



## *Erythrostemon sousanus* (Leguminosae: Caesalpinioideae), a new species from the Río Papagayo Basin in Guerrero, México

JOSÉ LUIS CONTRERAS-JIMÉNEZ<sup>1\*</sup>, SOLANGE SOTUYO<sup>\*2</sup>, LAURA CALVILLO-CANADELL<sup>2</sup> & GWILYM P. LEWIS<sup>3</sup>

<sup>1</sup> Facultad de Arquitectura, Benemérita Universidad Autónoma de Puebla, 4 Sur 104, Col. Centro, , Blvb. Valsequillo s/n Ciudad Universitaria C.P. 72590, Puebla, Puebla.

<sup>3</sup> Comparative Plant and Fungal Biology Department, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, U.K.

<sup>2</sup> Departamento de Botánica, Instituto de Biología, Universidad Nacional Autónoma de México, Circuito Exterior s/n, Ciudad Universitaria, Copilco, Coyoacán, A.P. 70-367 México, Ciudad de México, C.P. 04510.

\* corresponding author: [jssotuyo@ib.unam.mx](mailto:jssotuyo@ib.unam.mx)

### Abstract

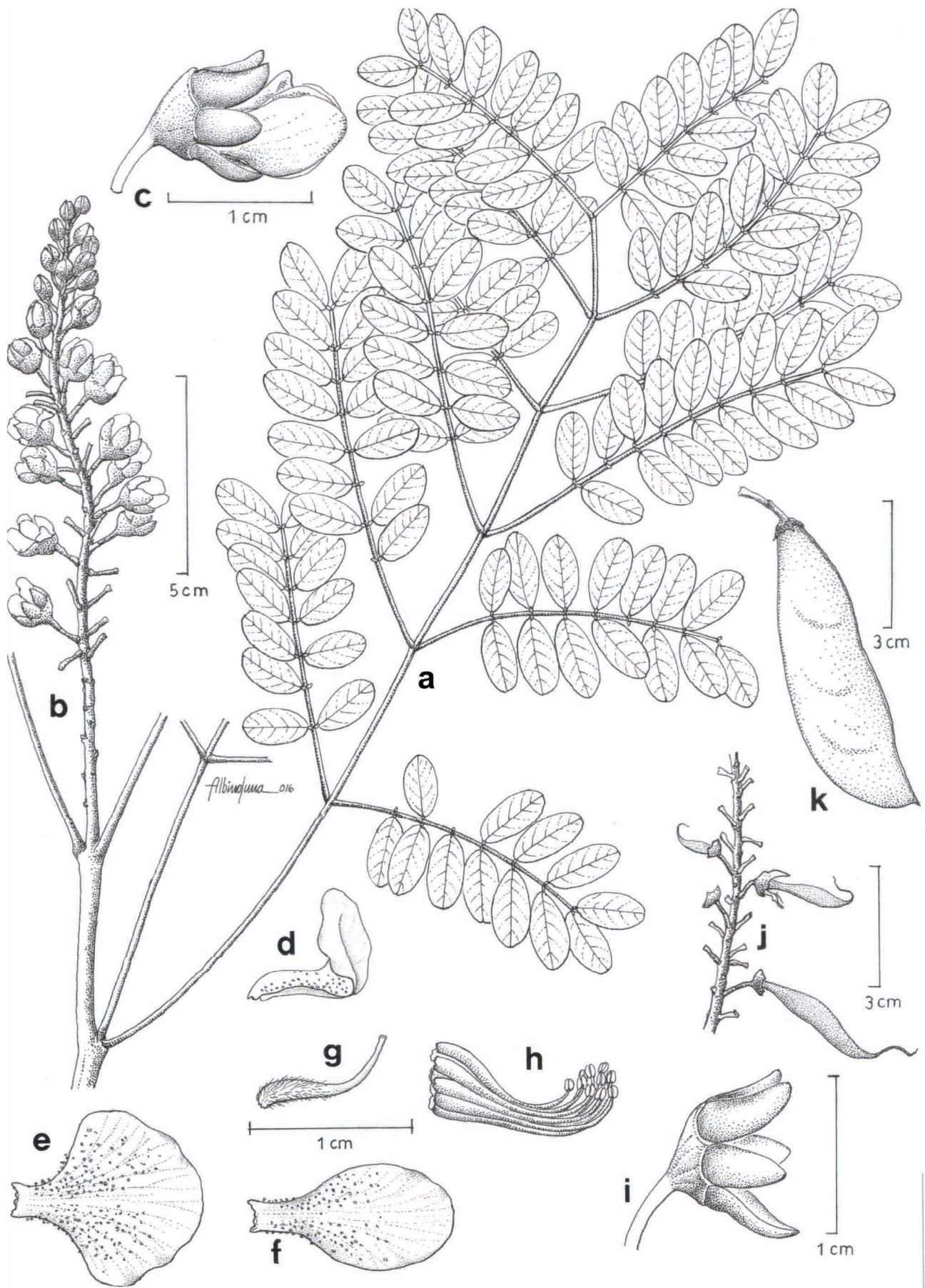
A new legume species, *Erythrostemon sousanus*, from seasonally dry forest of the Río Papagayo Basin in Guerrero, Mexico is described and illustrated. The new species is morphologically similar to *E. mexicanus*, from which it is distinguished by its glabrous leaves with a greater number of pairs of pinnae (6–11 vs 5–7) and each pinna with more pairs of leaflets (5–7 vs 2–4); by flowers, inflorescences and fruits densely pubescent; and by larger flowers (13–17 vs 12 mm long), fruits (8 × 2 vs 4 × 1.5 cm) and seeds (12 × 9 × 2 vs 9–10 × 7.5 × 1.5 mm).

**Key words:** *Caesalpinia*, *Erythrostemon*, Río Papagayo Basin

### Introduction

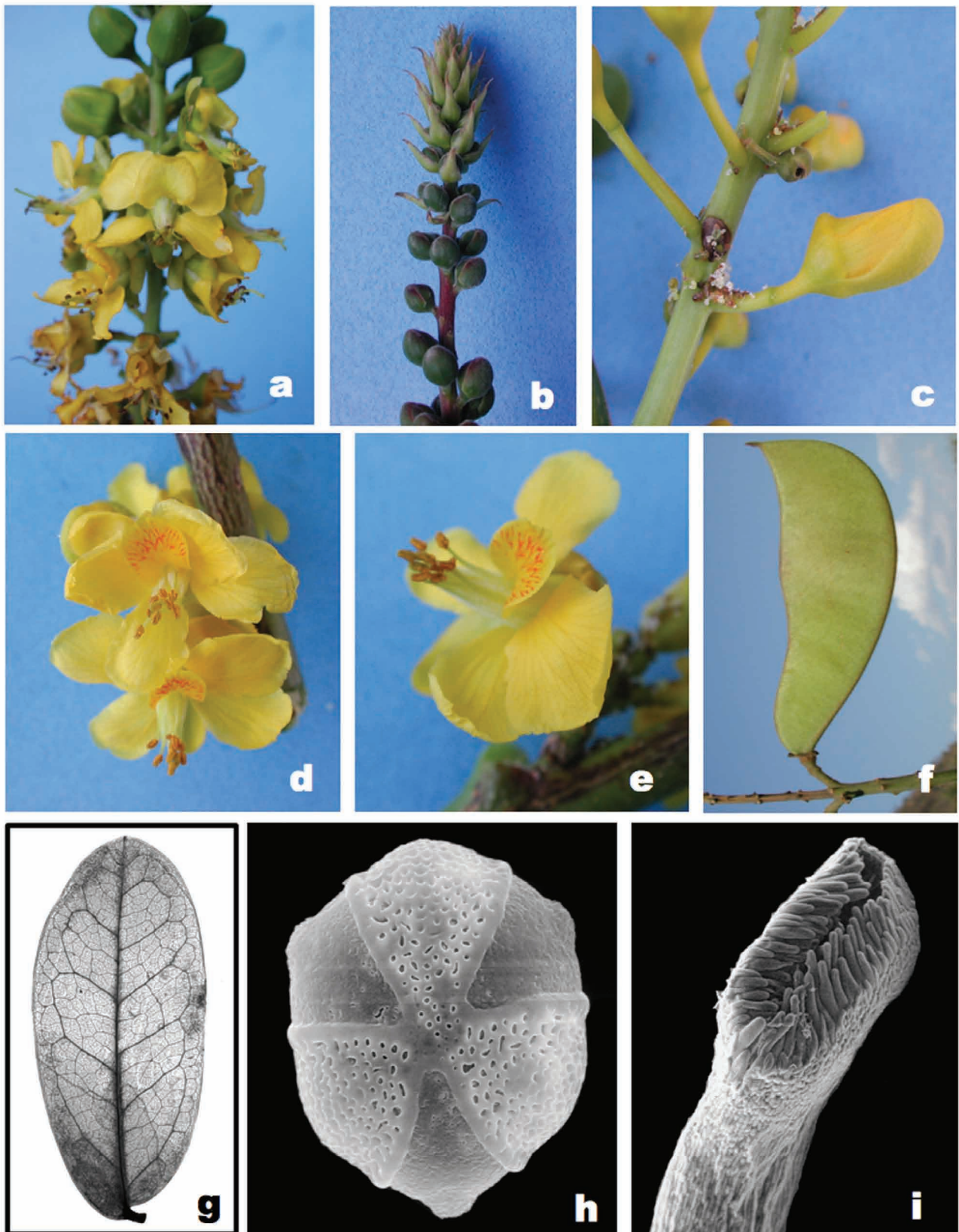
The genus *Erythrostemon* was re-circumscribed by Gagnon *et al.* (2016) and now comprises a total of 31 species of neotropical shrubs and trees, mostly in seasonally dry tropical forests. The genus has a bicentric amphitropical distribution in México (21 spp.), Central America, and the Caribbean; in Caatinga vegetation in Brazil, and in patches of dry forest, deserts, yungas-puna transition zones, and chaco-transition forests in Argentina, Bolivia, Chile and Paraguay (Lewis 1998; Gagnon *et al.* 2013; Gagnon *et al.* 2016).

In México, the state of Guerrero is especially rich in biodiversity, in large part due to its complex geological heterogeneity (Challenger, 1998). Twenty six percent of all Mexican Magnoliophyta species occur in Guerrero (Toledo 1988; Rzedowski 1991; Valencia-Ávalos *et al.* 2011; Villaseñor 2016). The region contains many endemics and several unique legume taxa. During a herbarium-based revision of *Caesalpinia* sensu lato for Guerrero, specimens from a little-explored area of the state, originally identified as *Poincianella mexicana* (= *Erythrostemon mexicanus*), but morphologically distinct from that species, were discovered. *Erythrostemon mexicanus* is distributed from Southern Texas, through central and eastern México (Nuevo León, Tamaulipas, San Luis Potosí, Querétaro, Hidalgo and Veracruz). The species is not known in Guerrero. Further analysis of the putative new species indicated that this group of specimens did not fit the description of any described *Erythrostemon* species although the overall morphology of the new taxon confirmed a morphological similarity with *E. mexicanus*. A comparison of the details of the leaflet venation of *E. mexicanus* and the newly discovered taxon clearly supports recognition of a new species which is described below.



**FIGURE 1.** *Erythrostemon sousanus*. **a** bipinnate leaf; **b** inflorescence; **c** flower lateral view; **d** median (standard) petal; **e** upper lateral petal; **f** lower lateral petal; **g** gynoecium; **h** stamens; **i** calyx; **j** developing infructescence; **k** fruit. Drawn from Contreras-Jiménez 7198 (a–j) and 7197 (k) (MEXU) by Albino Luna.





**FIGURE 2.** Different features of *Erythrostemon sousanus*. **a** part of inflorescence with buds and open flowers; **b** bracts at inflorescence apex; **c** flower bud showing the cymbiform, serrulate lower sepal and the articulated pedicel; **d** flowers front view; **e** flower lateral view; **f** fruit; **g** cleared leaflet with brochidodromous secondary veins; **h** pollen grain in polar view; **i** stigma. Photos **a–f** taken by J.L. Contreras-Jiménez.

## Methods

Mature leaflets of the new species were sampled from the National Herbarium of México (MEXU). A number of leaflets were cleared following the technique of Payne (1969), although the mounting medium was changed to a polyester resin. Depending on the leaflet characteristics (e.g. cuticle thickness and chemical content) the length of time that the leaflets were kept in *NaOH*, hypochlorite, and ethanol solutions varied. The venation structure was described from cleared specimens together with additional observations of un-cleared herbarium specimens.

Closed buds of the new species were dissected and prepared for scanning electron microscopy (SEM). Samples were dehydrated in an EtOH series. Pollen grains were prepared for SEM by the standard method described by Erdtman (1952). All samples were dry mounted on metal stubs using double-sided tape and then coated with gold. Images were taken on a JEOL JSM35 microscope at the Instituto de Ciencias del Mar y Limnología.

### *Erythrostemon sousanus* J.L. Contreras, S. Sotuyo & G.P. Lewis, sp. nov. (Figures 1 and 2)

**Type:**—MÉXICO. Guerrero: 2 km east of Petaquillas, J.L. Contreras 2810 (holotype FCME).

**Diagnosis:**—*Erythrostemon sousanus* is morphologically similar to *Erythrostemon mexicanus* (A. Gray) E. Gagnon & G.P. Lewis, but has densely pubescent fruits and inflorescences, the petals have confluent disciform glands towards the claw which cover the whole abaxial surface of the petal blade. *Erythrostemon sousanus* leaves have more pairs of pinnae and the pinnae have more pairs of leaflets, and the flowers, fruits and seeds are larger than in *E. mexicanus*. Table 1.

**TABLE 1.** Comparison of the diagnostic characters of *Erythrostemon mexicanus* and *E. sousanus*. All measurements in mm except for legume length in cm. Based on Herbarium material.

Characters	<i>E. mexicanus</i>	<i>E. sousanus</i>
Number of pinnae pairs per leaf	5–7	6–11
Number of leaflet pairs per pinna	2–4	5–7
Bract length	2.5	9–12.5
Calyx tube length	5.5–7	8.3–8.5
Sepal length	5–8	8.5–12.5
Flower length	12	13–17
Inflorescence indumentum	flower pedicels only pubescent at point of articulation, sometimes glabrous	pubescent
Flower indumentum	calyx pubescent on inner surface, petals glabrous; dorsal surface stipitate-glandular on the basal half and on the claw margin	pubescent, petals with confluent disciform glands towards the claw on the abaxial surface
Legume length	4–5 × 1.5	8–8.3 × 2–2.2
Legume indumentum	glabrous to moderately pubescent on suture	densely pubescent

*Erythrostemon sousanus* similis *E. mexicano* fructu pubescenti et inflorescentia penitus floribus inclusis; petalis unguem versus cum glandulis confluentibus disciformibus totam superficiem abaxialem tegentibus; foliis cum pluribus pinnis et foliolis binatim, fructibus et seminibus maioribus quam in *E. mexicano*; sicut in *E. mexicano* pubescentia solum ad articulum florescentiae vel glabra; calyce in superficie interiore pubescenti, petalis glabris, quamquam superficies dorsalis glandulas stipitatas in dimidio basali et secus marginem unguis praebet; fructibus circa suturam glabris vel modice pubescentibus. (Table 1).

Shrubs 1–3 m tall; bark green with abundant lenticels. Leaves bipinnate, 15.5–28.5 cm long, glabrous; stipules caducous (not seen); petioles 5.5–10.5 cm long; rachis 7.5–21 cm long; pinnae in (6–) 9–11 (–13) pairs per leaf, each pinna (2.3–) 4–9.5 (–11) cm long; leaflets in (4–) 5–7 (–8) pairs per pinna, elliptic, oblong–elliptic, ovate to obovate (1.4–) 2–3 × (0.4–) 0.9–1.5 (–1.8) cm, apex obtuse, rounded or retuse, margin entire, revolute, with punctate glands, base oblique, glabrous, secondary veins brochidodromous with fifth-order veins polygonal-reticulate. Inflorescence axillary, racemose, 25–45 cm long, peduncle thick (0.1–0.2 mm), striate, densely dark pubescent; bracts ovate, long acuminate, 9–12 × 2.5 mm, scarious, yellow-orange, pubescent on both surfaces; pedicels 6–11.5 mm long, articulated near the calyx base, dark pubescent; calyx green, its tube obliquely obconic, 8.3–8.5 × 3.5 mm, striate, pubescent, adaxial sepals oblong–ovate, 8.5–9.5 × 5.5–7 mm, apex obtuse to rounded, the margin serrulate, ciliate, lateral sepals oblong–ovate, 9–9.5 × 5.3–6 mm, apex obtuse, margin serrulate, ciliate, abaxial sepal ovate, cymbiform, 10.5–12.5 × 7.5–8.5 mm, apex rounded, margin erose, ciliate, all sepals pubescent on both surfaces; petals yellow, median petal

narrowly-ovate, 8.5–9.5 × 8.5–11 mm, apex rounded, base subcordate, petal lamina forming an angle of 90–105° with the claw, with red punctations, abaxial surface densely covered by green discoid glands, claw 5.5–7.5 mm long, incurved, glabrous on its adaxial surface, densely villose on its lower margin, glandular-stipitate on the abaxial surface with a pubescent fleshy membrane over the claw articulation, upper lateral petals ovate, 9–12.5 × 10.8–13.5 mm, apex rounded, base subcordate, abaxial surface covered by disciform green glands, these confluent around the 3–4 mm claw, pubescent on the adaxial surface, glandular-stipitate on the abaxial surface, lower lateral petals ovate, 9.5–12.5 × 8.2–10.5 mm, apex and base rounded, abaxial surface with green disciform glands, claw 3.5–4.5 mm long, puberulent on the adaxial surface, the margin glandular-stipitate on the abaxial surface; stamen filaments green, curved, 10–15.5 mm long, villose for  $\frac{2}{3}$  to  $\frac{4}{5}$  their length; anthers oblong-ovate, 1.4–2 × 0.8–1.2 mm, dark greenish; pollen grains spheroidal, prolate, tricolporate, syncolporate, semitectate, reticulate, pores lolongate; ovary sessile, curved, 6–6.5 mm long, style curved, 9–12 mm long, villose from base to half its length; ovules 3–4 per ovary; stigma terminal, obliquely cupuliform, ciliate. Fruit falcate, laterally compressed, 8–8.3 × 2–2.2 cm, valves yellow, subligneous, densely pubescent, elastically dehiscent. Seeds 1–3(–4) per fruit, ovate, laterally compressed, 12–13 × 9–10 × 2 mm, shiny, yellowish green.

**Selected specimens examined:**—MÉXICO. Guerrero: Municipio de Chilpancingo, camino a las grutas de Juxtahuaca, 30/05/1976, *A. Delgado 195 et al.* (CHAPA, MEXU); on the road from Chilpancingo to Mochitlán, 4 km from main Chilpancingo-Acapulco road, 09/02/1992, *D.J. MacQueen et al.* 427 (EAP, FHO, K, MEXU); 4 km to the east of Chilpancingo on the road Juxtahuaca-Colotipa, 26/05/2001, *J.L. Contreras et al.* 7197, 7198 (MEXU).

**Habitat:**—Seasonally dry tropical forest on limestone; 1000–1200 m.

**Distribution and phenology:**—Known only from the Río Papagayo basin (late Oligocene-Eocene) around Petaquillas in Guerrero, México. Flowering from December to May and in fruit from January to July.

**Etymology:**—The species is dedicated to Mario Sousa Sánchez who recently passed away (1940–2017). Friend, teacher, pillar of botany in México and researcher at the Universidad Nacional Autónoma de México, he was an expert on the legume genus *Lonchocarpus* and in floristic and vegetation studies of legumes (e.g. Sousa 2012; Sousa *et al.* 2001). Dr. Sousa, a devoted defender of herbaria and plant taxonomy, described up to 100 species new to science (Sousa *et al.* 2014), principally legumes. He was also instrumental in promoting botanical exploration throughout México and Central America as a leader of expeditions and general editor of *Flora Mesoamericana*. He was Head of Mexico's Herbario Nacional from 1975 to 1985 and 1994 to 2003. We are indebted to him for all he taught us and for having ensured the continuing success of Mexico's Herbario Nacional.

**Conservation assessment:**—We propose a conservation assessment of Vulnerable [VU (B1b-iii)] for *Erythrostemon sousanus*, in accordance with IUCN (2001) categories and criteria. The extent of occurrence (EOO) of *E. sousanus* is estimated to be below the 20,000 km<sup>2</sup> upper limit for Vulnerable status under criterion B1, but its area of occupancy (AOO) is estimated to be less than 10 km<sup>2</sup> (the limit for Endangered status under criterion B2). The species is currently known from fragmented vegetation in the state of Guerrero. The preferred habitat of the species is potentially threatened by settlements, forestry and agricultural activities, as well as by environmental problems associated with settler's armed uprisings.

## Acknowledgments

We thank Albino Luna for the botanical illustration, Yolanda Ornelas (ICMyL) and Carmen Loyola for SEM photographs and John Hazel for the Latin diagnosis.

## Literature cited

- Challenger, A. (1998) *Utilización y conservación de los ecosistemas terrestres de México: pasado, presente y futuro*. CONABIO, Instituto de Biología-UNAM, agrupación Sierra Madre. México, D.F., 847 pp.
- Erdtman, G. (1952) *Pollen morphology and plant taxonomy. Angiosperms*. Almqvist and Wiksell, Stockholm, 539 pp.
- Gagnon, E., Bruneau, A., Hughes, C.E., de Queiroz, L.P. & Lewis, G.P. (2016) A new generic system for the pantropical *Caesalpinia* group (Leguminosae). *PhytoKeys* 71: 1–160.  
<https://doi.org/10.3897/phytokeys.71.9203>
- Gagnon, E., Lewis, G.P., Sotuyo, S., Hughes, C.E. & Bruneau, A. (2013) A molecular phylogeny of *Caesalpinia* sensu lato: increased

- sampling reveals new insights and more genera than expected. *South African Journal of Botany* 89: 111–127.  
<https://doi.org/10.1016/j.sajb.2013.07.027>
- IUCN (2001) *IUCN Red List Categories and Criteria, Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom. Available from: <http://www.iucn.org> (accessed 1 June 2017)
- Lewis, G.P. (1998) *Caesalpinia: A Revision of the Poincianella-Erythrostemon Group*. Royal Botanic Gardens, Kew, 233 pp.
- Payne, W.W. (1969) A Quick Method for Clearing Leaves. *Ward's Bulletin* 8 (61): 4–5.
- Rzedowski, J. (1991) Diversidad y orígenes de la flora fanerogámica de México. *Acta Botánica Mexicana* 14: 3–21.  
<https://doi.org/10.21829/abm14.1991.611>
- Sousa, S.M., Ricker, M. & Hernandez, H.M. (2001) Tree species of the family Leguminosae in Mexico. *Harvard Papers in Botany* 6: 339–365.
- Sousa, M. (2012) *Inga* Mill. 31–38. In: Medina-Lemos, R. (Ed.) *Flora del Valle de Tehuacán-Cuicatlán. Vol. 109*. Mimosaceae tribu Ingeae. Instituto de Biología, UNAM. México, D. F., México, 75 pp.
- Sousa, M., Sotuyo, S. & Pedraza-Ortega, E. (2014) Sistemática de *Lonchocarpus* sección *Punctati* (Fabaceae: Millettieae), basada en datos morfológicos y moleculares, con la descripción de nueve especies nuevas. *Acta Botanica Mexicana* 109: 79–131.
- Toledo, V. (1988) La diversidad biológica de México. *Ciencia y Desarrollo* 14: 17–30.
- Valencia-Ávalos, S., Cruz-Durán, R., Martínez-Gordillo, M. & Jiménez-Ramírez, J. (2011) La flora del municipio de Atenango del Río, estado de Guerrero, México. *Polibotánica* 32: 9–39.
- Villaseñor, J.L. (2016) Checklist of the native vascular plants of México. *Revista Mexicana de Biodiversidad* 87 (3): 559–902.  
<https://doi.org/10.1016/j.rmb.2016.06.017>