

CENTROSEMA FLAVESCENS (FABACEAE, PAPILIONOIDEAE), A NEW SPECIES
FROM THE YUCATAN PENINSULA, MEXICO
CENTROSEMA FLAVESCENS (FABACEAE, PAPILIONOIDEAE), UNA NUEVA ESPECIE
DE LA PENÍNSULA DE YUCATÁN, MÉXICO

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Abstract

Background: *Centrosema* (Fabaceae) includes 35-44 species in the New World, 10 in Mexico, and 9 in the Yucatan Peninsula. Most species have trifoliolate leaves and bicolored flowers. Unifoliolate leaves are an infrequent character that is found in a few species, e.g., *C. sagittatum* (Humb. & Bonpl. ex Willd.) Brandege, but monochromatic flowers, e.g., lacking nectar guides, is even a more unusual character state. Several populations of a *Centrosema* from the Yucatan Peninsula share both character states, a combination that sets them apart from other members of the genus.

Question: Is the *Centrosema* with unifoliolate leaves, alate petioles, and monochromatic flowers of the Yucatan Peninsula, a species distinct from the phenetically similar *C. sagittatum*?

Studied species: *Centrosema* (Fabaceae, Papilionoideae).

Study site and dates: Yucatan Peninsula, Mexico, 2021-2023.

Methods: Botanical specimens were collected and determined taxonomically through the use of relevant literature, keys, and the consulting of botanical collections. The conservation status of the new species was assessed using the IUCN methodology.

Results: The specimens collected do represent an undescribed species that differs from *Centrosema sagittatum* by its smaller, cream-yellow, monochromatic flowers. The species is assessed as Endangered (EN).

Conclusions: A new species, *Centrosema flavescens* from the Yucatan Peninsula is proposed. Eleven species of *Centrosema* are now recognized in Mexico, nine in the Yucatan Peninsula. *C. sagittatum* does not occur in the Yucatan Peninsula.

Kew Words: Leguminosae, Papilionoideae, taxonomic novelty, Yucatán.

Resumen:

Antecedentes: *Centrosema* (Fabaceae) es un género de 35-44 especies en el Nuevo Mundo, 10 en México y 9 en la península de Yucatán. La mayoría de las especies tienen hojas trifolioladas y flores bicoloradas. Las hojas unifolioladas son un carácter poco frecuente que se encuentra en pocas especies; p.ej. *C. sagittatum* (Humb. & Bonpl. ex Willd.) Brandege, pero las flores monocromáticas, que carecen de guías de néctar, es incluso un estado de carácter más inusual. Varias poblaciones de *Centrosema* de la península de Yucatán comparten ambos estados de carácter, una combinación que las separa de otras especies del género.

Pregunta: ¿Es el *Centrosema* de hojas unifolioladas, peciolo alado y flores monocromáticas de la península de Yucatán una especie diferente de la fenéticamente similar *C. sagittatum*?

Especies de estudio: *Centrosema* (Fabaceae, Papilionoideae).

Sitio de estudio y fecha de estudio: Península de Yucatán, México, 2021-2023.

Métodos: Se recolectaron especímenes botánicos y se determinaron taxonómicamente mediante el uso de literatura relevante, claves y la consulta de colecciones botánicas. El estado de conservación de la nueva especie se evaluó utilizando la metodología de la UICN.

Resultados: Los especímenes colectados representan una especie no descrita que se diferencia de *C. sagittatum* por las flores cremosas, monocromáticas y más pequeñas. La especie es evaluada como En Peligro (EN).

Conclusiones: Se describe una nueva especie, *Centrosema flavescens*, de la península de Yucatán. Se reconocen once especies de *Centrosema* en México y nueve en la península de Yucatán. *Centrosema sagittatum* no crece en la península de Yucatán.

Palabras clave: Leguminosae, novedad taxonómica, Papilionoideae, Yucatán.

Centrosema (DC.) Benth. (Fabaceae: Papilionoideae: Phaseoleae) is one of the five genera of the subtribe Clitoriinae Benth. (Schrire 2005), three of which are found in Mexico: *Barbieria* DC., *Centrosema*, and *Clitoria* L. (Villaseñor 2016). All five genera feature resupinate flowers, which are uncommon in the Papilionoideae. *Centrosema* is characterized by having a flat or more or less convex banner (never deeply concave), with a dorsal short or gibbous spur, a bell-shaped calyx, wings shorter in length than the keel petals, and a broad “U”-shaped style. The fruits are sessile, flat and with two ribs near each margin (McVaugh 1987, Barreto *et al.* 2018). The name *Centrosema* comes from two Greek words: *kentron*, meaning spur and *sema*, meaning signal, probably referring to the small spur at the base of each petal. It can also refer to the central nectar guides of the banner.

Centrosema includes about 35-44 species distributed in the New World, some of which have naturalized in tropical Africa, Asia, and Oceania (Barreto *et al.* 2020, POWO 2023 www.plantsoftheworldonline.org). In Mexico, 10 species were then known (Villaseñor 2016), nine of which grow in the Yucatan Peninsula (Duno de Stefano *et al.* 2008, Carnevali *et al.* 2010).

In 2020 we visited the village of Chan Yokdzonot, near Valladolid, in the state of Yucatán, and collected a *Centrosema* with monochromatic flowers (Figures 1D, 2). Most of the Mexican species of this genus have leaves with three leaflets, with few exceptions, and the most striking is *C. sagittatum* (Humb. & Bonpl. ex Willd.) Brandege with one leaflet and a winged petiole. As described in the available literature and iconography, this species has white flowers with purple or reddish nerves or longitudinal spots (nectar guides) on the central portion of the “labellum” (the banner). Carnevali Fernández-Concha *et al.* (2021) considered this plant an albino form of this species, but pending further evaluation. For these reasons, we reevaluate the taxonomy of *C. sagittatum* from the Yucatan region.

The main purposes of this article are four: 1) To compare the morphology of the *Centrosema* population of Chan Yokdzonot and other localities in the Mexican Yucatan peninsula with the other species of the genus, but especially with *C. sagittatum*. 2) If warranted, to propose a new species of *Centrosema* including a detailed description, discussion of similarities, and relevant iconography. 3) To provide good photographic material of the species of *Centrosema* from the Mexican Yucatan Peninsula. 4) To provide a key for the identification of the *Centrosema* species of the area.

Materials and methods

Field and herbarium work. The study was conducted at Herbarium CICY of the Centro de Investigación Científica de Yucatán, A.C. (CICY), Yucatán, Mexico. Plants and other materials were obtained under scientific permits (SGPA/DGVS/01280/21 and SGPA/DGGFS/712/2913/17) issued by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) to researchers at CICY. Photographs were produced by GC with the use of a Nikon 3300 camera.

We examined approximately 50 herbarium specimens from the Yucatan Peninsula deposited in the *Centrosema* collection at herbaria CICY, UADY, and UCAM (acronyms follow Thiers 2020). All type specimens, as well as general collections, hosted by virtual herbaria, were consulted, including those maintained by JSTOR Global Plants (plants.jstor.org), Reflora Virtual Herbarium (reflora.jbrj.gov.br), speciesLink (specieslink.net), and Universidad Nacional Autónoma de México (MEXU; datosabiertos.unam.mx/biodiversidad).

General taxonomic literature on *Centrosema* was consulted; in particular, Fantz (1996, 2001, 2004), Duno de Stefano *et al.* (2008). Also, Neotropical bibliographic sources were analyzed: Barbosa-Ferevereiro (1977), Fantz (1999, 2001), Barreto *et al.* (2020). Additionally, the International Plant Names Index (www.ipni.org), and Tropicos (tropicos.org) were consulted to update the current nomenclature and geographical information, as well as evaluate and use photographic and morphological (particularly color description) information therein. Finally, the general color of the flower and of the nectar guides was assessed with the color chart of Exotica (Graf 1966).

A geographic distribution map was created using the software QGIS v.3.26.2 (QGIS Development Team 2023 www.qgis.org) with base map tiles by Stamen Design (maps.stamen.com). Whenever necessary, geographic coordinates were estimated from label data on herbarium specimens using Google Earth Pro 7.3.2.5776. The occurrence data used in the map were obtained from GBIF (www.gbif.org).

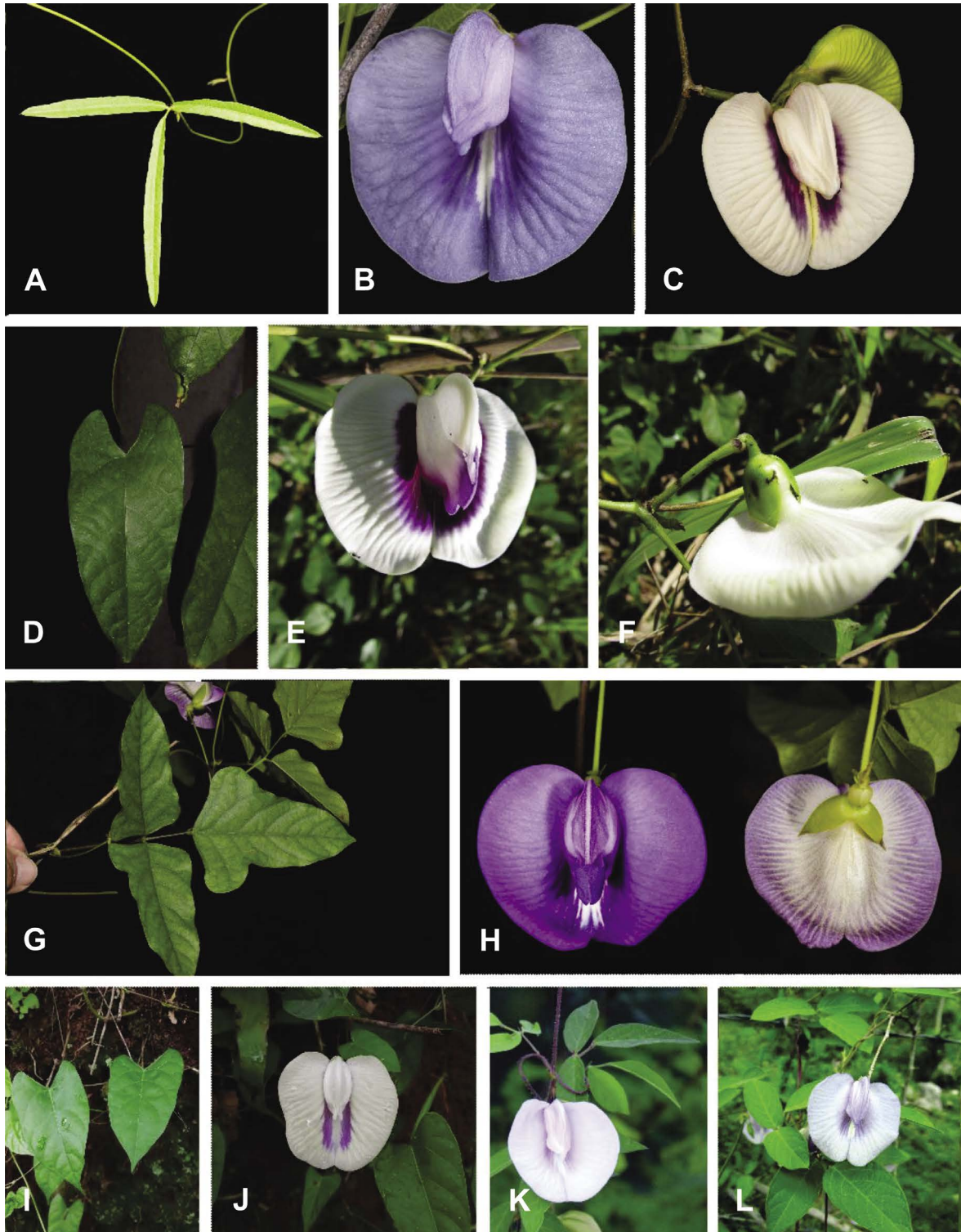


Figure 1. Morphology of some *Centrosema* species from the Yucatan Peninsula (including *C. sagittatum* for comparison). A-B. *C. angustifolium*, A. leaves B. flower, front view. C. *C. macrocarpum*, flowers, front view, D. *C. flavescens*, leaves. E-F. *C. plumieri*, E. flower front view. F. flower back view. G-H. *C. schottii*, G. leaves and flowers, H. flower front view and back view showing two bracteoles. I-J. *C. sagittatum*, I. leaves. J. flower, front view. K-L. *C. virginianum*, leaves and flower. Photos: A-B, H. Gustavo A. Romero-González. C-D, G, Germán Carnevali. E-F, K-L. Alfredo Dorantes Euán. I-J. Edgar Ramón Gómez Vega.

Morphological analysis. Descriptions were compiled mainly from living specimens supported by herbarium vouchers. The type specimen of the new species was cultivated successfully at a private collection. Some additional flowers from herbarium material were rehydrated by boiling and then soaking them in a soapy solution. All material was examined under a dissecting microscope. Pretreated flowers were temporarily pickled for further study and eventually returned to herbarium sheets.

Conservation assessment. The conservation status of the new species was assessed using the IUCN Red List Criteria (IUCN 2012, 2020). We relied on criterion B, geographical distribution assessed both as B1 (extent of occurrence) or B2 (area of occupancy), as implemented in GeoCAT (Bachman *et al.* 2011). We complemented these assessments with our own field experience, published data, and iconography, whenever available.

Results

Centrosema includes 35-44 species (Barreto *et al.* 2020, POWO 2023 www.plantsoftheworldonline.org). The genus includes about 35 species with trifoliolate leaves (*e.g.*, *Centrosema acutifolium* Benth., *C. pascuorum* Mart. ex Benth., *C. pubescens* Benth., and *C. virginianum* (L.) Benth.), two species with 3-palmate leaves (*C. bracteosum* Benth., and *C. venosum* Mart. ex Benth.), one species with 5-7-foliolate leaves (*C. heptaphyllum* Moric.), and lastly, five species with unifoliolate leaves (*C. carajasense* Cavalc., *C. fasciculatum* Benth., *C. sagittatum*, *C. tapirapoa-nense* Hoehne, and *C. unifoliatum* (Rose) Lundell). In all cases, the unifoliolate condition is achieved by reduction of the lateral folioles of a normally trifoliolate leaf. *Centrosema unifoliatum* is the most distinct among the unifoliolate species: a plant with a terete petiole and very narrowly oblong to linear leaflets. Both *C. carajasense* and *C. fasciculatum* have winged petioles, and, despite the base of the leaflet being cordate, the leaflet overall outline is never sagittate. Only *C. sagittatum* has both winged petioles and sagittate leaves and it is thus easy to associate the Yucatan plants with *C. sagittatum* (Figures 1 I-J).

Here we are basing our species conceptualization on the Unified Species Concept (de Queiroz 2007). Thus, any new taxon is a hypothesis of relationships between taxa at a lower rank. Species are seen as groups of individuals or populations that are hypothesized to be more closely related to each other than to other individuals or populations that we would refer to different species. The proposed relationship is supported by evidence provided from phylogenetic, ecological, biogeographic, and morphological data and characters, which identify the proposed taxon as distinct from closely related taxa and evidence its status as a lineage (or lineages) with an independent evolutionary history, adapted to a particular niche in its own geographical and ecological context.

In the case of the taxon herein proposed, it shares the unifoliolate, sagittate leaf with the winged petiole with the phenetically similar *Centrosema sagittatum*. However, it has pale cream-yellow flowers that are monochromatic, *e.g.*, they lack the usual-colored nectar guides (lavender) that characterize *C. sagittatum*. There is also geographical coherence in the distribution of this color morphotype and is apparently restricted to the Yucatan Peninsula Biotic Province as defined by Carnevali *et al.* (2010) and it is disjunct from *C. sagittatum*. Furthermore, there are additional morphological differences, described below, that support the recognition of this entity as a new taxon.

Centrosema flavescens Carnevali, Duno & Angulo, sp. nov (Figures 1D, 2, 3). *Type:* México, Yucatán, Municipio Valladolid, 680-700 m al E del poblado de Chan Yokdzonot 2, unos 1,380-1,400 m al este del desvío Valladolid-Chan Yokdzonot, unos 3.7-4 km al norte en línea recta de Valladolid, 20° 44' 15.34" N, 88° 11' 23.46" W, 25 m; "... trepadora con hojas unifolioladas y peciolo alado. Frutos delgados, color café-rojizo; las flores enteramente blanco-amarrillento", 9 junio 2022, G. Carnevali, R. Duno & M.A. Caamal-Dzul 9395 (holotype: CICY; isotypes: MEXU, MO).

Diagnosis. A species of *Centrosema* similar to *C. sagittatum* but with entirely pale cream-yellow flowers lacking nectar guides or any other colored pattern on the banner, with smaller, ovate (*vs.* elliptic-oblong) bracteoles associated with each flower. Furthermore, the overall size of the flower is smaller (25-26 *vs.* 22-46 mm) where the

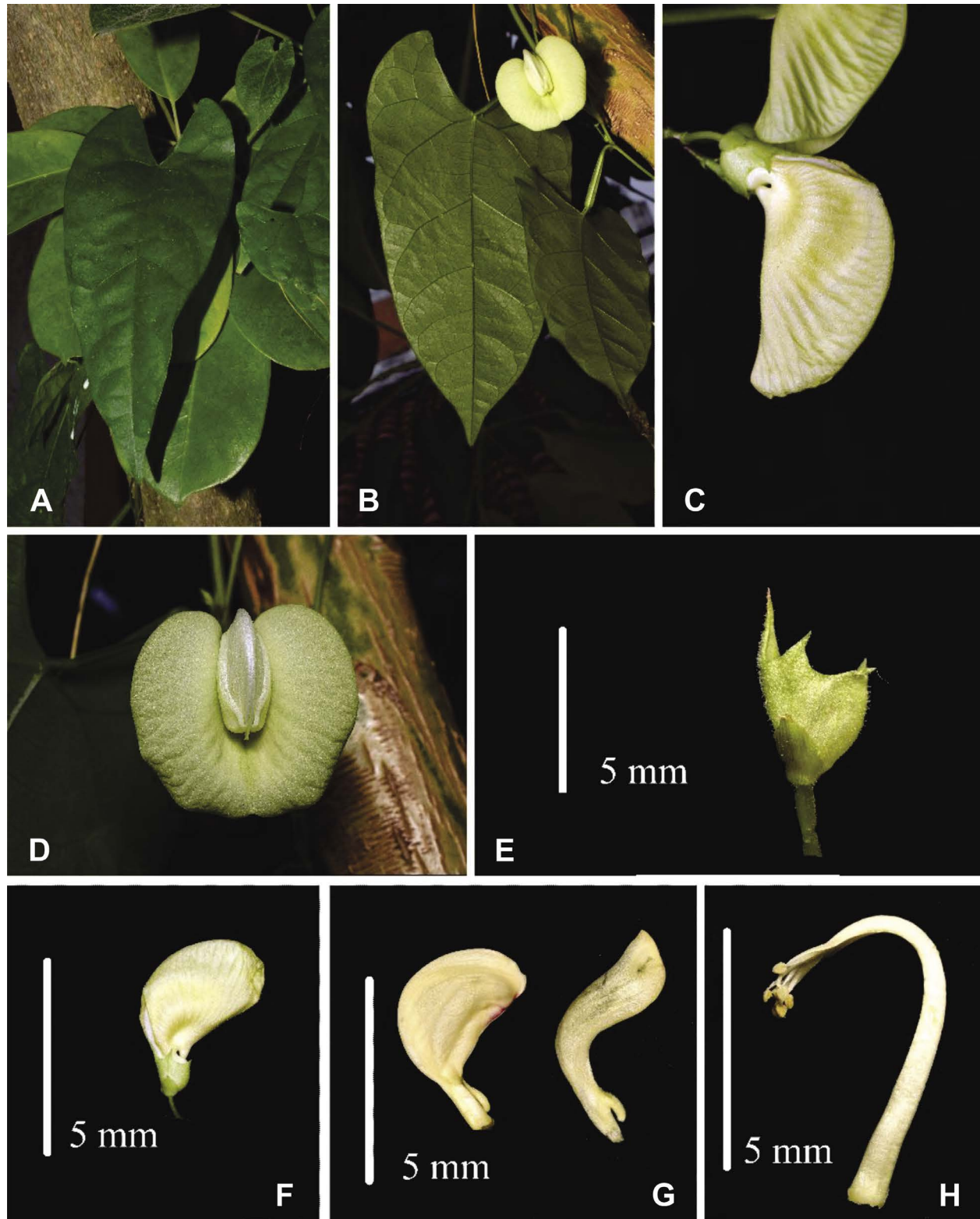


Figure 2. Morphology of *Centrosema flavescens*. A. leaves. B. leaves and flower. C. flower, lateral view, showing the close banner. D. flowers, front view. E. calyx and bracteole. F- G. keel and wing, lateral view. H. stamens. (Photos: A-H. Germán Carnevali).

banner is reduced in size (24-26 vs. 21-58 mm long) and the calyx and its tube are proportionally longer than in *C. sagittatum*.

Description. **Vine**, perennial, to 10 m long. **Stem** terete, green becoming brown, lenticels present, glabrous. **Leaves** (6-)8.0-18 × (2.5-)4.0-8.8 cm, consisting in a sagittate single foliole of an ontogenetically 3-foliolate leaf (by abortion of lateral folioles), underside pale green, upperside darker, petiole 1.5-40 mm long, winged, thickening toward the apex, 1.5-4.0 mm wide; stipules setiform, triangular, persistent, 3.0-3.2 mm long, 0.5-0.6 mm broad, 5-6-veined, apex acute, base without basal appendages; stipels at the apex of petiole 0.01-0.02 mm long; apex acute, basal, retrorse lobules 2.3-4.5 cm long, the internal margin, 2.4-3.8 cm at its widest, sinus slightly curved, 2.2-6 cm across the spread apices of the lobes, rounded, penninerved, bearing 4-6 secondary veins, abaxial surface glabrous, adaxial surface glabrous with a few diminute hairs along the main vein; apex narrowly acute. **Inflorescences** pseudoracemes, each raceme 1-2(-3)-flowered, sometimes with one abortive flower; peduncle quadrangular, pubescent, 15-35 mm long, dull brown, one pair of bracts at the apex of the peduncle, diminute, pedicel 6-7 mm long, pale green, each flower subtended by two bracteoles 3.5-6.0 × 2.2-3 mm, ovate, acute, base slightly cordate, multinervate, abaxial and adaxial surface glabrous. **Flowers** resupinate, showy, pale cream-yellow without colored nectar guides on the banner, 2.5–2.6 cm long; calyx of 5 sepals, 15-16 × 6-11 mm, tube 9-10 mm long, 9-10 mm wide, minutely indumented, lobes unequal, triangular, upper (carinal) lobe 3-5.5 × 2-3.0 mm, two laterals 2.5 × 1.5 mm, lower (vexillary) lobes 1 mm long; corolla consisting of a banner 24-26 × 22-27 mm, orbicular, minutely indumented along margins and on the adaxial face, base 5 mm long, the dorsal spur 1 mm long; the wings 20 × 5-8 mm, sigmoid, base 2-4 mm long, spur 3 mm long, the remainder distal portion 15 mm long, abaxial face minutely

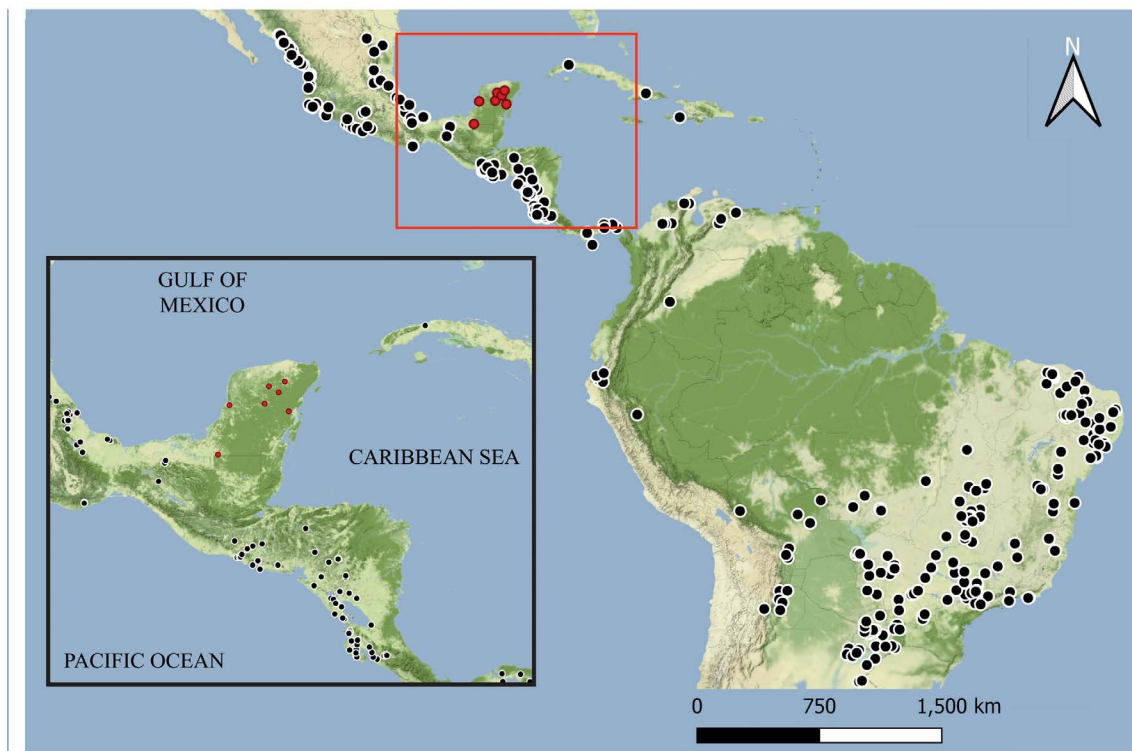


Figure 3. Distribution of *Centrosema flavescens* (red circles) in the Yucatan Peninsula, and *C. sagittatum* (black circles) in tropical America. Map created using the Free and Open Source QGIS (www.qgis.org). The occurrences of *Centrosema sagittatum* from the Global Biodiversity Information Facility (GBIF, www.gbif.org).

indumented, adaxial surface glabrous; keel 16×18 mm, the base 4 mm long, the rudimentary claw 1 mm long, the abaxial margins 12 mm long, both faces glabrous; androecium with 10 stamens, the central one running along the banner, filaments incurved plus anthers 24-28 mm long, irregularly U-shaped, proximally fused for 20 mm, free portion 3-4 mm long, anthers ca. 1 mm long to oblong, oblong-elliptic, basifixed; nectary disc cylindrical, not lobed. Gynoecium 27-30 mm long, ovary 10×1 mm, cylindrical, glabrous, 20 mm long, stigma capitate. **Legume** elastically dehiscent, generally one per inflorescence, linear, straight or falcate, plano-compressed, 12×0.6 cm, pedicel 1.0 cm long, apex rostrate, rostrum little to well developed, up to 1.5 cm long, margins thickened; valves leathery, puberulent to glabrous. **Seeds** 8-10 per pod, not compressed, oblong-ellipsoid; brown, most often with patches of a lighter color dark; hilum short, oblong to circular.

Distribution and ecology. Campeche, Quintana Roo, and Yucatan (Mexico). Endemic to Mexico where it seems to be restricted to the Yucatan Peninsula (Figure 3). It grows in lowland (10-100 m asl), seasonally dry forests. All specimens of *Centrosema flavescens* seen by the authors grow in the margins of partially undisturbed forests and the flowers are always presented low on the plants, under shady conditions. The totally pale cream-yellow flowers are presumably an adaptation to the reflection of the low levels of sunlight that reach the understory of the forests. At this time, it is unknown whether the flowers of this species feature ultraviolet nectar guides, in lieu of colored ones. In the Yucatan Peninsula all the other species of *Centrosema* grow primarily in secondary vegetation associate to seasonally dry forests, most commonly directly exposed to sunlight.

A botanical sample from the Municipality of Teapa in the state of Tabasco (*H. M. Medina 16*, MEXU) has a unifoliate leaves with a sagittate blade, and winged petioles. This plant resembles *Centrosema flavescens* and *C. sagittatum*, but this particular specimen was collected in sterile condition and it is impossible at this time to ascertain whether it represents either species. Also, this plant grows in more humid, riparian forests.

In Mexico, *Centrosema sagittatum*, the putative sister species, grows in Chiapas, Guerrero, Hidalgo, Jalisco, Michoacán, Nayarit, Nuevo León, Oaxaca, Puebla, Sinaloa, Tabasco, Tamaulipas y Veracruz (partially Figure 3). Elsewhere, it grows in Central America (Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama), South America (Colombia, Venezuela, Brazil, Bolivia, Paraguay, Argentina), and the Antilles. In the Yucatan Peninsula there are nine species of *Centrosema* (see key, Figure 1).

Conservation Status. The GeoCAT tool (Bachman *et al.* 2011) estimated the Extent of Occurrence (EOO) of *Centrosema flavescens* as 43,848.885 km², and its Area of Occupancy (AOO) as 28 km², based on cells of 2×2 km. Following the IUCN (2012) criteria, the EOO and AOO results place *C. flavescens* in the Near Threatened (NT) and Endangered (EN) categories, respectively. Because the species is rare, its AOO is small, the species only occurs naturally in nearly undisturbed vegetation, and most of its known populations occur in areas where the original vegetation is currently being transformed or is likely to be substituted by anthropogenic ecosystems during the next few years or decades, we propose the species to be treated as Endangered (EN).

Phenology. *Centrosema flavescens* flowers June to February, and sets fruits in April to June. On the other hand, throughout its distribution *C. sagittatum* has been recorded in flower and/or fruit all the year excepting August and September whereas Mexican populations of the species have been collected in anthesis October through January.

Etymology. The specific epithet “*flavescens*” refers to the color of the flower, a pale cream yellow.

Common name. Buy-ak’ (maya) (*A. Ankli 128*).

Additional specimens examined. **MEXICO. Campeche.** Municipio Campeche, 15 km E of Campeche, 19° 48’ 30” N, 90° 22’ 10” W, 4 March 1980, *C. D. Johnson 1660-80* (CICY); Municipio Candelaria, 3.5 km al sureste de Miguel Hidalgo, 17° 51’ 38” N, 90° 49’ 31” W, 30 October 2002, *C. Gutiérrez Báez 7572* (CICY, MEXU, UCAM).

Quintana Roo. Municipio Felipe Carrillo Puerto, Xeret, km 30 carretera Chetumal, 19° 34' N, 88° 02' W, 05 May 1986, *J. S. Flores 10862* (UADY). **Yucatán.** Municipio de Tixcacalcupul, Ekpedz, 20° 18' 55" N, 88° 25' 46" W, 28 January 1995, *A. Ankli 128* (CICY, MEXU); Municipio Peto, Utziná, 19° 52' 03" N, 88° 59' W, 19 November 1992, *G. Campos 2988* (CICY); Municipio de Yaxcabá, Yaxcabá, 20° 33' N, 88° 49' W, 30 April 1986, *D. Zizumbo & P. Sima 278* (CICY).

Discussion

Originally this population was considered an albino form of *Centrosema sagittatum*. Later we realized that this character state is recurrent in all specimens and populations of *Centrosema* with unifoliolate, sagittate leaves and winged petioles (features of *C. sagittatum*) growing in the Yucatan Peninsula, and that there were at least six other localities in the states of Campeche, Quintana Roo, and Yucatan. In general, the flowers of *Centrosema* species show a color pattern where there is a difference, often dramatic, between the overall flower color and the nectar guides (or macula) of the banner. As a rule, species with lavender, lilac, or mauve flower color (colors 43, 44, 46, Graf 1966) have white nectar guides, whereas predominantly white or pale yellowish flowers display cherry, blood red or cardinal red (colors 26, 27, and 28, Graf 1966) nectar guides. *Centrosema flavescens* is the only known species with an entirely pale cream-yellow flower in Mexico (color 1, Graf 1966) lacking nectar guides reflecting in the visible spectrum. Furthermore, in this new species the pair of bracteoles associated with each flower are smaller and ovate (*vs.* elliptic-oblong), the general size of the flower is smaller (25-26 *vs.* 22-46 mm long) and the same is true of the banner (24-26 *vs.* 21-58 mm long). Also, the calyx and its tube are longer in *C. flavescens* as compared with *C. sagittatum* (Table 1).

It would be always possible to consider this taxon as a subspecies of *Centrosema sagittatum*, differing in coloration of the flower, some morphological differences and the geographical isolation but we believe these Yucatan Peninsula populations are quite distinctive from *C. sagittatum* and other unifoliolate species from South America.

Table 1. Distinguishing characters of *Centrosema flavescens* and *C. sagittatum*.

	<i>C. flavescens</i>	<i>C. sagittatum</i> ⁽¹⁾	<i>C. sagittatum</i> ⁽²⁾
Bracteole (mm)	3.5-6.0 × 2.2-3	4.5-10 × 2-5	7-9 × 5-7
Bracteole, shape	Ovate	Elliptic-oblongate	-
Flower length (cm)	2.5-2.6	2.2-4.8	2.5-4
Calyx size (mm)	15-16 × 6-11	7-13.5	-
Tube calyx length (mm)	9-10	5-7	5-6
Calyx lobes, length (mm)	3-5.5	3-7	4-6
Calyx lobes, wide (mm)	2-3.0	-	-
Banner, color	Pale cream-yellow without nectar guides	White with purple nectar guides	White with purple nectar guides
Banner, length (mm)	24-26	21-58	-
Banner, wide (mm)	22-27	17-32	-
Wings, length (mm)	20	20-24	-
Wings, wide (mm)	5-8	-	-

Character states from Barreto *et al.* 2020 ⁽¹⁾ and Fantz 1993 ⁽²⁾

**Key to the species of *Centrosema* in the Yucatan Peninsula
(*C. sagittatum* included for comparison)**

1. Leaves 1-foliolate, rarely 3-foliolate but only in the base of the plant2
1. Leaves always 3-foliolate3
2. Petioles lacking wings; leaflets linear to narrowly oblong; flowers purple or lavender *Centrosema unifoliatum*
2. Petioles winged; leaflets sagittate; flowers entirely pale cream-yellow, white with purple center or completely white3
3. Bracteole 3.5-6.0 × 2.2-3 mm, ovate; calyx 15-16 × 6-11 mm; tube 9-10 mm long; banner 24-26 × 20-27 mm, pale cream-yellow, lacking nectar guides..... *Centrosema flavescens*
3. Bracteole 4.5-10 × 2-5, elliptic-oblongate; calyx 7-13.5 mm long, tube 5-7 mm long; banner 21-58 × 17-32 mm, white or yellowish with purple nectar guides.....*Centrosema sagittatum*
4. Ventral calyx lobes subequal to the other four teeth or inconspicuous.....5
4. Ventral calyx lobes longer than the other four teeth6
5. Leaflets linear; flowers purplish to violet with white center, 1-1.5 cm long; fruits 5.5-7 × 3-4 mm.....
.....*Centrosema pascuorum*
5. Leaflets elliptic-ovate, narrowly oblong, or rarely linear; flowers lavender with white center, 2.5-3.5(4) cm long; fruits 8-13 × 3-5 mm.....*Centrosema virginianum*
6. Petiolules nearly absent, to 3 mm long; leaflets typically linear to narrowly oblong, no more than 0.5 cm wide.....
.....*Centrosema angustifolium*
6. Petiolules conspicuously longer than 3 mm long; leaflets more than 1.5 cm wide, ovate, ovate-rhombic, elliptic, sometimes pandurate7
7. Leaflets rhombic-ovate, basally asymmetric; ventral calyx lobes 1-2 mm long8
7. Leaflets elliptic to ovate or elliptic-lanceolate, basally symmetric; ventral calyx tooth more than 2.5 mm long...9
8. Petiolules 5-6 mm long; leaflets ovate to rhombic-ovate, often blackish when dried; flowers white with purple banner center, 3.5-5 cm long; fruits 8-12 mm wide.....*Centrosema plumieri*
8. Petiolules 3-4 mm long; leaflets generally pandurate, leaves not blackish when dried; flowers violet to purplish-red with white nectar guides, 2.5-3 cm long; fruits 9-16.5 mm wide*Centrosema schottii*
9. Bracteoles 10-15 mm long; flowers white fading dull yellowish, maroon medially and along veins, 3-3.5 cm long; fruits 10-19 cm long, rostrum 12-18 mm long.....*Centrosema macrocarpum*
9. Bracteoles 6-11 mm long; flowers pale purple with pale-yellow to white nectar guides, 2-3 cm long; fruits (6.5-)10-14 cm long, rostrum 5-12 mm long*Centrosema molle*

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