatiotemporal dynamics, and interactions with plant species are reported. Further research is needed to accurately evaluate its distribution, ecological role, and nesting behavior in Puerto Rico.

Introduction

Megachile (Pseudocentron) luctifera Spinola (Hymenoptera: Megachilidae; hereafter *Megachile luctifera*) is a continental species originally described from French Guiana that has expanded its range into the Lesser Antilles. The exact timing of its expansion is unknown, but it is plausible that, like other continental species colonizing Caribbean islands, *M. luctifera* utilized the Aves Ridge pathway (i.e., the historical island chain linking South America to the Greater Antilles during the late Eocene to early Oligocene) either through continuous emergent land or via island-hopping (Genaro 2008, MacPhee and Iturralde-Vinent 1995, Vinent and MacPhee 2023). Currently, this species has been recorded on multiple islands in the Lesser Antilles, including Barbados, Dominica, the Grenadines, Grenada, Martinique, St. Barthelemy, St. Vincent, and the US Virgin Islands (St. Croix and St. Thomas) (Genaro 1998, Genaro and Franz 2008, Meurgey and Dumbardon-Martial 2019, Meurgey and Questel 2015).

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Megachile luctifera belongs to the subgenus *Pseudocentron* (Michener 2007), a primarily Neotropical group and the largest South American subgenus of *Megachile*, comprising 66 recognized species including *Megachile holosericea* (Fabricius), the only species of this subgenus reported for Puerto Rico until now (Ascher and Pickering 2024, Genaro and Franz 2008, Michener 2007). The most distinctive characteristic of this subgenus is the female's sixth sternite (S6), which has at least the posterior half bare or nearly so, except for a subapical row of short hairs, behind which there is a smooth, bare rim directed posteriorly (Fig. 1; Gonzalez 2008, Gonzalez et al. 2019). Females exhibit additional distinguishing traits, including 4-toothed mandibles with a well-defined cutting edge in the third interspace, an acute or rounded inner mandibular angle, a straight and entire clypeal margin, and an S6 with a broadly truncate or rounded distal margin. Males, on the



Figure 1. Dorsal view of the female holotype (on the left) deposited at Museo Regionale di Scienze Naturali, Torino. Photograph © F. Giachino.

other hand, have a distinctive apical prong on the middle tibia, likely representing a fused spur, that may sometimes be reduced to a large, acute tooth. Their front and middle tibiae remain simple and unmodified, while their front tarsi are slender and typically black (Gonzalez 2008, Gonzalez et al. 2019). Sexual dimorphism in this species is notable (Fig. 2): males have dense golden hairs on the head and thorax and possess more circular abdomens with white hair bands, while females have triangular-shaped abdomens with white stripes (Cockerell 1937).

Observations and Discussion

The first *M. luctifera* specimen recorded in Puerto Rico was a male we collected in October 2021 from the Coamo River, near a hot spring in the municipality of Coamo (south-central region; Kardas 2024). In May 2022, we collected female specimens from the Guánica State Forest (hereafter Guánica) in southwestern Puerto Rico. To confirm the species identity, we subject both male and female specimens to detailed morphological examination, including diagnostic trait comparisons. We also examined historical bee records from entomological collections including the Museum of Entomology and Tropical Biodiversity (MEBT; Agricultural Experiment Station, University of Puerto Rico–Mayagüez), the Museum of Zoology (MZUPRRP; University of Puerto Rico–Río Piedras), and the American Museum of Natural History (AMNH; New York, NY, USA), to determine whether specimens of this species may have been previously collected but remained unreported or misidentified. No verified specimens matching our focal species were found in these collections. Additionally, we performed DNA barcoding for 14 specimens

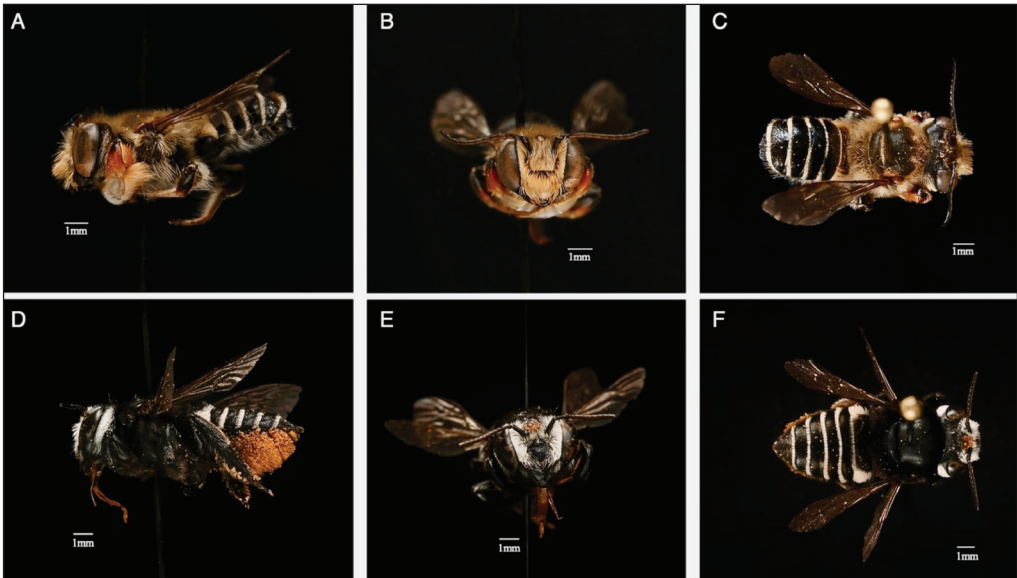


Figure 2. Male and female specimens of *Megachile luctifera* from Puerto Rico. Male specimens in (A) lateral, (B) frontal, and (C) dorsal views. Female specimens in (D) lateral, (E) frontal, and (F) dorsal views. Scale = 1 mm. Photographs © Alana Freytes-Rivera and Javier J. Freytes.

collected in Puerto Rico from 2021 to 2024 using the cytochrome oxidase 1 (*cox1*) gene to further validate the identification. We sampled hind legs from fresh and curated specimens and sequenced them at the Canadian Centre for DNA Barcoding using SMRT sequencing technology. All sequences were deposited in the Barcode of Life Data System (BOLD; Ratnasingham and Hebert 2007). We analyzed genetic distances using Kimura's 2-parameter (K2P) model (Kimura 1980), to assess species delimitation (Hebert et al. 2003) and detect a barcode gap distinguishing *M. luctifera* from related species. Genetic analysis confirmed species identity.

Since its first observation, we have consistently recorded both males and females of *M. luctifera* in Guánica through monthly censuses conducted as part of a pollination network study conducted over the last 3 years (2022–2024). To date, we have collected a total of 13 females and 12 males and deposited them in the Museum of Zoology at the University of Puerto Rico. These censuses involved direct observations in the field and video-recordings to document plant–pollinator interactions and seasonal activity patterns. The data reveal notable temporal fluctuations in visitation frequency, with the lowest activity observed in April and August (Fig. 3). Males were most frequently recorded in March and May, while females exhibited peak activity in February and July. Additionally, we have observed *M. luctifera* foraging on 28 plant species across 25 genera and 13 families. Some of the most frequently visited species include *Tephrosia cinerea* (L.) Pers. (Ashen Hoary-pea) (Fabaceae), *Erithalis fruticosa* L. (Black Torch) (Rubiaceae), *Neltuma juliflora* (Sw.) Raf. (Bayahonda Blanca) (Fabaceae), *Croton discolor* Willd. (Lechecillo) (Euphorbiaceae), and *Coccoloba diversifolia* Jacq. (Pigeon Plum) (Polygonaceae) (Fig. 4). In Coamo, *M. luctifera* has been observed visiting *Croton lucidus* L. (Fire Bush) (Euphorbiaceae), *Jatropha gossypifolia* L. (Bellyached Bush)

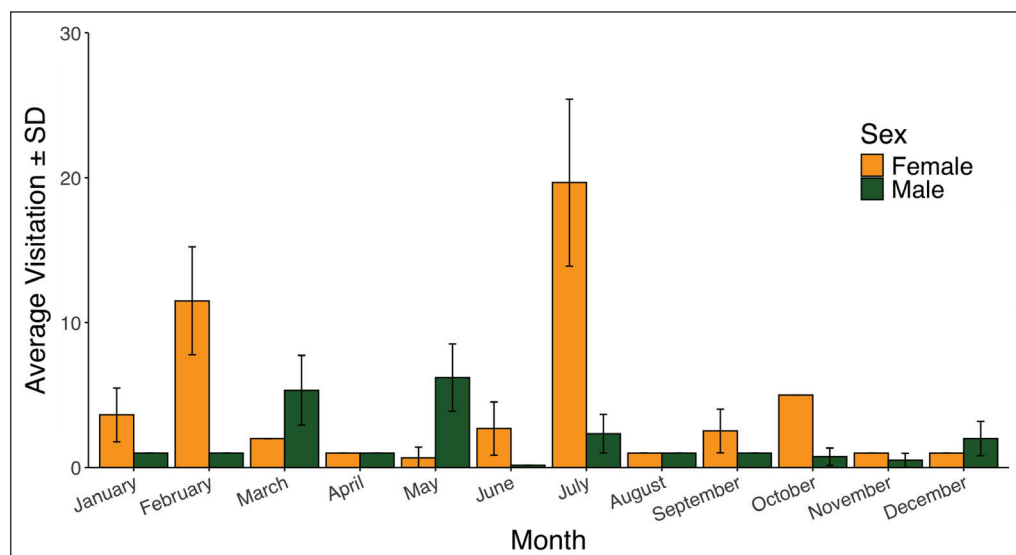


Figure 3. Average monthly visitation frequency of *Megachile luctifera* within the Guánica State Forest. Values represent the mean visitation frequency per observation sex period per month, averaged over 3 years (2022–2024), with standard deviation.

(Euphorbiaceae), and *Coccoloba krugii* Lindau (Whitewood) (Polygonaceae). All species, except for *N. juliflora*, are native to the island of Puerto Rico, highlighting their role as important pollen sources for *M. luctifera* and underscoring the pollinator's significance for the reproduction of native flora.

Preliminary observations have also highlighted potential nesting behavior of *M. luctifera* in Guánica. We observed females entering and exiting limestone rock cavities in the extensive limestone platform that dominates the deciduous shrubland landscape in this area (Fig. 4A). The presence of dried leaves and other organic materials within these cavities suggests active nest construction. Similar nesting has been described for this species in Martinique (Meurgey and Dumbardon-Martial 2019) and for the closely related species *Megachile (Pseudocentron) alleni* Mitchell on the Bahamas (Landry et al. 2014). However, further detailed studies are needed to confirm nesting dynamics and understand the species' nesting ecology in this habitat, including elucidating which plant species it utilizes for nest construction and cell provision.

The discovery of *M. luctifera* in Puerto Rico expands its known range and suggests the species may continue dispersing into other parts of the Caribbean. Unconfirmed reports from Salinas in south-central Puerto Rico and the municipality island of Culebra indicate a potentially broader distribution across the Puerto Rican Archipelago. The species' preference for native plants indicates its

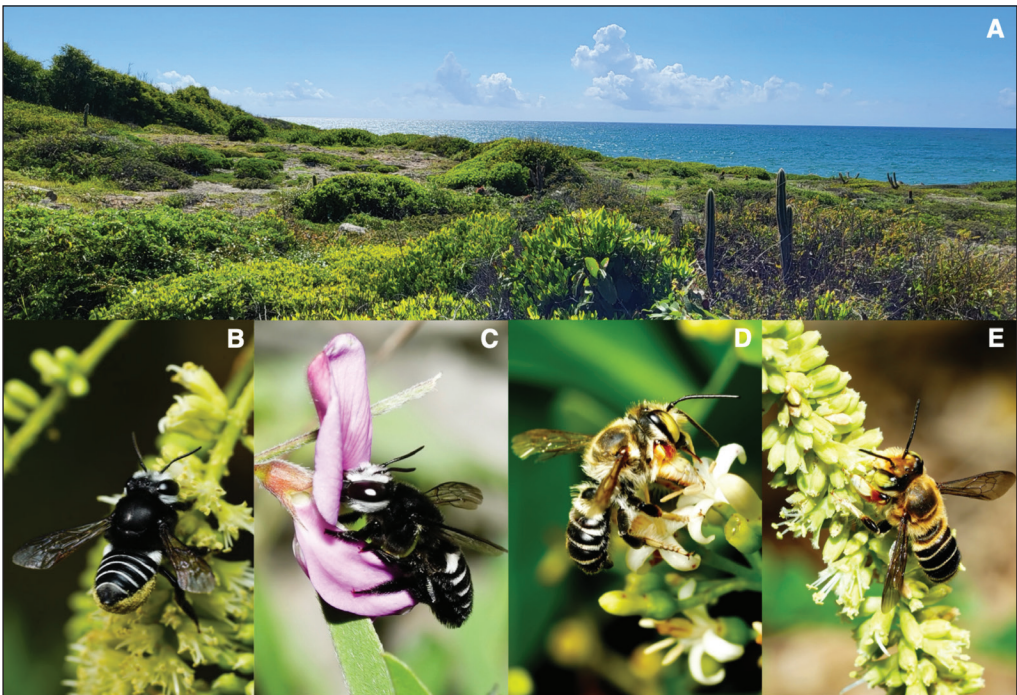


Figure 4. (A) Distinctive deciduous shrubland in the Guánica State Forest where *Megachile luctifera* occurs. Female of *M. luctifera* visiting (B) *Neltuma juliflora* and (C) *Tephrosia cinerea*. Male of *M. luctifera* visiting (D) *Erithalis fruticose* and (E) *N. juliflora*. Photographs © Daniel Anglés-Alcázar and Julissa Rojas-Sandoval.

potential role in local pollination networks. This study establishes *M. luctifera* as part of Puerto Rico's bee fauna and highlights the need for further research to document its ecological role, particularly its interactions with both native and non-native plant species, as well as its nesting behavior. Additional studies are also required to determine the full extent of its distribution in Puerto Rico and the broader Caribbean, contributing to a more comprehensive understanding of pollinator diversity in the region.

Acknowledgments

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Data Availability Statement

The *cox1* sequences, along with voucher data, images, and trace files, were deposited in the Barcode of Life Data System and can be accessed at www.boldsystems.org under the dataset "DS-MLUCTIPR."

Voucher specimens from the first collections in Puerto Rico:

PUERTO RICO, Coamo, Near Aguas Termales de Coamo, 16.X.2021, coll. E. Kardas (1 male). Deposited in the University of Puerto Rico's Museum of Zoology.

PUERTO RICO, Bosque Guayacancito, Guánica, 6.ii.2023, coll. J. Rojas-Sandoval (2 females); Plot Trichillia, Guánica, 6.ii.2023, coll. J. Rojas-Sandoval (2 males) Deposited at J.A. Genaro's personal collection, Toronto, ON, Canada.

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