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An updated description of *Drypetes guatemalensis* (Putranjivaceae), with notes on its classification, distribution and conservation status

Una descripción actualizada de *Drypetes guatemalensis* (Putranjivaceae), con notas sobre su clasificación, distribución y estado de conservación

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Abstract:

Background and Aims: *Drypetes* (Putranjivaceae) is a pantropical genus comprising 220 species of trees and shrubs. To this day, *D. guatemalensis* remains incompletely described, as the only available description of this species appears in its protologue, which was based solely on fruiting specimens. In addition, its occurrence outside Guatemala was considered provisional. This study aims to provide an updated description of *D. guatemalensis*, as well as a summary of the current state of knowledge regarding this species, including remarks about its classification, geographical distribution and conservation status.

Methods: This study is based on fieldwork conducted in the Southern Pacific region of Costa Rica and herbarium studies between 2023 and 2026. Specimens of *D. guatemalensis* were examined either *in situ* or via online repositories. The species' preliminary conservation status category was assessed using IUCN Red List criteria.

Key results: A detailed description of *D. guatemalensis* is presented here, notably including the first description of its flowers and its occurrence is confirmed for Costa Rica. In addition, we provide a photographic plate with field images, an updated distribution map, and a key to the species of *Drypetes* in Central America. The species has been preliminarily assessed as Endangered (EN) under criterion B2ab(iii).

Conclusions: The newly documented floral characters of *D. guatemalensis* provide new insights into its taxonomy and classification and further support its distinction from *D. brownii*.

Key words: Central America, *Drypetes brownii*, floral characters, identification key, IUCN Red List, Malpighiales.

Resumen:

Antecedentes y Objetivos: *Drypetes* (Putranjivaceae) es un género pantropical que comprende 220 especies de árboles y arbustos. Actualmente, *Drypetes guatemalensis* se encuentra descrita de forma incompleta, ya que la única descripción disponible se encuentra en su protólogo, la cual se basó únicamente en especímenes con frutos. Además, su ocurrencia fuera de Guatemala era considerada provisional. El objetivo de este estudio es proporcionar una descripción actualizada de *Drypetes guatemalensis*, así como un resumen sobre el estado del conocimiento actual de esta especie, incluyendo notas sobre su clasificación, distribución geográfica y estado de conservación.

Métodos: El presente estudio se basa en trabajo de campo realizado en la región Pacífico Sur de Costa Rica y estudios de herbario entre 2023 y 2026. Se examinaron especímenes de *D. guatemalensis* *in situ*, o a través de repositorios en línea. La categoría del estado de conservación fue evaluada preliminarmente conforme a los criterios de la Lista Roja de la UICN.

Resultados clave: Se presenta una descripción detallada de *D. guatemalensis*, incluyendo por primera vez la descripción de sus flores y se confirma su ocurrencia en Costa Rica. Además, se proporciona una lámina fotográfica con imágenes de campo y un mapa de distribución actualizado, así como una clave dicotómica de identificación para las especies del *Drypetes* en Centroamérica. Esta especie es preliminarmente evaluada como En Peligro (EN), de acuerdo con el criterio B2ab(iii).

Conclusiones: Los nuevos caracteres florales documentados de *D. guatemalensis* aportan nueva información sobre su taxonomía y clasificación y apoyan su distinción con respecto a *D. brownii*.

Palabras clave: caracteres florales, Centroamérica, clave de identificación, *Drypetes brownii*, Lista Roja UICN, Malpighiales.

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Introduction

Drypetes Vahl (Putranjivaceae, Malpighiales) is a pantropical genus that comprises 220 species of trees and shrubs. Most of its species are found in Asia and the Pacific region (112 spp.), followed by Africa (86 spp.), and the Americas (21 spp.) (Quintanar et al., 2025a, b). The species typically inhabit the understory and middle to lower canopy strata of evergreen lowland forests with high rainfall regimes, with some extending to montane formations and monsoon or seasonally dry forests or savannas (Quintanar et al., 2020; 2023). Three sections of *Drypetes* are represented in the Neotropics: *D.* sect. *Drypetes* with 14 species, *D.* sect. *Sphragidia* (Thwaites) Pax & K.Hoffm. with two species, and *D.* sect. *Oligandrae* Pax & K.Hoffm. with one species. The remaining six species have not been yet assigned to any section (Quintanar et al., 2025a). Unfortunately, *Drypetes* has not currently been subject of phylogenetic studies, meaning that the current infrageneric circumscription is unlikely to accurately reflect its evolutionary relationships. A revised, updated study of the genus integrating molecular analyses is urgently needed.

The species of *Drypetes* are often considered difficult to identify due to a series of factors, including the lack of a global taxonomic revision for over a century (Pax and Hoffmann, 1922), as well as other issues summarized by Quintanar et al. (2021, 2023): 1) the genus is highly diverse; 2) the inconspicuous flowers and small fruits are, in many species, borne 10-30 m high in the canopy and are therefore rarely observed or gathered; 3) the dioecious nature of the genus poses an additional challenge to the gathering of male and female flowers and fruits; 4) the species can range from narrow endemics to widely distributed; and 5) the available descriptions of many species are too often just a few lines long and based on gatherings at a single phenological stage (A. Quintanar, pers. comm.). This has resulted in a large proportion of unidentified herbarium specimens at the species level (Quintanar et al., 2025a), which often compromises accurate identification of its species. Finally, we must consider the likely lack of funding and support for taxonomic research on this genus, reflecting the broader decline of taxonomic research worldwide (Britz et al., 2020).

Five species of *Drypetes* have been recorded in Central America: *D. asymmetricarpa* G.A.Levin, *D. brownii* Standl., *D. lateriflora* (Sw.) Krug & Urb., *D. guatemalensis* Lundell and *D. standleyi* G.L.Webster. Most of these species are poorly understood due to the factors mentioned above. Specifically, *D. guatemalensis* (*D.* sect. *Sphragidia*, see Levin, 2013), the main focus of this study, was originally described based solely on fruiting plants gathered in Guatemala (Lundell, 1971), and flowers have not yet been described. Additionally, the species was only briefly described in its protologue, leaving many other important features unknown. Years later, *D. guatemalensis* was tentatively recorded as occurring in Costa Rica based on a gathering made in 1993 (González, 2010). However, the cited specimen could not be located to confirm its identification during the preparation of the Manual de Plantas de Costa Rica, and it has remained unverified for over 25 years. *D. guatemalensis* was later reported in Belize through a single sterile gathering from 2006, that was previously misidentified as *D. brownii*.

As explained above, *D. guatemalensis* has been neglected for many years and requires further study. Thanks to recent botanical exploration at middle elevations in Costa Rica and subsequent herbarium studies, the species has finally been confirmed in Costa Rica and flowering plants have been discovered and documented for the first time. In this study, we provide an updated and more thorough description of *D. guatemalensis*, including a description of its flowers for the first time, as well as remarks on its taxonomic status and an update of its geographic distribution. Finally, we provide a key for the species of *Drypetes* occurring in Central America.

Material and Methods

Specimens of *D. guatemalensis* were examined physically in the herbaria CR and USJ (herbarium acronyms follow Thiers, 2026, continuously updated), or digitally via the websites JSTOR (2026) and GBIF (2026). These included specimens from B, BRIT, CAS, DUKE, F, MICH, MO, LL, NY and S. Available materials and information on *D. guatemalensis* were supplemented by fieldwork conducted in the Southern Pacific region of Costa Rica between 2023



and 2026. *Drypetes guatemalensis* was studied, gathered and photographed at middle elevations (1400-2000 m). The samples gathered were then dried and deposited in CR and spirit preparations were deposited in USJ. Measurements were taken from dry specimens using a scale and an Olympus SZX16 stereomicroscope (Tokyo, Japan). Additional measurements were taken from the digitalized specimens using JImage (Schneider et al., 2012). Taxonomic terminology mostly follows Beentje (2016), and the inflorescence categories follow Quintanar et al. (2023). The occurrence map was created using the geographical coordinates of the examined specimens with QGIS v. 3.24.0 (QGIS, 2024), using an ESRI Shaded Relief basemap. For herbarium specimens lacking geographical data, coordinates were extracted from the available information in GBIF (2026); these are indicated with parenthesis in the additional examined material section. The conservation status and the extinction risk category of the species were preliminarily assessed using the methodology published by the International Union for Conservation of Nature (IUCN, 2022). The Extent of Occurrence (EOO) and Area of Occupancy (AOO) were estimated using the geographical data of the examined specimens and calculated with the Geospatial Conservation Assessment Tool (Bachman et al., 2011).

Results

Taxonomy

Drypetes Vahl (sect. *Drypetes*)

TYPE: *D. glauca* Vahl

Drypetes guatemalensis Lundell, Wrightia 4: 177. 1971.

Fig. 1.

TYPE: GUATEMALA. Izabal, Puerto Mendez, on Río Dulce Road, 26 km, 22.IX.1970, (fr), *E. Contreras 10332* (lectotype (designated by Quintanar et al. (2025a)): LL 00371653!; isolectotypes: CAS 0026476!, DUKE 10000443, LL 00371652! (photocopy in MO 457290), LL 00373266!, MICH 1104804!, RSA 0002686, S10-38217!, S S-R-10468!).

Tree 7-35 m tall; trunk 60 cm diameter at breast height; bark grayish brown, smooth, with conspicuous lenticels; young stems slightly grooved, glabrescent; apical buds ca. 1 mm, conical, attenuate, pulverulent with yellowish appressed trichomes; leaves simple, alternate; stipules 0.5-1 mm, deltoid, glabrous, early deciduous; petioles 5-15 mm long, ca. 1 mm diameter, canaliculate, drying dark brown, glabrous; blade 8-27 × 2-8.5 cm (length-to-width ratio 2.8-5.2), narrowly elliptic to lanceolate, chartaceous, base slightly asymmetrical, cuneate, margin entire, apex acute, the adaxial surface medium to dark green (drying dark brown to reddish brown), abaxial surface paler (drying light brown to reddish brown), glabrous; venation brochidodromous, obscurely looping and anastomosing near the margin, midrib and higher-order venation slightly raised on both surfaces, secondary veins 8-12 pairs, higher-order venation finely reticulate; male inflorescences 3-6-flowered clusters, axillary (category IV), borne on new leafy and leafless shoots, often resembling spikes, bracts 0.5 × 0.5 mm, pilose; staminate flower subsessile, pedicel ca. 0.5 mm; sepals 4, 2-2.5 × 1-1.25 mm, ovate, rounded to obtuse, ciliate, abaxial surface glabrous, adaxial surface densely puberulent; stamens 5-7, surrounding the disc and enveloped by its marginal folds, filaments 1.5-2 mm long, glabrous, anthers ca. 1 mm long, glabrous; disc ca. 1 mm high, 1.5 mm diameter, concave, lobed, glabrous; female inflorescences 1-3-flowered, axillary (categories III or IV); bracts ca. 0.5 × 0.5 mm, deltate, pilose; pistillate flower subsessile, pedicel ca. 1 mm long, glabrous; sepals 4-5, 4-5 × 3-3.5 mm, ovate, rounded to obtuse, sometimes slightly cucullate, abaxial surface glabrous, adaxial surface puberulous; disc ca. 0.5 mm high, ca. 0.5 mm diameter, annular, glabrous; ovary ca. 2.5 mm long, ca. 3 mm diameter, oblate, slightly laterally compressed, 2-locular, densely pubescent; style ca. 1 mm long; stigmas 2, ca. 1 mm long, flabellate; drupes 1.5-3 × 1-3 cm, green to yellowish green, globose to obovoid, apiculate, densely puberulent, 2-seeded; seeds 1-2.5 cm long, 0.5-1.5 cm diameter, ellipsoid, striate, light brown.

Distribution and habitat: this species is known from Guatemala, Belize and Costa Rica (Fig. 2), at 650-1600 m.



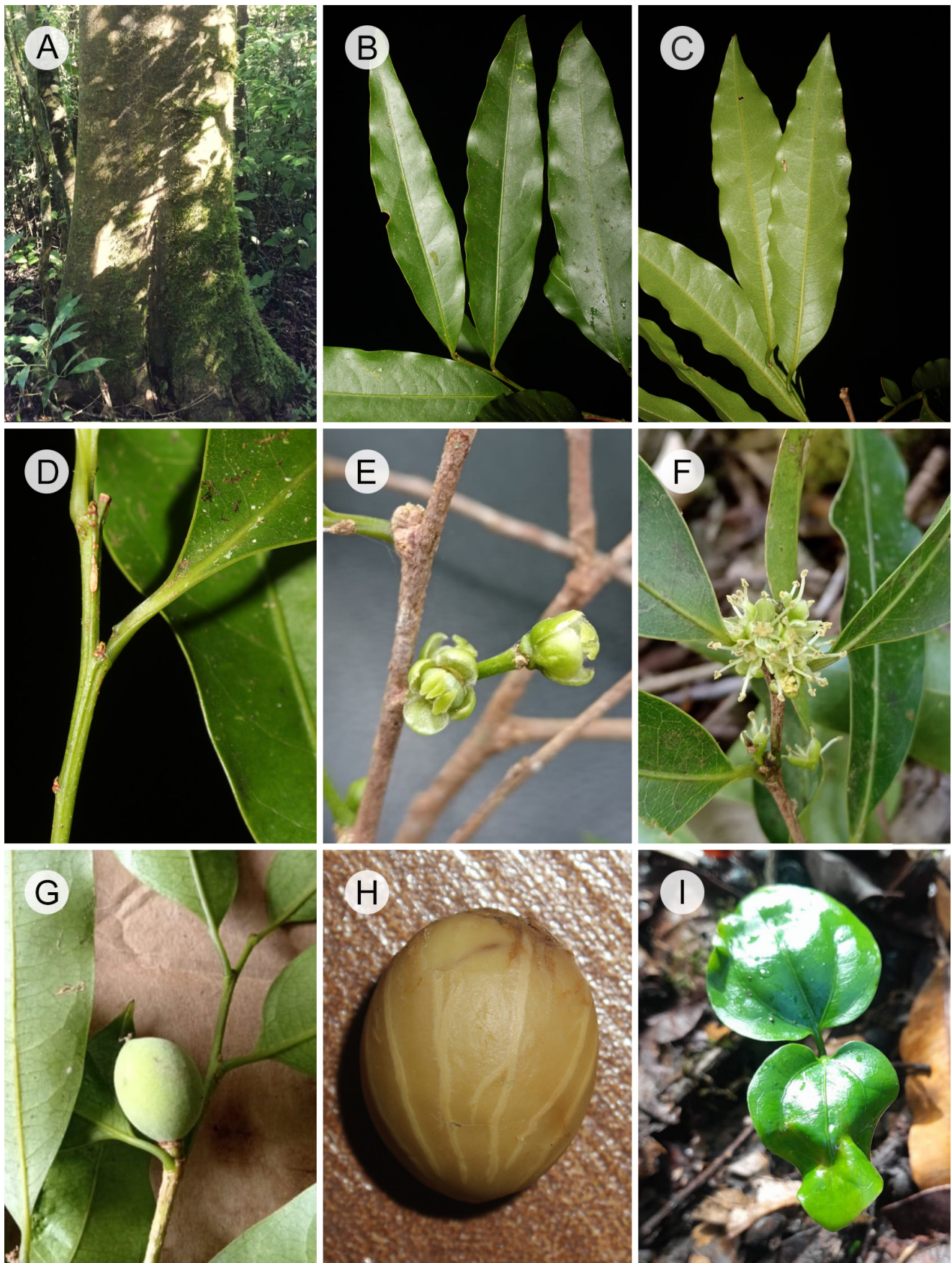


Figure 1: *Drypetes guatemalensis* Lundell. A. tree trunk; B. leaves showing adaxial surfaces; C. leaves showing abaxial surfaces; D. stem and petioles close-up; E. pistillate flowers; F. staminate flowers; G. branch with fruits; H. seed; I. seedling. Photographs taken in Costa Rica by the authors.

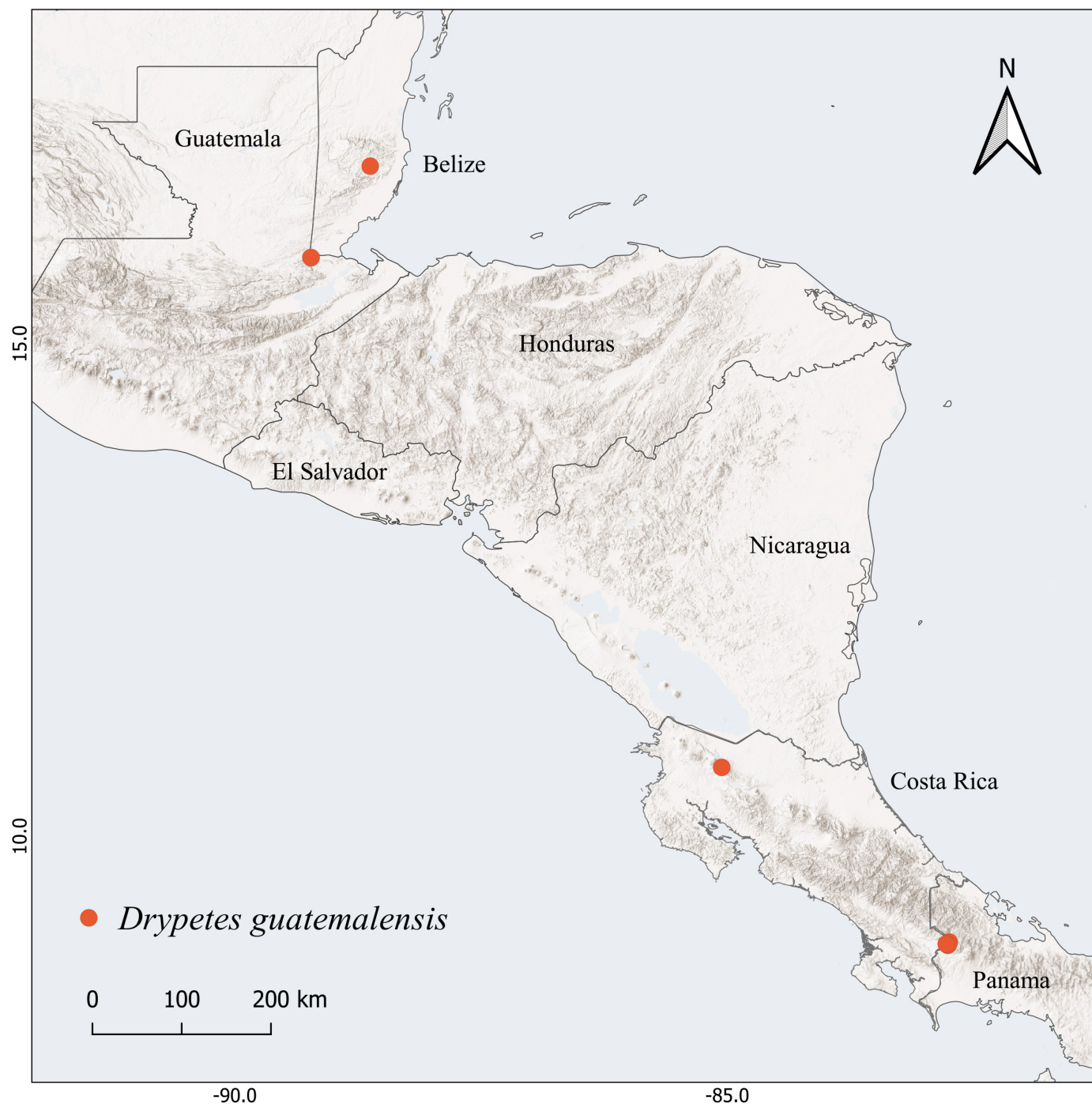


Figure 2: Updated distribution map of *Drypetes guatemalensis* Lundell.

It inhabits middle tropical rain forests and premontane moist or cloud forests.

Phenology: flowering specimens have been gathered from February to May, and fruiting specimens from June to December. Seedlings were observed in July and Au-

gust, mostly beneath their parent trees (Fig. 1I). The mechanisms of pollination and seed dispersal are unknown.

Propagation: this species has been successfully propagated in the Southern Pacific region of Costa Rica, achieving a germination rate close to 90%. Germination was accom-



plished by submerging the seeds in water for 12 h and then sowing them in fungus-treated soil containing organic matter.

Preliminary conservation status: *Drypetes guatemalensis* is known from 14 occurrences across three countries in Central America. The AOO for the species was calculated as 24 km² and the EOO as 91,980.79 km². There are four known locations. The major threats are habitat reduction due to agricultural expansion and illegal logging. Ongoing habitat decline has been reported around its area of distribution, particularly in northern Central America (Hansen et al., 2013). In addition, we observed several remnant trees of *D. guatemalensis* in coffee plantations or along forest edges on the southern Pacific slope of Costa Rica, which suggests habitat loss due to the expansion of coffee farming. Furthermore, the species' distribution area is likely to be severely fragmented since the known subpopulations are isolated.

Based on the abovementioned information, *D. guatemalensis* meets B2 criterion, with an AOO of less than 500 km², and the subcriteria (a) and (b), with fewer than five locations and a continuing decline in habitat extent, respectively. Consequently, this species is preliminarily assessed as Endangered (EN) under criterion B2ab(iii). Further ecological studies and conservation efforts are required to ensure the long-term survival of this species.

Additional examined material: BELIZE. Stann Creek, North-Central Cockscomb Basin Wildlife Sanctuary, along the south face of the Cockscomb range, upper slope of a spur ridge running south from the Cockscomb range, 650 m, 16°48'13"N, 88°37'29"W, 22.XI.2006, (st), S. W. Brewer and M. Pau 3395 (MO 5490135). COSTA RICA. Province Alajuela, Upala, Bijagua, El Retiro, margen derecha del Río Tenorio, 650 m, 10°42'00"N, 85°03'20"W, 20.VI.1993, (fr), G. Herrera 6306 (CR 164215, MO 05009276). Province Puntarenas, Coto Brus, Sabalito, Finca Las Tinieblas, propiedad de Billen Gamboa, filas hacia el norte del potrero principal, 2060 m (1600 m), 8°55'36.7"N, 82°44'43.7"W, 10.XII.2025, (st), L. Álvarez et al. 1419 (CR 5154019); Mellizas, Finca Palo Hueco, 1550 m, 8°53'39.5"N, 82°45'35.6"W, 04.VI.2023, (fr), B. Gamboa 2403 (CR 5153672); Finca La Amistad, camino al sector La Neblina, orilla de camino, 1500 m, 8°54'27.2"N,

82°46'33.2"W, 19.II.2024, (fl, female), B. Gamboa 2419 (USJ (spirit)); loc. cit., 8.II.2025, (fl, male), B. Gamboa 2420 (CR); loc. cit., 6.IV.2025, (fr), B. Gamboa 2421 (CR); cuenca Térraba - Sierpe, Finca Cafrosa (finca La Amistad), sendero sin nombre, 1400-1500 m, 8°54'22.85"N, 82°46'25.7"W, 9.V.2003, (fl, male), R. Kriebel et al. 2306 (CR 3912845); Z.P. Las Tablas, cuenca Térraba - Sierpe, Hacienda La Amistad, La Neblina, 1600-2000 m, 8°53'50"N 82°45'20"W, 28.XII.2003, (buds), R. Kriebel et al. 4173 (B 101148060, CR 4082459, K 001609384). GUATEMALA. Izabal, Seja, in high forest on Río Dulce road, 10.VII.1970, (fr), E. Contreras 10172 (CAS 668969, F 1968608, LL 00574100, US 01323528); Río Dulce road, between Seja and Ciénaga, 5 km from Seja, high forest, 11.VII.1970, (fr), E. Contreras 10190 (BRIT 437185, F 1710358, LL 00574102, LL 00574101, NY 03995251); Puerto Méndez, on Río Dulce Road, Ciénaga, high forest, in Zapotal, 22.IX.1970, (fr), E. Contreras 10334 (LL 00574104); Puerto Méndez, on Río Dulce Road, 26 km, in Zapotal (15°52'33"N, 89°13'35"W), 22.IX.1970, (fr), E. Contreras 10335 (LL 00574105, MO 125903).

Discussion

The results presented here bring to light the flowers of *D. guatemalensis* for the first time since the initial species description 50 years ago. This represents a substantial contribution to the knowledge of the genus in Central America. The updated description of *D. guatemalensis* also sheds light on its classification: based on the number of stamens (5-7), it remains unclear whether it actually belongs to *D. sect. Sphragidia* or *D. sect. Oligandrae*, (5-)8-12(-50) vs. 3-4(-7) stamens, respectively, see Pax and Hoffmann (1922). Furthermore, new molecular evidence does not preliminarily support the traditional subgeneric classification of *Drypetes* (A. Quintanar, pers. comm.), implying that the current sections will likely require amendments in order to achieve monophyly. It also places *D. guatemalensis* as a sister lineage to *D. brownii*, both forming a well-supported clade (A. Quintanar, pers. comm.). Therefore, we have provisionally reclassified *D. guatemalensis* within *D. sect. Drypetes*. The newly described flower characters of *D. guatemalensis* provide additional diagnostic characters that strengthen its circumscription with respect to the species of closest morphology, *D. brownii*: the male inflores-



cences of *D. guatemalensis* are often borne on new short shoots resembling spikes (vs. male inflorescences born on leafy twigs, and not resembling spikes in *D. brownii*); the male inflorescences bear 3-6 flowers and the female inflorescences 1-3 (vs. up to 30 flowers and 5-8 flowers in *D. brownii*, respectively); the pedicels are much shorter (0.5-1 vs. 3-7 mm long); the sepals of the staminate flowers are smaller and have fewer stamens ($2-2.5 \times 1-1.3$ mm, 5-7 stamens vs. $2.5-3.5 \times 2.5-3$ mm, 8-12 stamens), whereas the sepals of the pistillate flowers appear to be larger ($4-5 \times 3-3.5$ mm vs. $2-2.5 \times 1-1.25$ mm).

As mentioned above, the presence of *D. guatemalensis* in Costa Rica was previously considered tentative, as it was based on just one gathering (G. Herrera 6306). However, it is now confirmed by seven additional gatherings (see 'Additional examined material' section), which were either newly made or corresponded to specimens that had previously been identified as *D. brownii*. The Costa Rican specimens do not differ significantly from those from Guatemala, and variability was observed mostly in the leaves, which tend to be either narrower or shorter in the Costa Rican material. Other diagnostic characters, such as the reticulate tertiary veins and the size and indument of the fruits are consistent and match well with the type material. We also found some differences in the size of certain floral characters between the staminate flowers and pistillate flowers of *D. guatemalensis*, which could have led to the conclusion that the material was gathered from different species. However, sexual dimorphism has previously been observed in some *Drypetes* species (Quintanar et al., 2023). We are confident that the specimens of both sexes examined correspond to *D. guatemalensis*, as the vegetative characters are consistent among these specimens and with the available material of this species in the herbaria.

The only record of *D. guatemalensis* from Belize is based on a sterile gathering (S. W. Brewer and M. Pau 3395), which was previously misidentified as *D. brownii*. We provisionally agree with this identification, as the leaf blade size and shape, as well as the higher order venation, match well the species concept of *D. guatemalensis*. However, we recognize that flowers and fruits are needed to confirm its presence in the country beyond doubt. *Drypetes*

guatemalensis is also expected in Panama, given that some Costa Rican gatherings are close to the Panamanian border.

This study highlights the current need for a taxonomical revision of *Drypetes* in Central America. In order to achieve more complete descriptions, especially for characters that are lost during the field and herbarium processes, detailed field information and documentation with high-quality images are recommended. Ideally, future research should focus on assembling a more thorough and comprehensive treatment of Central American *Drypetes*, incorporating integrative approaches such as morphometrics, molecular studies, or spectral techniques including near-infrared leaf-spectroscopy. It should also investigate their evolutionary history, ecology and conservation needs. In addition, further gatherings from the type location of *D. guatemalensis* and Belize are needed in order to assess the morphological variation of the species, particularly with regard to its floral features, which are currently only known from Costa Rica. Finally, with this work we aim to encourage more attention and research into *Drypetes* in Central America. We also advocate for future conservation efforts for *Drypetes* species, particularly *D. guatemalensis* and *D. asymmetricarpa*, which are likely the most threatened species of the genus in Central America. Below, we present an identification key for the Central American species of *Drypetes*.

Key to the species of *Drypetes* in Central America

- 1a. Ovary unilocular 2
- 1b. Ovary bilocular 3
- 2a. Leaf blade 1.5-5 cm wide; fruit not asymmetrical, stigma apical *D. standleyi* G.L.Webster
- 2b. Leaf blade 4-10 cm wide; fruit asymmetrical, stigma lateral *D. asymmetricarpa* G.A.Levin
- 3a. Leaf blade 3-6 cm long, margin sinuate or slightly serrate; fruits red when ripe
..... *D. lateriflora* (Sw.) Krug & Urb.
- 3b. Leaf blade 8-27 cm long, margin entire; fruits green to yellowish green or light brown when ripe 4
- 4a. Leaf blade length-to-width ratio 2-2.7, higher-order venation broadly reticulate; male inflorescences with up to 30 flowers; pistillate flower pedicels 3-7 mm



long; sepals 2.5-3.5 × 2.5-3 mm *D. brownii* Standl.

- 4b. Leaf blade length-to-width ratio 2.8-5.2, higher-order venation finely reticulate; male inflorescences with 3-6 flowers, pistillate flower pedicels ca. 1 mm long; staminate flower sepals 2-2.5 × 1-1.25 mm; pistillate flower sepals 4-5 × 3-3.5 mm
..... *D. guatemalensis* Lundell

Author contributions

Project administration: LAA; Conceptualization: LAA, AHR, BGR, NAZ; Investigation: LAA, AHR, NAZ; Methodology: LAA; Resources: LAA, BGR; Writing – original draft: LAA, AHR, NAZ; Writing – review and editing: NAZ; Visualization: LAA.

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Declaration of use of Artificial Intelligence

The authors declare no use of any Artificial Intelligence tools for the study.

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