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Polystemma fishbeiniana (Apocynaceae, Asclepiadoideae), a new species from the Balsas Depression of Michoacán, Mexico

Polystemma fishbeiniana (Apocynaceae, Asclepiadoideae), una nueva especie de la Cuenca del Balsas, Michoacán, México

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Abstract

Background: *Polystemma* (Apocynaceae subfamily Asclepiadoideae) is a small genus currently with seven species characterized by having white glandular trichomes becoming crystalline in age; filiform corona appendages; and fusiform, smooth, mottled follicles. Exploration in the Balsas Depression of Michoacán, Mexico resulted in the discovery of an unknown species of *Polystemma*.

Questions: Are the unknown *Polystemma* plants occurring in the Balsas Depression of Michoacán new to science? If so, how are they distinguished from other species of the genus, what are their ecological preferences, what is their distribution, and are they endangered?

Studied species: Species of *Polystemma*.

Study site and dates: Balsas Depression, Michoacán, Mexico; 2001, 2003, 2004, 2014.

Methods: Fieldwork to collect herbarium specimens and photograph plants; review of literature on *Polystemma* to determine taxonomic status; preparation of a morphological description; evaluation of conservation status using IUCN Redlist criteria.

Results: *Polystemma fishbeiniana* is proposed as a new species and illustrated with photographs. It occurs at two locations in the xeric scrub and open thorn forest of the Zicuirán-Infiernillo Biosphere Reserve, at elevations from 275 to 400 m. Flowering occurs from June to September, with mature fruits present from October to March; dehisced fruits can persist on the plants for almost a year. Its conservation status is assessed as Endangered, EN B1ab(iii)+2ab(iii).

Conclusions: *Polystemma fishbeiniana* is distinguished from congeners by its suffrutescent habit, small leaves, and flowers abaxially yellowish with a blackish to dark burgundy red margin and central line with short lateral extensions. These traits are otherwise unknown in the genus.

Key words: biosphere reserve, endangered species, taxonomy, thorn forest, xeric scrub, Zicuirán-Infiernillo

Resumen

Antecedentes: *Polystemma* (Apocynaceae subfamilia Asclepiadoideae) es un género pequeño con siete especies. Se caracteriza por tener tricomas glandulares blancos que se vuelven cristalinos; apéndices de la corona filiformes; y folículos fusiformes, lisos y moteados. Exploraciones en la Cuenca del Balsas, Michoacán, México resultó en el descubrimiento de una especie desconocida de *Polystemma*.

Preguntas: ¿Son nuevas para la ciencia las plantas de *Polystemma* encontradas en la Cuenca del Balsas, Michoacán, México? ¿Cómo se distinguen de otras especies de *Polystemma*? ¿Cuáles son sus preferencias ecológicas? ¿Cuál es su distribución? ¿Están en peligro de extinción?

Especies de estudio: Especies of *Polystemma*.

Sitio y años de estudio: Cuenca del Balsas, Michoacán, México; 2001, 2003, 2004, 2014.

Métodos: Trabajo de campo para colectar ejemplares del herbario y fotografiar plantas; revision de literatura pertinente; preparación de una descripción morfológica; evaluación de riesgo de peligro según los criterios de la lista roja de la IUCN.

Resultados: Se propone como especie nueva *Polystemma fishbeiniana*. Ocurre en dos localidades en el matorral xerófilo y bosque espinoso de la Reserva de Biosfera Zicuirán-Infiernillo a altitudes de 275 a 400 m. Florece desde junio hasta septiembre, con frutos maduros presentes de octubre a marzo; los frutos viejos pueden quedar sobre las plantas por casi un año. Se evalua como en Peligro de Extinción, EN B1ab(iii)+2ab(iii).

Conclusiones: *Polystemma fishbeiniana* se distingue por su hábito sufrutescente, sus hojas pequeñas y sus flores amarillentas con con líneas negruzcas o de color vino oscuro. Estas características no se conocen en otras especies del género.

Palabras claves: bosque espinoso, especie en peligro de extinción, matorral xerófilo; Reserva de la Biosfera Zicuirán-Infiernillo, taxonomía

The subfamily Asclepiadoideae (Apocynaceae) is a widespread and diverse component of the Mexican flora, and it is distributed in all states and nearly all types of vegetation from sea level to more than 3,000 m. Alvarado-Cárdenas *et al*. (2020) report 27 genera and 315 species. Although there are a few notable exceptions, e.g., the genera *Asclepias* L. and *Pherotrichis* Decne., in Mexico the subfamily is easily recognized, even when sterile, because the majority of its members are twining climbers with copious white (rarely yellowish) latex and opposite leaves that are cordate at the base and have colleters. When flowers are present, placement in Asclepiadoideae is readily indicated by the fusion of the anthers and stylar head into a gynostegium, usually with appendages (*i.e*., the gynostegial corona), and the presence of pollen agglutinated into waxy pollinia. The taxon is particularly diverse in tropical deciduous forest and thorn forest.

During fieldwork to document the flora of the Balsas Depression in central Michoacán, plants of an unknown species of Asclepiadoideae were encountered that had white glandular trichomes that become crystalline in age; filiform corona appendages; and long, fusiform, smooth, and mottled follicles. These features are characteristic of *Polystemma* Decne, as circumscribed by Stevens (2005) and McDonnell & Fishbein (2016). However, the characters of this plant do not correspond to any previously described species of *Polystemma*, and it is herein described as new.

Materials and methods

Herbarium specimens were collected in 2001, 2003, 2004, and 2014 following preparation techniques detailed by Lot & Chiang (1986). Photos were taken in the field with a Nikon D5200 using an AF-S MICRO 105 ED lens and a SIGMA EM 140 ring flash. Pertinent literature on *Polystemma* was consulted: Stevens (2005), McDonnell & Fishbein (2016), and Hernández Barón (2021). The morphological description was prepared at the QMEX herbarium, and specimens were distributed to ARIZ, FCME, MEXU, MO, and QMEX, acronyms according to Thiers (2021). The conservation status was evaluated using IUCN Redlist criteria (IUCN 2019), and the extent of occurrence (EOO) and area of occupancy (AOO) were determined by the methods described in Bachman *et al*. (2011)

Results

Polystemma fishbeiniana V.W. Steinm. & W.D. Stevens, sp. nov. (Figure 1).

Type. Mexico, Michoacán, municipio de Arteaga, along MEX 37, ca. 75 km (by road) N of Arteaga and 1 km S of El Descansadero, 18.643487 °N, 101.968979 °W, 08 July 2004, *V.W. Steinmann & L. Alvarado Cárdenas 4401* (Holotype: QMEX; Isotypes: ARIZ, FCME, MEXU, MO).

Diagnosis. Species similar to other members of *Polystemma* in having white glandular trichomes that become crystalline in age; filiform corona appendages; and fusiform, smooth, mottled follicles; it differs by its small leaves, suffrutescent habit, and flowers abaxially yellowish with a blackish to dark burgundy red margin and central line with short lateral extensions.

Description. Suffrutescent perennial, forming a dense tangle 30–50 cm tall, plants solitary or sometimes climbing on associates and reaching 1 m tall, lower woody stems with a grayish, fissured, corky periderm, upper herbaceous stems twining, latex white, herbage with a strong fetid odor. Internodes 1.2-6.3 cm long, indumentum in two levels, longer trichomes acicular, 0.2-0.6 mm long, white, straight, spreading or slightly reflexed, shorter trichomes capitate-glandular, 0.05-1 mm long, pale brown to whitish. Leaves opposite, stipules absent or represented by an inconspicuous, papillose colleter 0.1-0.3 mm long, petiole slender, 0.5-1.4 mm long, with indumentum like the stems, lamina ovate to lanceolate, 0.6-1.9 cm long, 0.4-1.4 cm wide, base deeply lobate, the lobes widely separated by a profound sinus 0.2-0.4 cm deep, apex acute to obtuse, midrib prominent, with 1-3 pairs of lateral veins, colleteres papillose, 2-4 at the base of the lamina, indumentum like that of the stems. Flowers 3-6 in congested, umbelliform, extra-axillary cymes, peduncle 1-4.5 mm long, with indumentum like that of the stems, bracts subulate to linear, 1-2.6 mm long,

pedicels 5.5-6.7 mm long, with indumentum like that of the stems, sepals narrowly triangular, lanceolate or subulate, free, 1.7-2.7 mm long, 0.3-0.7 mm wide, abaxially with indumentum like the stems, bearing a colleter in each sinus, aestivation imbricate and dextrose, corolla narrowly pyramidal and 4.8-6.5 mm long in bud, lobes 4.6-7.1 mm long, 0.9-1.1 mm wide proximally, united at the base into a short tube 0.7–1.5 mm long, adaxially blackish to dark burgundy red, abaxially yellowish with a blackish to dark burgundy red margin and central line with short lateral extensions, pilose inside with unicellular trichomes, glabrous outside, tapering to an acute apex, margin undulate, gynostegium sessile; corona blackish to burgundy red, external corona connate at the base into a structure 0.6 mm tall, 5-lobed above, each lobe subsequently 3-lobed, central lobe erect, ovate-cucullate, ca. 0.6 mm long, 0.3 mm wide, the lateral lobes filiform, somewhat reflexed, ca. 0.7 m long, internal corona with lobes reduced to small mounds between the central lobes of the external corona and the anthers; terminal appendages of the anthers adpressed to the style apex, reniform, white; style apex 1.5 mm wide, slightly convex, smooth. Pollinaria more or less horizontal on the anther margins, corpusculum approx. 0.18 mm long, 0.09 mm wide, ellipsoid, light brown, translator arms 0.09 mm long, pollinia ca 0.4 mm long, 0.26 mm wide, obovate, slightly asymmetrical, apex truncate with an excavated portion. Follicles narrowly fusiform, 1 or rarely 2 per flower, 7.2–11.3 cm long, 0.7-1.2 cm in diameter, mottled green-white; seeds ca. 40 per fruit, pear- to teardrop-shaped, flattened, 4.7-5.3 mm long, 3.2–3.9 mm wide, apex truncate, base rounded with an erose margin, coma 2.4-3.6 cm long, white.

Figure 1. *Polystemma fishbeiniana*. A, H. Flowering stems; B, G. Close-ups of flowers; C. Habit; D, E, I. Inflorescences; F. Fruit.

Etymology. *Polystemma fishbeiniana* is named in honor of Mark Fishbein, our friend and colleague, with whom the first author had the pleasure of accompanying on trips to the tropical vegetation of northwestern Mexico in the early 1990s. He is a noted specialist of Asclepiadoideae and has made significant contributions to our understanding of the Mexican flora, including describing several species, including *Polystemma canisferum* A. McDonnell & Fishbein.

Distribution and habitat. This new species is known only from two locations in the Zicuirán-Infiernillo Biosphere Reserve, in the Balsas Depression of central Michoacán, Mexico. One location is on the west side of the Cerro El Barril, and the other is about nine kilometers (airline) to the south-southwest, along the tollfree portion of Highway 37 between Las Canas and El Descansadero; at 275-400 m elevation. The vegetation is xeric scrub or open thorn forest with a dominance of columnar cacti and a carpet of *Bouteloua* spp. Associated shrubs and trees include *Pachycereus tepamo* S. Gama & S. Arias and *Stenocereus quevedonis* (González Ortega) Bravo (Cactaceae), *Pseudosmodingium perniciosum* (H.B.K.) Engl. (Anacardiaceae), *Crossopetalum managuatillo* (Loes.) Lundell (Celastraceae), *Cordia seleriana* Fern. (Cordiaceae), *Croton flavescens* Greenm., *Euphorbia arteagae* Buck & Huft, and *Jatropha jaimejimenezii* V.W. Steinm. (Euphorbiaceae), *Erythrostemon macvaughii* (J.L. Contr. & G.P. Lewis) Gagnon & G.P. Lewis, *Lonchocarpus balsensis* M. Sousa & J.C. Soto, *Senna wislizeni* (A. Gray) Irwin & Barneby, *Cenostigma eriostachys* (Benth.) Gagnon & G.P. Lewis (Fabaceae), *Krameria sonorae* Britton (Krameriaceae), *Ruprechtia fusca* Fern. (Polygonaceae), *Randia laevigata* Standl. and *R. thurberi* S. Watson (Rubiaceae), *Bonellia macrocarpa* (Cav.) B. Ståhl & Källersjö subsp. *pungens* (A. Gray) B. Ståhl & Källersjö (Primulaceae) and *Karwinskia johnstonii* R. Fernández (Rhamnaceae).

Conservation status. *Polystemma fishbeiniana* is a rare species and only about 50 plants have been observed. However, a careful census of mature individuals has not been conducted, and the actual number is surely greater because it occurs in a little-explored area with abundant suitable habitat, including sites between the two known locations. Also lacking is sufficient information to determine if there has been a reduction in population size and to what extent. The known EOO is 6 km^2 and the AOO is 16 km^2, but both of these values are likely underestimates. Although endemic to a biosphere reserve, the locations are close to small towns and subject to extensive cattle and goat grazing. Furthermore, there is evidence that drought also negatively affects the populations because in August of 2020, after a very delayed start of the rainy season, many plants that had been alive for more than a decade were deceased. Thus, a reduction in habitat quality has been observed and will likely continue. Given these conditions and following the IUCN Red List criteria (IUCN 2019), the conservation status of *P. fishbeiniana* is assessed as Endangered, EN B1ab(iii)+2ab(iii). This takes into account that AOO and EOO are predicted to be larger but not enough to change the status of Endangered, which would require an EOO of 5,000 km^2 and an AOO of 500 km^2, as well as the discovery of more locations.

Phenology. Flowering occurs from June to September, with mature fruits present from October to March; dehisced fruits can persist on the plants for almost a year.

Additional specimens examined. Mexico. Michoacán: municipio de Arteaga, along MEX 37, 7 km (by road) N of Las Canas, 18.626546 °N, 101.971740 °W, 24 June 2001 (fls), *V.W. Steinmann 1694* (QMEX); municipio de Arteaga, along MEX 37, ca. 75 km (by road) N of Arteaga and 1 km S of El Descansadero, 18.643487 °N, 101.968979 °W, 7 October 2001 (fts), *V.W. Steinmann 2060* (QMEX); municipio de La Huacana, ca. 0.5 km NE of Los Ranchos, at western base of Cerro El Barril, 18.70555556 °N, 102.0083333 °W, 30 August 2003 (fls, young fts), *V.W. Steinmann & M. Lara-Camacho 3471* (QMEX); municipio de La Huacana, Cerro El Barril, ca. 1 km (en línea recta) NNE de Los Ranchos, 18.7122222 °N, 102.009722 °W, 14 March 2014 (fts), *V.W. Steinmann & Y. Ramírez-Amezcua 7805* (QMEX).

Discussion

The genus *Polystemma* was first proposed by Joseph Decaisne (1844) in his treatment of the tribe Asclepiadeae for Alphonse de Candolle's *Prodromus Systematis Naturalis Regni Vegetabilis*. Nearly a century later, Woodson (1941)

synonymized the genus with *Matelea* Aublet, but Stevens (2001, 2005) resurrected it to accommodate plants having a combination of white glandular trichomes that become crystalline in age; filiform corona appendages; and long, fusiform, smooth, and mottled follicles. All of these features are possessed by *Polystemma fishbeiniana*. The characterization and delimitation of *Polystemma* is still incomplete. Although only seven species have been formally placed in the genus, Stevens (2005) and McDonnell & Fishbein (2016) mention that it contains approximately 20 Mexican species. Hernández Barón (2021) provided a treatment of 12 Mexican species, but many of these species do not yet have combinations in *Polystemma* or are undescribed. *Polystemma fishbeiniana* was treated as *Polystemma* sp. 2, and information about its morphological distinctions and distribution were provided.

Polystemma fishbeiniana is a distinctive species readily distinguished from its congeners by having a suffrutescent habit, leaves less than 2 cm long, and a corolla abaxially yellowish with a blackish to dark burgundy red margin and central line with short lateral extensions. All of these traits are otherwise unknown in the genus, and the other species have leaves that are larger than 2 cm long, a non-suffrutescent habit, and flowers that lack the characteristic pattern of yellow with black or dark burgundy. It is one of four species of *Polystemma* occurring in Michoacán, the others being *P. guatemalense* (Schltr.) W.D. Stevens, *P. viridiflorum* Decne., and an undescribed species that was treated by Hernández Barón (2021) as *Polystemma* sp. 3. A key to distinguish these taxa, as well as the other members of *Polystemma*, is provided in Hernández Barón (2021).

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