



Marsdenia calichicola (Apocynaceae), a narrow endemic, endangered new species from the Mexican Yucatan Peninsula

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Abstract

Marsdenia (Apocynaceae: Asclepiadoideae, Marsdeniae) is represented by five species in the Mexican Yucatan Peninsula (vs. seven in the whole of the province), one of which is herein proposed as new to science. The new species, *Marsdenia calichicola* Carnevali & Juárez-Jaimes, is only known from a narrow strip of sub-xerophytic forests over calcareous, rocky soils along the northwestern edge in the Yucatán state of Mexico. *Marsdenia calichicola* is morphologically similar and likely related to *M. gallardoae* and *M. trivirgulata*. Among other characters, it differs from *Marsdenia gallardoae* by the presence of a corona composed of cushion-like calli (corolla lacking calli in *M. gallardoae*) whereas *M. trivirgulata* has a glabrous or glabrescent corolla (vs. pubescent in *M. calichicola*); additional characters are herein discussed. We provide pertinent iconography to aid in the identification of the new species plus a key to diagnose the three species in the *M. trivirgulata* complex. The conservation status of the new taxon is assessed against the IUCN criteria as CR. A distribution map and a key to the species of *Marsdenia* from the Yucatan Peninsula Biotic Province are presented.

Keywords: Asclepiadoideae, Endemism, IUCN, *Marsdenia* sect. *Edules*, Marsdeniae, Mexico, Yucatan Peninsula Biotic Province

Resumen

El género *Marsdenia* (Apocynaceae: Asclepiadoideae, Marsdeniae) está representado por cinco especies en la porción mexicana de la Provincia Biótica Península de Yucatán (adonde hay siete especies), una de las cuales se propone aquí como nueva para la ciencia. La nueva especie, *M. calichicola* Carnevali & Juárez-Jaimes, se conoce sólo de una estrecha franja de selvas subxerofíticas sobre suelos calcáreos, rocosos, a lo largo del margen noroeste del estado de Yucatán, México. *Marsdenia calichicola* es morfológicamente similar y probablemente relacionada con *M. gallardoae* y *M. trivirgulata*. Entre otros caracteres, se diferencia fácilmente de *M. gallardoae* por la presencia de una corona corolina compuesta de callos como cojines (vs. corona corolina sin callos como cojines en *M. gallardoae*). Por otra parte, *M. trivirgulata* posee una corola glabra o glabrescente (vs. densamente pubescente en *M. calichicola*); diferencias adicionales se discuten en el texto. Se provee iconografía que permitirá identificar la nueva especie entre sus relativos cercanos, así como una clave para distinguir las tres especies del complejo de *M. trivirgulata*. El estado de conservación del nuevo taxón es analizado con los criterios de la IUCN y evaluado como CR. Se presenta un mapa de distribución y una clave para las especies de *Marsdenia* de la Provincia Biótica Península de Yucatán.

Palabras clave: Asclepiadoideae, Endemismo, IUCN, *Marsdenia* sect. *Edules*, Marsdeniae, México, Provincia Biótica Península de Yucatán

Introduction

The genus *Marsdenia* Brown (1810: 460), a member of subfamily Asclepiadoideae, tribe Marsdeniae of Apocynaceae, includes about 200 species in the tropics and subtropics (Forster 1995, Stevens & Juárez-Jaimes 1999, Stevens 2009),

particularly in the Neotropics. The genus is well represented in Megamexico II (an area encompassing the territory of Mexico southward to the Nicaraguan Depression that shares a common biota and biogeographic history, Rzedowski 1991) with 42 species, 34 of which are restricted to Mexico proper (e.g. Juárez-Jaimes *et al.* 2007, Stevens 2009, Juárez-Jaimes 2015). Of these, seven species have been recorded (Stevens 2009) in the Yucatan Peninsula Biotic Province (YPBP; see key provided below). Following Carnevali *et al.* (2010b), the YPBP is here defined as encompassing the three Mexican states of the peninsula (Campeche, Quintana Roo, and Yucatan), as well as the three northernmost districts of Belize (Belize, Orange Walk, and Corozal) and the Guatemalan Peten. Some contiguous areas of the Mexican states of Chiapas and Tabasco may also belong in this biotic province but boundaries are yet to be critically assessed. This province shares a relatively species-poor, yet distinctive, flora with a relatively high level of endemism (Carnevali *et al.* 2010b).

The flora of the Mexican portion of the YPBP (hereafter Mexican Yucatan Peninsula, MYP) is much better known than that of the rest of the province because it has larger cities, is much more densely populated, and is crisscrossed by many, mostly well-paved roads. This northern flora is even less diverse than that of the southern portions of the YPBP. However, it is more endemic-rich because a considerable part of it consists of an island of seasonally dry vegetation surrounded by more humid associations to the south and the Caribbean Sea and the Gulf of Mexico to the north, east, and west.

Four species of *Marsdenia* had been previously known to occur in the MYP, three of which were clearly referable to formally described species, namely *Marsdenia coulteri* Hemsley (1882: 336), *M. gualanensis* Donnell-Smith (1910: 456), and *M. propinqua* Hemsley (1882: 337) (Stevens 2009, Carnevali *et al.* 2010b). The fourth species had been referred to the mainly South American *Marsdenia macrophylla* (Schultes 1820: 86) Fournier in Martius (1885: 321) by Durán *et al.* (2000) and later treated as *M. macrophylla* of authors by Carnevali *et al.* (2010b). These plants have now been more correctly identified as referable to the recently described *M. hiriartiana* Juárez-Jaimes & Stevens (2005: 552) and as such the species constitutes a new record for the MYP (see below).

More recently, field work in the northern, driest portion of the MYP, yielded yet another novelty, a taxon that could not be matched with any previously described congener and closely related to a complex of two species restricted to the dry lowlands of the Pacific watershed of Megamexico II. This novelty is herein proposed as *Marsdenia calichicola*. In this article, we formally document the new species, including relevant iconography and discussion of affinities. We also provide an assessment of the conservation status of the new species following IUCN (2001). A key to diagnose the *Marsdenia* species native to the YPBP is also included.

This article is the first of a series dealing with the flora and vegetation of the Yucatan sub-xerophytic ecosystems growing over caliche and other calcareous rocks and soils.

Materials and methods

Specimens of *Marsdenia* were studied at herbaria relevant to the flora of the region (CICY, CIQR, UADY, and UCAM), the National Herbarium of Mexico (MEXU), and some international herbaria pertinent to the floristic record of the area (GH, NY, and US). Also, databases such as TROPICOS (<http://www.tropicos.org>) were critically consulted. Nomenclatural types of all related names and species were analyzed, either as actual specimens or high-definition digital images. Species in the article were circumscribed following the Unified Species Concept of de Queiroz (2007).

Specimens were analyzed with a dissecting stereomicroscope. Flowers were studied fresh, pickled, or rehydrated to study their morphology. Photographs of herbarium specimens were taken with a SONY Cybershot DSC-W120. Distribution maps for *Marsdenia* were produced by plotting locality data extracted from available herbarium specimens, and later condensed into a single map. Cartography was produced on a DIVA-GIS base map (Hijmans *et al.* 2004), using ArcView 3.2 (ESRI 1999). The resulting map was edited with Adobe Photoshop 6.0.1. (Adobe Systems Inc, San Jose, CA).

The conservation status of the new species of *Marsdenia* was assessed using the IUCN Red List Criteria (IUCN 2001). Because exhaustive population data of this species are not available, we relied on the set of B criteria, *i.e.*, geographical distribution assessed both as B1 (extent of occurrence) or B2 (area of occupancy). We complemented this assessment with our field experience, as well as information and opinions furnished by experts in the flora and vegetation of the MYP.

Taxonomy

Marsdenia calichicola Carnevali & Juárez-Jaimes, *sp. nov.* (Figs. 1, 2)

Similar to *M. trivirgulata* but the corolla is rotate (vs. campanulate), pubescent adaxially (vs. glabrous), glabrous or glabrescent abaxially (vs. puberulent), the callous cushions are transversely elliptic, densely pubescent, broader than long (vs. longer than wide, pubescent), and the styler appendix is proportionally longer and apically sigmoid (vs. straight).

Type:—MEXICO. Yucatán: Municipio Chicxulub Pueblo, camino blanco entre Rancho Chenwayum y Rancho San Antonio, ubicado a unos 9 km al S del desvío de la carretera Progreso-Telchac a lo largo de la carretera Chicxulub Puerto-Chicxulub Pueblo; partiendo del desvío son 2.79 km al E y luego 1.17 km al N, 21°14'9.47"N, 89°32'0.62"W, 5–8 m.s.n.m., selva baja caducifolia con abundancia de cactáceas columnares y muchas leguminosas espinosas sobre suelos someros y afloramientos de rocas calizas, [unpaved road between Chenwayum and Rancho San Antonio, about 9 km south of turnoff from the Chicxulub Puerto-Chicxulub Pueblo highway; 2.79 km E from turnoff, then 1.17 km N, 21°14'9.47"N, 89°32'0.62"W, 5–8 m above sea level, low caducifolious forest with many columnar cacti and spiny legumes over shallow soils and limestone outcrops], 6 November 2008, G. Carnevali, R. Duno, J. C. Trejo & D. Angulo 7394 (holotype CICY!; isotypes MEXU!, MO!).

Twining or basally subprostrate vines with white latex, heliophilous. Stems basally glabrous or glabrescent, brown, subwoody and corky-suberous, often rooting upon contacting the topsoil layer, eventually yielding new ramets; young branches retrorse-puberulent with simple hairs 0.2–0.4 mm long, these arranged in irregular longitudinal bands. Leaves opposite, blades 3.0–4.5 × 1.5–2.4 cm, elliptic to widely elliptic, apex acute to abruptly acuminate, more rarely obtuse to broadly obtuse, margin entire, base acute-cuneate, adaxial surface dark green, sparsely strigulose, abaxial surface paler green, more sparsely strigulose, lateral veins sulcate, 3–4 pairs emerging at an angle of ca. 45° relative to the midnerve, laxly provided with long pale green hairs, conical colleters 2 at adaxial base of midrib, ca. 0.5 mm long; petioles 3–6(–8) mm long, sulcate ventrally, with ubiquitous pubescence but denser toward the bases, consisting of 0.2–0.4 mm long hairs. Inflorescences axillary, one per node, an umbelliform cyme, 4–8-flowered, with 2–3 clustered flowers facing different directions open simultaneously; peduncle ca. 2 mm long, slightly and irregularly puberulent, the pubescence ubiquitous but denser toward the base, hairs 0.2–0.4 mm long, pedicels 1–2 mm long; bracts 0.8–1.1 mm long, one per flower, ovate, apex acute, slightly and irregularly puberulent. Flowers relatively showy, calyx shorter than the corolla tube, lobes 2.4–2.6 × 1.2–1.4 mm, ovate to ovate elliptic, dextrosely imbricate, apex broadly obtuse, abaxial surface glabrescent or slightly and irregularly puberulent, margin ciliolate, colleters 2 per sinus, conical, ca. 0.2 mm long; corolla white with 3–4 reddish longitudinal bands in the basal half of each lobe, color bands tenuously noticeable on the abaxial surface (the color pattern is obscured in dry material), rotate, 5–6 mm diameter, tube 1.5–2.0 mm long, adaxially glabrous or very sparsely pubescent with the pubescence arising from the throat to the corolla lobes, abaxially glabrous, throat densely pubescent, corolla lobes oblong elliptic, 3.5–4.5 × 1.0–1.1 mm, apex obtuse to obliquely subtruncate-emarginate, slightly and regularly puberulent in the inner surface, glabrous on the outer surface, margins slightly revolute, sparsely ciliolate, particularly toward the apex; callous cushions of the corolline corona transversely oblong to sub orbicular, located at the sinus of the corolla lobes, densely pubescent; gynostegium 1.8–2.0 mm long (not including the styler head appendix), sessile, narrowly conical; gynostegial corona 5-lobed, adnate to the stamens only at the very base, covering the basal third of the anther appendages, lobes 0.6–0.7 × 1.1–1.2 mm, apex broadly rounded, concave and thickened marginally, overlapping contiguous lobes and covering the stigmatic surface; anthers 1.3–1.4 × 0.4–0.5 mm, anther membranes triangular-caudate, 0.3–0.4 mm long, apex acute; style head appendix conical, rostrate, sigmoid in the apical half, apex cleft about 1/3 of its length, 2.2–2.3 mm long; corpuscle oblong, ca. 0.2 × 0.05 mm, straight, apex rounded; pollinia ca. 0.25 × 0.06 mm, narrowly obovate-reniform, caudicles ca. 0.1 mm long. Follicles unknown.

Etymology:—The specific epithet “*calichicola*” refers to the habit of growing over caliche, the hardened sedimentary rock that outcrops in many places of the northern Yucatan Peninsula and forms a thick, impermeable shell that sustains a xerophytic or sclerophyllous, endemic-rich community. *Marsdenia calichicola* inhabits this ecosystem, with the basal portion of its stems often trailing and rooting over the naked rock in the shade of shrubs.

Phenology:—*Marsdenia calichicola* has been observed in flower in October (2011) and November (2008, 2011). When in bloom, 4–10 distal internodes per branch flower simultaneously, with a mature plant producing several hundred, faintly and sweetly fragrant flowers. However, in spite of abundant flowers produced, no fruits have been seen to date. Self-sterility has been reported for some species of *Asclepias* L. (Wyatt & Lipow 2007); for example, the inability to produce fruits is due to a single gene (Lipow & Wyatt 2010) in *Asclepias exaltata* L. (1756: 404) a member of the APSA group (a clade consisting of subfamilies Apocynoideae, Periplocoideae, Secamonoideae, and

Asclepiadoideae, Livshultz *et al.* 2007) such as the genus *Marsdenia*. The scarcity of fruits in *Marsdenia calichicola* is probably related to self-sterility since incompatible systems are usually conserved among closely related taxa (de Nettancourt, 1977). Similarly, Acevedo (1999) reported the case of *Marsdenia woodburyana* Acevedo (1999: 167), a rare endemic from calcareous, coastal areas in Puerto Rico that similarly flowers sporadically and fruits rarely. Perhaps this phenological strategy is shared by other *Marsdenia* species growing in such habitats. In our experience with *M. calichicola*, no insects have been observed visiting the flowers or feeding on the vegetative portions. The plants are partially to totally deciduous during the peak of the dry season (late March–early June). In cultivation, with regular watering, most leaves are retained throughout the year. The species is readily propagated by means of rooted stolons, and several plants are already under cultivation at the Jardín Botánico Regional “Roger Orellana”, at CICY, and in a few private collections.

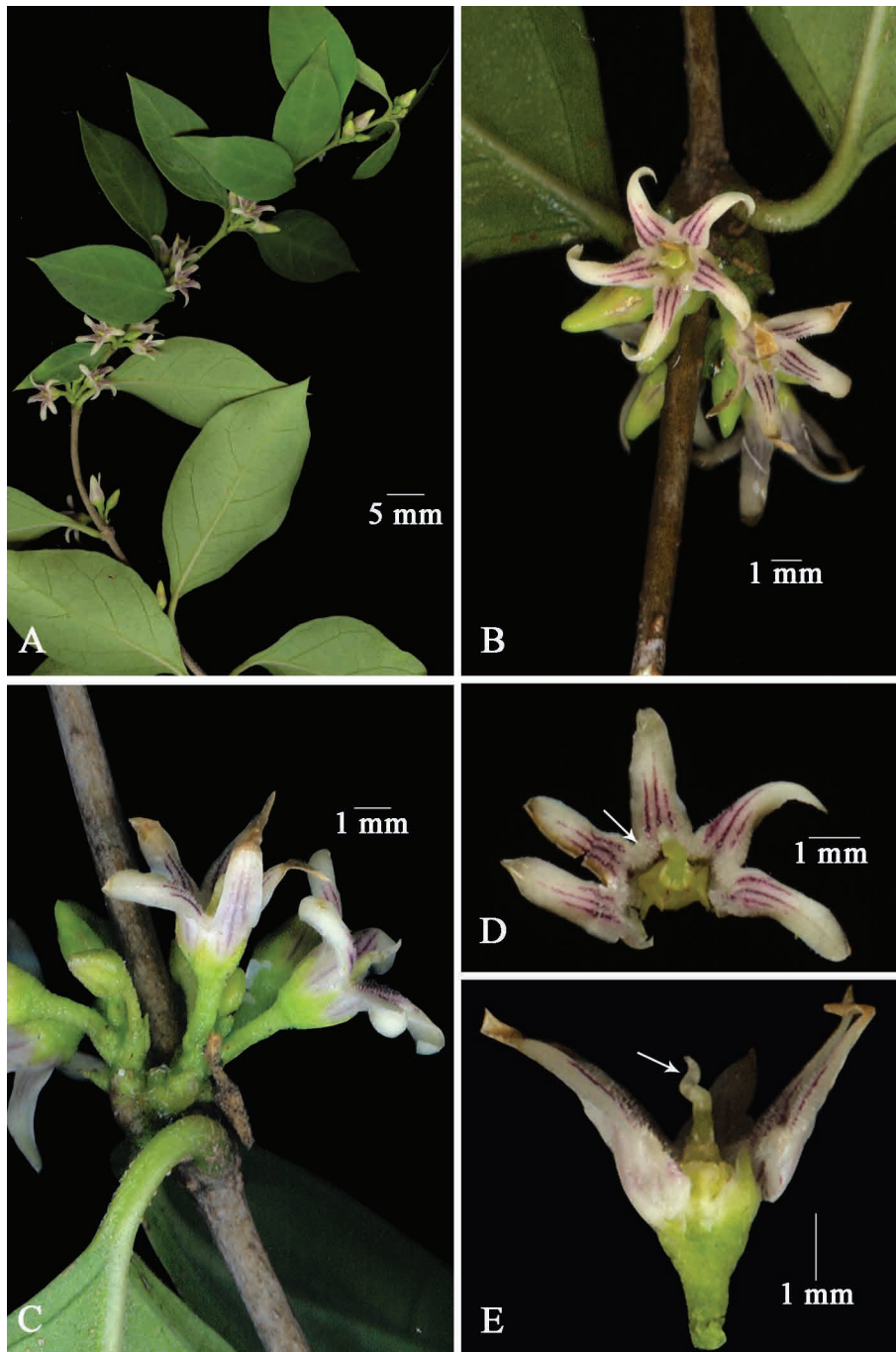


FIGURE 1. *Marsdenia calichicola* Carnevali & Juárez-Jaimes (based on Carnevali *et al.* 739, CICY, MEXU, MO; all photographs by Germán Carnevali). **A.** Flowering plant. **B.** Inflorescence featuring flowers at anthesis, one in front view; note corolla color pattern. **C.** Inflorescence with flowers in anthesis in lateral view. **D.** Front view of partially disassembled flower; note pubescent calli at base of the corolla lobes (arrowed). **E.** Lateral view of partially disassembled flower showing apical portion of gynostegium; note sigmoid stylar appendix (arrowed).

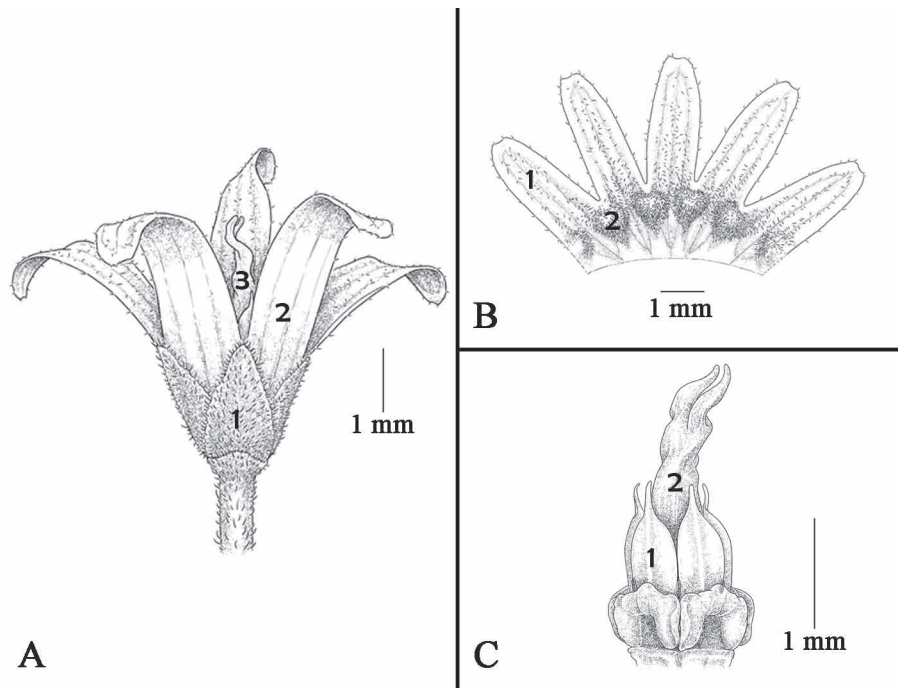


FIGURE 2. *Marsdenia calichicola*, flower details (based on Carnevali *et al.* 739, CICY, MEXU, MO; line drawings by Alberto Guerra). **A.** Flower at anthesis, lateral view. A1. Calyx, A2. Corolla. A3. Stylar appendix. **B.** Spread corolla, featuring shape of the corolla lobes and position, shape, and pubescence of the calli. B1. spread corolla. B2. cushion-like calli. **C.** Gynostegium, lateral view, featuring shapes and relative sizes and position of the corona lobes, the anther appendices, and the sigmoid stylar appendix. C1. Anther appendice, C2. sigmoid stylar appendix

Distribution and Ecology:—*Marsdenia calichicola* is restricted to a narrow fringe of very specialized habitat (Fig. 3). It is found only along the northernmost edge of an ecosystem characterized by the outcropping of a thick limestone slab, the caliche, which is variously eroded and covered partially by a thin layer of organic soil. This narrow strip of caliche is located from just a few hundred meters up to a few kilometers from the coast. This ecosystem has been called “selva baja caducifolia con cactáceas columnares” (low deciduous forest with columnar cacti, see Olmsted *et al.* 1999 for a characterization and Carnevali *et al.* 2003 for a brief discussion of its phylogeography). It harbors a specialized flora along with a mosaic of vegetation types adapted to high temperatures and severe seasonal drought. In fact, a relatively high number of the phytotaxa endemic to the YBPB seem to occur here (Carnevali *et al.* 2003) mainly because it constitutes an island of dry vegetation types surrounded by the sea or by moister plant associations to the south. To find other areas supporting these or equivalent vegetation types, a traveler would have to go the Chiapas Central Depression (650–700 km in a straight line to the SW) or to central Veracruz (800–850 km to the WSW), where similar plant associations occur.

At the type locality, *M. calichicola* grows along with other restricted, critically endangered endemics such as *Ipomoea sororia* Austin & Tapia-Muñoz (2001: 807), *Wimmeria obtusifolia* Standley (1930: 20), *Zephyranthes orellanae* Carnevali, Tapia-Muñoz & Duno (in Carnevali *et al.* 2010a: 45), and several species of Cactaceae.

Discussion:—On account of its compact inflorescences, shortly tubed corollas, lobes of the staminal corona not surpassing the anthers, and elongated stylar appendix, *Marsdenia calichicola* belongs to *Marsdenia* section *Rostratae* Rothe (1915: 425). Within the section, it is further referred to subsection *Edules* (Rothe 1915: 425) because of the corolla lobes much longer than the corolla tube (Rothe 1915, Juárez-Jaimes & Alvarado-Cárdenas 2010). Within subsection *Edules*, *M. calichicola* belongs in a complex of three very similar, yet distinct species that include *M. gallardoae* Lozada-Pérez (2000: 128), from the Tehuantepec Isthmus area and contiguous Chiapas, and *M. trivirgulata* Bartlett (1909: 632), which ranges widely along the Pacific watershed from Sinaloa to Panama. This group of species referred to as the *Marsdenia trivirgulata* complex is characterized by small, ovate-elliptic leaves, short, densely flowered, subumbellate cymes, and basically white corollas with longitudinal red or red-purple stripes; all three species occur in tropical seasonally dry forests (“selva baja caducifolia”) at elevations below 500 m (rarely up to 800 m).

Marsdenia calichicola is most similar and probably most closely related to *M. trivirgulata* from which it is easily distinguished, among other characters, by its densely pubescent corolla, ovate calyx lobes (vs. elliptic in *M. trivirgulata*)

and the apically sigmoid stylar appendix (vs. straight). From *M. gallardoae*, which also features an internally pubescent corolla, the novelty presented here is easily diagnosable by the conspicuous cushion-like calli composing the corolline corona, which are absent from *M. gallardoae* and the 4–8 flowered inflorescences (2–4-flowered in *M. gallardoae*). The three species can be most easily distinguished by the following key, which includes additional characters:

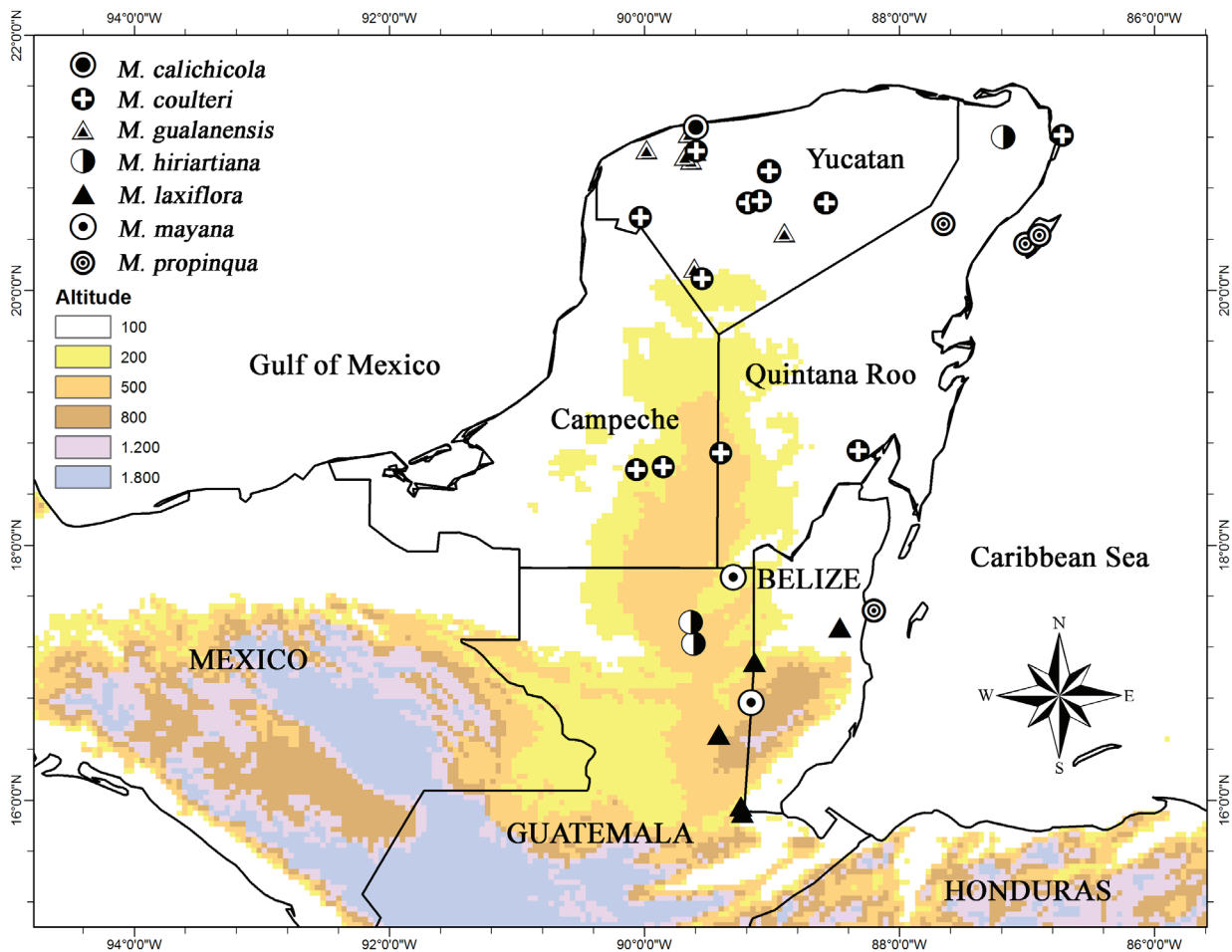


FIGURE 3. Distribution of *Marsdenia* species in the Yucatan Peninsula Biotic Province.

Key to the species of the *Marsdenia trivirgulata* complex

1. Inflorescences with 2–4 flowers open at a time; corolla lacking a corona altogether; lobes of the gynostegial corona longer than wide, cordate, with a broadly rounded apex, covering 2/3 of the anther appendages; stylar appendix minutely bifid at apex; plants from the Tehuantepec Isthmus area and neighboring Chiapas State *M. gallardoae*
- Inflorescences with 4–8 flowers open at a time; corolla exhibiting a corona of cushion-like calli; lobes of the gynostegial corona wider than long, subrectangular with a subtruncate apex, covering only the basal ¼ of the anther appendages; stylar appendix deeply bifid at apex; plants from the northern Yucatan Peninsula or from the Pacific watershed from Sinaloa (Mexico) southward to Panama 2
2. Calyx lobes ovate; corolla white, with 3–4 continuous red stripes restricted to the lower half, rotate, internally densely pubescent, gynostegium 1.8–2.0 mm long; calli of the corolline corona densely pubescent, wider than long; stylar appendix ca. twice as long as the anther appendages, apically sigmoid; corpuscle thicker, ca. 3 times longer than wide, shorter than the pollinia; petioles 5–8 mm long; leaf blades adaxially sparsely strigulose, strigose abaxially; plants from the dry forests over caliche in the extreme NW of the Yucatan Peninsula *M. calichicola*
- Calyx lobes elliptic; corolla white to pale red or purplish, with discontinuous red stripes over all its surface, campanulate, internally glabrous or glabrescent; gynostegium 1.0–1.5 mm long; calli of the corolla glabrous, longer than wide; stylar appendix ca. 1.2–1.5 times longer than the anther appendages, apically straight; corpuscle very narrow, ca. 7 times longer than wide, as long or longer than the pollinia; petioles 6–10 mm long; leaf blades adaxially glabrescent or with adpressed hairs on the nerves, abaxially sparsely puberulent or with lax hairs on the veins; plants from the Pacific watershed from Sinaloa (Mexico) southward to Panama *M. trivirgulata*

IUCN Conservation assessment:—CR. *Marsdenia calichicola* meets criteria B1a of the IUCN. It is currently known from a single locality and its extent of occurrence is of less than 2 km². The species is severely threatened

because its habitat is highly fragmented under natural conditions and is also simultaneously being transformed by anthropogenic activities, particularly touristic developments and cattle ranching. The single known population resides in an area that lacks any level of protection; actually, it is inside a property where extensive cattle ranching is sustained. We have visited the type locality several times since 2008 and found the lone population in flowers only three times. Furthermore, after thorough searches, we have only been able to identify what we believe are five independent genotypes, all over a stretch of ca. 200 m along an unpaved road. Because the plants produce underground stolons (that can easily be cut and rooted for cultivation) and the basal stems root upon contacting the thin topsoil layer, eventually yielding new ramets, it is difficult to assess at this time how many genotypes may really exist in the population. We have never found a fruit, in spite of abundant flowers produced. However, because this species is most likely self-incompatible (see above) there is probably more than one genotype in the population.

Marsdenia calichicola could be classified as a DD (data deficient) species but we strongly argue for its classification as CR in terms of the current state of knowledge of the flora and vegetation of the area where it has been collected. The ecosystem and geographic area where the species occurs have been intensively sampled during the last 20 years by many botanists yet *M. calichicola* remains known from a single record. In discussing DD species, the IUCN (2001) clearly establishes: "It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified." Thus, to effectively procure the necessary conservation actions, *M. calichicola* is best considered CR.

***Marsdenia* in the Yucatan Peninsula Biotic Province (YPBP):**—Six species of *Marsdenia* had been previously reported from the YPBP. *Marsdenia calichicola* is the seventh species to be recorded from this general area. Of these seven species, only *M. coulteri* and *M. gualanensis* occur in the driest, northern portion of the peninsula, along with the novelty featured herein. *Marsdenia gualanensis* is sympatric at the type locality of *M. calichicola* but the two species are easily distinguished by vegetative and floral characters (see key below). All other species of *Marsdenia* in the YPBP grow in more humid vegetation types to the south of the province, mostly in semideciduous tropical forests ("selva mediana subcaducifolia"-SMSC, and "subperennifolia"-SMSP). Of these, *M. laxiflora* Donnell Smith (1905: 8) and *M. mayana* Lundell (1940: 23) occur in tropical rain forests ("selva alta perennifolia").

Key for the species of *Marsdenia* from the Yucatan Peninsula Biotic Province

1. Inflorescences laxly paniculate, often exceeding the subtending leaves, always very much exceeding the petioles, composed of long (25–70 mm), glabrous, filiform peduncles and branches each topped by an umbel with 3–5 long pedicelled flowers; pedicels 15–25 mm long.....*M. laxiflora*
- Inflorescences congested, paniculiform or umbelliform, usually shorter than subtending leaves, shorter, subequaling to slightly longer than petioles, composed of one or few, short, thick, variously pubescent peduncles plus branches (1–16 mm long) each topped by few- to many-flowered fascicles or subumbels, pedicels 1.5–10.0 mm long.....2
2. Leaves narrowly elliptic or oblong, glabrous; colleters absent at leaf base; corolla greenish to extremely dark purple, almost black.....*M. mayana*
- Leaves elliptic, ovate, broadly ovate to suborbicular, always pubescent; colleters present at leaf base; corolla white, pale yellow, greenish white, or white with red stripes.....3
3. Leaves broadly elliptic to suborbicular, almost as broad as long, base always cordate, sinus 1/10 of total leaf-blade length, inconspicuously ferruginous-pubescent; lateral veins 7–8 pairs; laminar colleters 6–24.....*M. hiriartiana*
- Leaves elliptic to ovate, almost twice as long as wide, base acute, truncate, obtuse to shallowly lobed, when rarely lobed then sinus not exceeding 1/20 of total leaf-blade length, glabrous or with various indument types but never ferruginous-pubescent; lateral veins 3–7 pairs; laminar colleters 2–10.....4
4. Leaves oblong-elliptic to broadly elliptic, 3.0–4.5 × 1.5–2.4 cm, base cuneate; lateral veins 3–4 pairs; petioles 3–5 mm long; corollas white with 3–4 red longitudinal stripes that cover 2/3 of total corolla lobe length; sinuses of the corolla lobes with thickened, cushion-like, densely pubescent calli.....*M. calichicola*
- Leaves elliptic to ovate, 2.5–19.0 × 1.2–11.5 cm, base obtuse, truncate to shallowly lobed; lateral veins 4–7 pairs; petioles exceeding 5 mm; corolla pale yellow or greenish-white, never with red longitudinal stripes covering 2/3 of total corolla lobe length; sinuses of the corolla lobes lacking calli.....5
5. Leaves ovate, 2.5–7.8 × 1.2–5.9 cm; corolla subrotate, lobes adaxially appressed-pilose excepting a glabrous margin, abaxially glabrous or (more rarely) sparsely appressed-pilose; apex of the style rostrate.....*M. coulteri*
- Leaves elliptic to ovate, 5.5–19.0 × 3.3–11.4 cm; corolla campanulate or tubular, lobes adaxially papillose to glabrous, abaxially glabrous; apex of the style variously shaped but never rostrate.....6
6. Leaf apex acuminate; petiole 1.4–6.0 cm long, appressed-tomentulose; pedicels 1.5–4.5 mm long; calyx lobes 1–2 × 0.8–1.5 mm; corolla campanulate, tube 1–2 mm long, lobes 1.5–2.5 × 0.8–1.5 mm, adaxially papillose; gynostegium stipitate, 0.2–0.4 mm tall; corolline corona absent; follicles 4.5–8.5 × 2–3 cm.....*M. gualanensis*
- Leaf apex abruptly acuminate (more rarely rounded); petiole 0.9–3.8 cm long, glabrous or tomentulose; pedicels 4–10 mm long, calyx lobes 2.5–4 × 2–3 mm; corolla tubular-salverform, tube 2.5–3 mm long, lobes 2.5–3.5 × 1.5–2.5 mm, adaxially glabrous; gynostegium sessile, 2 mm tall; corolline corona present; follicles 10.5–13.0 × 3.5–4.0 cm.....*M. propinqua*

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