



Annona breviflora (Annonaceae), a new species endemic to western Mexico

Annona breviflora (Annonaceae), una nueva especie endémica del occidente de México

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Abstract:

Background and Aims: In Mexico, *Annona* is among the most species-rich genera of the family Annonaceae, with 18 currently recorded species. As part of our ongoing revision of the genus in Mexico, we examined specimens from western Mexico that correspond to a previously undescribed species, which is described and illustrated here.

Methods: The new species was recognized based on the unique combination of morphological features, through comparisons with similar species and a thorough review of the literature. Its conservation status was assessed by calculating its Extent of Occurrence (EOO) and Area of Occupancy (AOO), using the GeoCAT tool and following the IUCN Red List Categories and Criteria.

Key results: A new *Annona* species, *Annona breviflora*, endemic to western Mexico, is described and illustrated. Based on the criteria established by the IUCN, the species can be provisionally assessed as Endangered (EN B2 ab (i, ii, iii, iv)).

Conclusions: The most similar species to *Annona breviflora* is *A. globiflora*, with which it shares small flowers bearing three petals and small leaves that are longer than wide, with 6-10 secondary veins per side. However, *A. globiflora* occurs in eastern Mexico and exhibits morphological characteristics, such as nearly sessile flowers and glabrous leaves, that clearly distinguish it from *A. breviflora*.

Key words: herbarium, floral morphology, Neotropics, taxonomy, tropical dry forest.

Resumen:

Antecedentes y Objetivos: En México, *Annona* se encuentra entre los géneros más ricos en especies de la familia Annonaceae, con 18 especies registradas actualmente. Durante la revisión taxonómica del género en México, examinamos especímenes del occidente del país que correspondían a una especie no descrita previamente, la cual se presenta e ilustra en este trabajo.

Métodos: La nueva especie fue reconocida con base en la combinación única de caracteres morfológicos, mediante comparaciones con especies similares y una revisión exhaustiva de la literatura. Su estado de conservación se evaluó calculando su Extensión de Presencia (EOO) y área de ocupación (AOO) con la herramienta GeoCAT, aplicando las categorías y criterios de la Lista Roja de la UICN.

Resultados clave: Se describe e ilustra una nueva especie de *Annona*, *Annona breviflora*, endémica del occidente de México. De acuerdo con los criterios establecidos por la UICN, la especie puede evaluarse provisionalmente como En Peligro (EN B2 ab (i, ii, iii, iv)).

Conclusiones: La especie más similar a *Annona breviflora* es *A. globiflora*, con la cual comparte las flores pequeñas con tres pétalos y las hojas pequeñas, más largas que anchas, con 6-10 venas secundarias por lado. Sin embargo, *A. globiflora* se distribuye en el oriente de México y presenta características morfológicas, como flores casi sésiles y hojas glabras, que la distinguen claramente de *A. breviflora*.

Palabras clave: bosque tropical seco, herbario, morfología floral, Neotrópico, taxonomía.

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Introduction

The genus *Annona* L. comprises approximately 180 species of trees and shrubs and is one of the most diverse and economically important lineages within the Annonaceae family (Guo et al., 2017; Lora et al., 2018; Nge et al., 2024). Several species are prized for their edible fruits, while their leaves, stems, and roots have significant value in traditional medicine. Furthermore, various species have been utilized to isolate chemical compounds that are valuable in pharmacology (Leite et al., 2020). Among the most distinctive morphological characteristics of the genus are its distichous leaves with an impressed primary vein on the upper side, trimerous flowers usually bearing fleshy and rigid petals, large, syncarpous fruits formed by the complete union of its carpels, and carpels containing a single ovule (Safford, 1914; Couvreur et al., 2012). Only some species, such as those formerly placed in the genus *Raimondia* Saff. (synonymized into *Annona* by Rainer, 2001), have thin and flexible petals, but they conform to the other distinctive characteristics of *Annona*.

The genus is distributed in tropical areas of Africa (4 species) and America (~175 species), with the highest number of species in South America, where they are a frequent element in lowland tropical forests (Kessler, 1993; Hurtado-Reveles et al., 2026; Flora e Funga do Brasil, 2026). Notably, many South American species reach their northernmost distribution in southern Nicaragua, underscoring a marked species turnover between the regions spanning southern Nicaragua, Costa Rica, and South America, and those extending from northern Nicaragua to Mexico (Ortiz-Rodríguez et al., 2026).

Phylogenetic analyses based on cpDNA sequences suggest that the genus *Annona* (including the genera *Raimondia* and *Rollinia* A. St.-Hil.; Rainer, 2001; 2007) is placed within the subfamily Annonoideae, tribe Annoneae (Chatrou et al., 2012), along with the genera *Anonidium* Engl. & Diels, *Asimina* Adans., *Boutiquea* Le Thomas, *Diclinanona* R.E.Fr., *Disepalum* Hook.f., *Goniotalamus* Hook.f. & Thomson, and *Neostenanthera* Exell. Within the genus, phylogenetic analyses fail to recover the traditionally proposed divisions into groups and sections (Chatrou et al., 2009), challenging the taxonomic framework established in earlier classifications (Safford, 1914; Fries, 1931).

During the preparation of the taxonomic revision of the genus *Annona* in Mexico, we examined specimens from western Mexico that did not correspond to any of the previously recognized species of the genus. The distinctive combination of morphological traits in these specimens led us to conclude that they represent a new species to science. Accordingly, we describe and illustrate here a new species of *Annona*, endemic to western Mexico.

Materials and Methods

Given the absence of a global-scale synthesis of diversity patterns within *Annona*, and to place the new Mexican species in the broader context of the geographic distribution of the genus, a species richness map was generated from curated occurrence records. Geographic coordinates were obtained from GBIF.org (GBIF, 2026) and filtered to retain only reliable records, excluding points outside the native range of the genus, country and province centroids, records beyond valid geographic bounds, and oceanic locations. Widely cultivated species (*A. cherimola* Mill., *A. muricata* L., *A. reticulata* L., *A. squamosa* L., and *A. purpurea* Moc. & Sessé ex Dunal) were excluded from the analysis. The map was generated in QGIS v. 4.0.2 (QGIS, 2026) and edited in Inkscape v. 1.4.2 (Inkscape Project, 2025).

In the framework of an ongoing revision of the genus *Annona* in Mexico, we examined specimens of *Annona* deposited in the MEXU herbarium (acronym following Thiers, 2026) and consulted digitized type specimens available through JSTOR Global Plants (JSTOR, 2026). The new species was recognized using the unique combination of features criteria (Donoghue, 1985) through comparisons with morphologically similar species and a literature review.

The distribution area of the species was determined based on the geographic information of the collection locations recorded on the herbarium specimens studied. A map of the species distribution was generated by projecting data points in QGIS v. 4.0.2 (QGIS, 2026), and further edits were performed in Inkscape v. 1.4.2 (Inkscape Project, 2025). We assessed the preliminary conservation status of the species by calculating its Extent of Occurrence (EOO) and Area of Occupancy (AOO) with the GeoCAT tool (Bachman et al., 2011). For this analysis, locations were defined on the default value of 2 km² cell size. We used these sta-



tistics to conduct a preliminary conservation assessment under IUCN Red List criterion B, based on the geographic distribution of species (IUCN, 2022).

Results

Species richness within *Annona* exhibits a marked geographic structure across its distribution range (Fig. 1). The highest concentrations of species occur in South America, especially in the western Amazon Basin, the Brazilian Atlantic Forest, and the Paraná region, with secondary centers of richness located in northern South America and the Costa Rica-Panama isthmus. Beyond these areas, species richness decreases progressively toward Mesoamerica, reaching lower values in Nicaragua, El Salvador, Honduras, Guatemala, Belize and Mexico, as well as across the Caribbean. Finally, African forests are associated with the lowest levels of species richness within the global distribution of the genus (Fig. 1).

A new species of *Annona*, endemic to western Mexico, is described and illustrated below.

Taxonomy

Annona breviflora Ortiz-Rodr., Hurt.-Rev. & Amancio, **sp. nov.** Fig. 2.

TYPE. MEXICO. Nayarit, municipio Ruiz, Arroyo Aguascalientes, 5.4 km del Naranjo, brecha a Jesús María, 20°01'16"N, 104°53'24.08"W, 16.VII.2007, P. Tenorio et al. 24376 (holotype: MEXU!).

Annona breviflora is morphologically similar to *Annona globiflora* in the small flowers with three petals, and flower buds pyramidal to globose. However, it is distinguished from it by its broader leaves, 2.5-5 cm wide, sparsely to densely covered with adpressed to ascending hairs below (vs. 1-3 cm wide, glabrous below), and by its longer floral pedicels up to 30 mm long (vs. flowers almost sessile, pedicel up to 3 mm long).

Trees, small to medium-sized, 1-6 m tall, bark brownish grey, sparsely to densely covered by orbicular lenticels, young branches densely covered with ascending to erect,

simple, light brown hairs, about 0.5 mm long, glabrous with age, older branches striate, internodes 0.4-3 cm long; leaves, lamina elliptic to obovate, slightly bullate in vivo, 5-15 × 2-8 cm, length: width ratio 2:1 to rarely 2.5-3:1, acute to rounded at the base, broadly acute, broadly acuminate to cuspidate at apex, acumen 3-7 mm long, glabrous to sparsely covered by adpressed hairs above, denser along midvein, sparsely to densely covered by adpressed to ascending hairs below, venation pattern brochidodromous, midvein flat to slightly canaliculate above, prominently raised below, 6-10 secondary veins per side, pocket domatia in the axils of secondary veins, petioles 8-14 mm long, ca. 1 mm in diameter, canaliculate; inflorescences terminal or internodal (emerging at 4-12 mm above a subtending leaf), sometimes arising from the leafless portions of branches, flowers solitary, pedicels 10-38 mm long (25-30 mm long in fruit), ca. 1 mm in diameter, verrucose, sparsely to densely covered by ascending to erect light brown hairs, with a scaly bract at 5-10 mm from the base, caducous, flower buds pyramidal to globose, rounded at apex, 7-10 mm width; flowers trimerous, sepals 3, free, broadly ovate, 1-2 × 2 mm, densely covered with appressed to ascending light brown hairs outside, sparsely covered with appressed light brown hairs inside, petals 3, fleshy, broadly elliptical to ovate, 7-15 × 4-7 mm, yellowish green in vivo, longitudinally ridged, triangular in cross-section, densely covered with long, adpressed, yellowish hairs outside, densely covered with short, crispate, yellowish hairs inside, often with a triangular, velvety patch inside, 3-4 × 3-5 mm, receptacle concave to cusped around the stamens, densely covered with short, crispate, yellowish hairs, stamens numerous, 150-300, 1-2 mm long, connective tissue prolonged above the thecae, angulate, discoid, densely covered with short hairs, carpels, 20-50, ca. 1-1.5 mm long, ovary cylindrical, densely covered with long, light brown hairs, stigma lanceolate, erect, tongue-shaped, ca. 0.4-0.5 mm long; fruits globose, strongly tuberculate, 22-45 × 28-53 cm, sparsely covered with ascending, light brown to yellowish hairs, carpels evident as areoles or rounded protuberances, free at their apices, apex obtuse, acute to pointed; seeds orbicular to elliptical, 8-20, 10-13 × 7-8 mm, coat thick, smooth to slightly wrinkled, shiny, pale brown colored, raphe a slightly elevated rib, frequently dehiscent, ruminations spiniform.



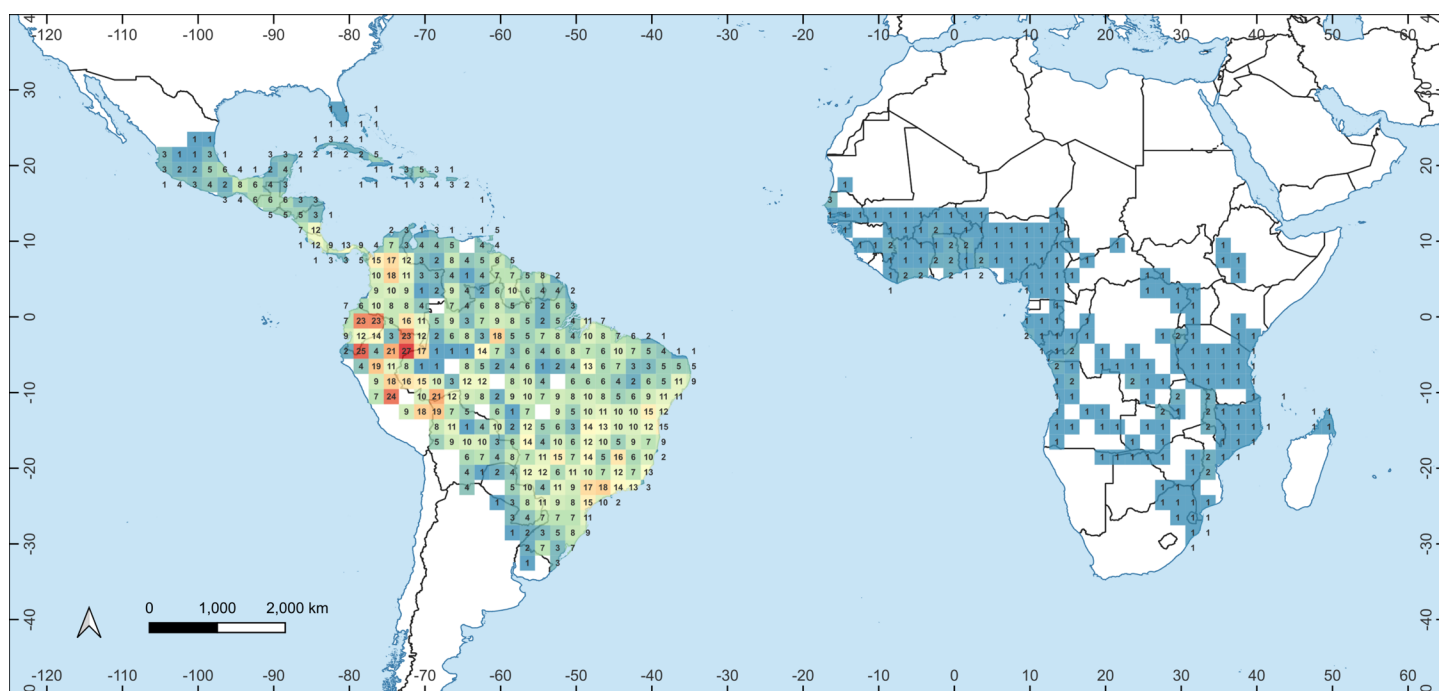


Figure 1: Spatial patterns of species richness in *Annona* L. across its distribution, summarized per $2^{\circ} \times 2^{\circ}$ grid cell. The color gradient indicates increasing richness from low to high values.

Etymology: the species epithet “*breviflora*” (from Latin *brevis*, short) refers to the small size of its flowers, petals and buds.

Habitat and ecology: the species inhabits tropical dry forests, growing on sandy soils along riverbanks.

Phenology: flowering occurs in July and August, while fruiting takes place from April to August.

Preliminary conservation status: *Annona breviflora* is known from three collections, the most recent dating back to 2007, nearly two decades ago. The area of occupancy (AOO) is 12 km², and the extent of occurrence (EOO) is 267.94 km², within the limits of Endangered, under criterion B. The species is restricted to a specific portion of western Mexico and is currently documented from two locations (sensu IUCN, 2022), also within the limits of Endangered status under criterion B. Although it shows a more or less continuous distribution and is typically found in well-preserved tropical dry forests, in the northern part of its range (Nayarit), it is increasingly threatened by unsustainable ac-

tivities such as logging, fires, and illegal settlements, and now persists only in small forest fragments. We project that the ongoing loss of its habitat will induce a strong, continuous decline in the number of locations, as well as in its EOO and AOO. This species is thus assigned a preliminary conservation status of Endangered (EN B2 ab (i, ii, iii, iv)).

Additional material examined: MEXICO. Jalisco, municipio San Sebastián del Oeste, arroyo Los Reyes al E de La Haciendita (San Isidro), 350 m, 20°52'N, 104°50'0.01"W, 08.IV.1998, *R. Ramírez-Delgadillo and J. J. Reynoso-Dueñas 5384* (IBUG, MEXU); arroyo El Zonteco, a 400 m de la brecha San Sebastián del Oeste - La Haciendita, 20°52'20"N, 104°43'46"W, 470-540 m, 16.VIII.1998, *R. Ramírez-Delgadillo et al. 5683b* (IBUG, MEXU). Nayarit, municipio Del Nayar, Paraje El Huayno, 8 m, 27.VIII.1991, *A. Benitez-Paredes 3532* (MEXU).

Photographic records from iNaturalist: MEXICO. Nayarit, municipio Compostela, El Refilión, 817 m, 21°18'28.8"N, 104°54'38.16"W, 15.VII.2022, *E. Gómez (ed-gargmez)* (iNaturalistMx, 2026).



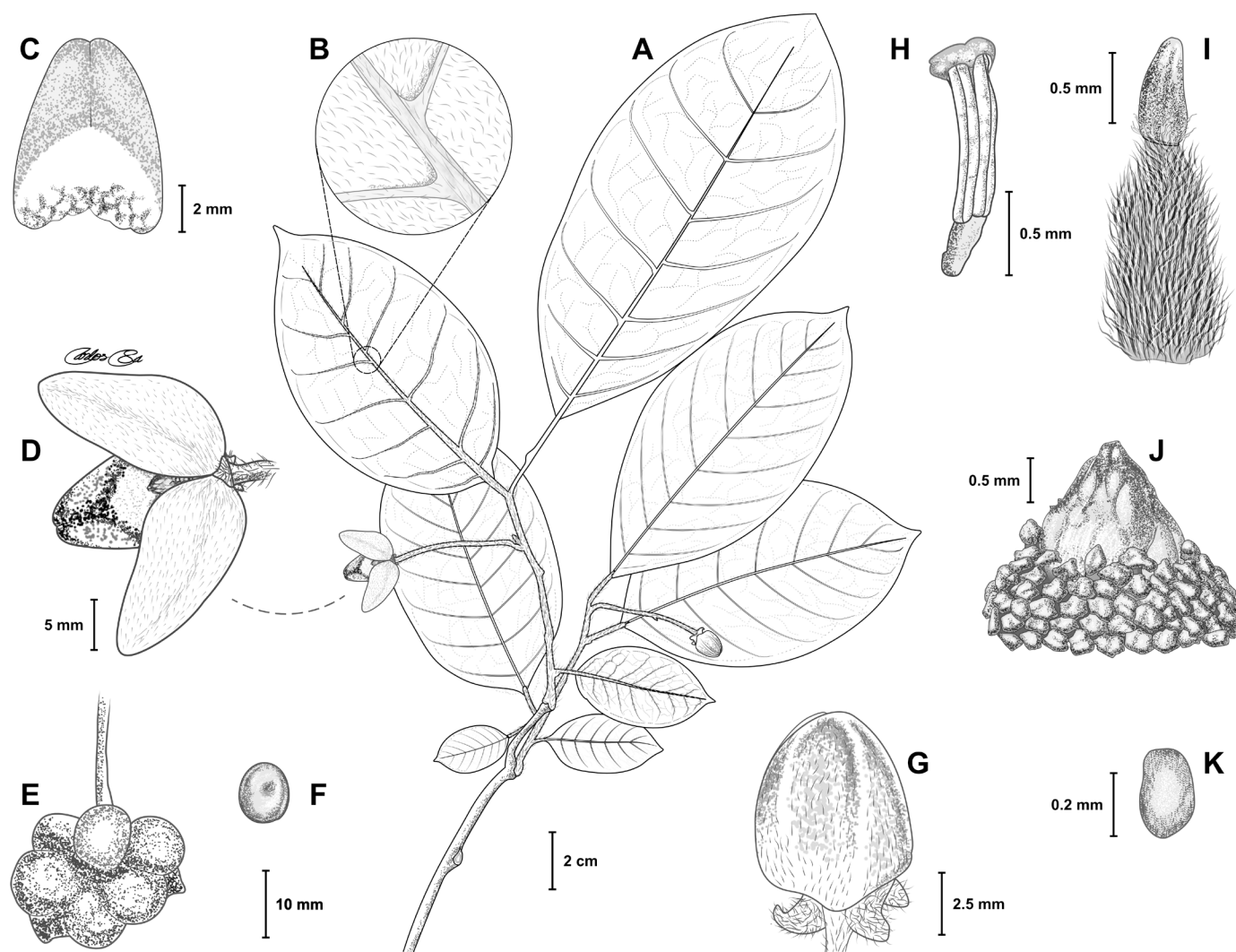


Figure 2: *Annona breviflora* Ortiz-Rodr., Hurt.-Rev. & Amancio. A. habit; B. close-up of the leaf surface showing a dense indumentum of appressed to ascending trichomes. C. petal, inner view; D. complete flower with three broadly ovate petals rounded at the apex; E. fruit, a syncarp that is somewhat tuberculate, with carpels separated at their tips; F. seed; G. pyramidal to globose floral bud; H. stamen; I. carpel; J. arrangement of stamens and carpels at the center of the flower; K. ovule. Drawn by Carlos M. Ochoa Zárate based on *P. Tenorio et al.* 24376 (MEXU).

Taxonomic comments: *Annona breviflora* exhibits flower buds ranging from pyramidal to globose, a condition also observed in *A. contrerasii* J. Jiménez Ram. & J.C. Soto, *A. glabra* L., *A. globiflora* Schtdl., *A. holosericea* Saff., and *A. purpurea* Moc. & Sessé ex Dunal, all of which also occur in Mexico. Phylogenetic evidence does not support a close relationship among these species (Chatrou et al., 2009), suggesting that this character has evolved multiple times independently within the genus. Nevertheless, this bud morphology distinguishes them from species with narrowly triangular and elongated

buds (here named “alligator-head” buds), such as those observed in *A. cherimola* and *A. reticulata*.

The species most similar to *Annona breviflora* is *A. globiflora*, with which it shares small flowers bearing three petals and small leaves that are longer than wide, with 6–10 secondary veins per side. However, *A. globiflora* occurs in eastern Mexico, from Chiapas to Veracruz and Tamaulipas, and exhibits morphological characteristics, such as nearly sessile flowers and glabrous leaves, that clearly distinguish it from *A. breviflora* (Fig. 3).





Figure 3: Geographic distribution of *Annona breviflora* Ortiz-Rodr., Hurt.-Rev. & Amancio and its most morphologically similar species, *A. globiflora* Schtdl.

Another species with which *A. breviflora* could be confused is *A. palmeri* Saff., also native to western Mexico, from Guerrero to Jalisco. Both species share long-pedicellate flowers and leaves with few secondary veins per side. Nevertheless, *A. palmeri* differs in having narrowly lanceolate leaves, flowers with linear-ovate petals, and elongated flower buds (alligator-head buds).

Discussion

Tropical dry forests in Mexico have been proposed as ancient biomes derived from humid forest lineages that progressively adapted to arid conditions (Pennington et al., 2009). This aridification has been linked to the uplift of the Sierra Madre Occidental and the Trans-Mexican Volcanic Belt, which created topographic barriers, altered precip-

itation regimes, and fragmented pre-existing humid habitats (Becerra, 2005; Cevallos-Ferriz et al., 2012). Based on this evidence, western Mexico may be hypothesized to be a center of origin for this biome in northern Mesoamerica (from Mexico to Nicaragua).

Annona breviflora joins *A. contrerasii*, *A. globiflora*, *A. longiflora* S.Watson, *A. longipes* Saff., and *A. palmeri* as species endemic to Mexico. Except for *A. longipes* and *A. globiflora*, all are narrowly distributed in western Mexico, highlighting this region as a localized center of endemism for the genus within the country. Notably, in western Mexico, all cases of endemism are restricted to tropical dry forests. Furthermore, the four endemic species of western Mexico exhibit striking morphological contrasts: *A. longiflora* and *A. palmeri* bear elongated, linear petals and alli-

gator-head buds; *A. contrerasii*, although with pyramidal to globose buds, has six well-developed petals arranged in two clearly differentiated whorls; while *A. breviflora* possesses pyramidal to globose buds but only three well-developed petals. These differences suggest that diversification within the genus has not occurred uniformly in western Mexico, but rather that distinct lineages have followed independent evolutionary trajectories, further highlighting the evolutionary significance of this region (Ortiz-Rodríguez et al., 2026).

On the other hand, the discovery of *A. breviflora* from historical herbarium material suggests that part of the diversity of *Annona* yet to be described has already been collected and is deposited in national herbaria, as has occurred with other genera of the Annonaceae family (Ortiz-Rodríguez et al., 2024). In the particular case of *Annona*, eleven years have passed since the last addition to the Mexican flora (*A. contrerasii*; Jiménez-Ramírez and Soto-Núñez, 2015), and before this, seventy-two years had elapsed since the publication of a new species (*Annona primigenia* Standl. & Steyermark; Standley and Steyermark, 1943) with distribution in Mexico. Both *A. breviflora* and *A. contrerasii* are endemic to the dry forests of western Mexico, which suggests that if additional new species of Annonaceae exist, they are likely represented in herbarium collections from this region of the country.

Author contributions

Conceptualization: AEOR; Project administration: AEOR; Formal analysis: AEOR, LHR; Data curation: AEOR, LHR, GA; Investigation: AEOR, LHR, GA, Methodology: AEOR, LHR, Writing – original draft: AEOR; Writing – review and editing: LHR, GA, AEOR, CMOZ; Supervision: AEOR, GA; Visualization: CMOZ, LHR.

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Declaration of use of Artificial Intelligence

The authors declare that no artificial intelligence was used in the elaboration of this manuscript.

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