



Gonolobus cthulhui (Apocynaceae), a new species from Oaxaca, Mexico

Gonolobus cthulhui (Apocynaceae), una nueva especie de Oaxaca, México

Leonardo O. Alvarado-Cárdenas^{1,2}, Karen G. Maya-Mandujano¹, María Guadalupe Chávez-Hernández¹

Abstract:

Background and Aims: In Mexico, the genus *Gonolobus* is currently represented by 43 species. *Gonolobus* has been studied for some regional floras and taxonomic novelties are continuously being described. In this context, during the review of the herbarium material and collections made in the state of Oaxaca, a specimen that failed to be assigned to any described *Gonolobus* in Mexico and Mesoamerica was found. Therefore, the objective of this work was to describe a new species of *Gonolobus* from Oaxaca.

Methods: Eleven herbaria and five virtual collections were revised, and several field trips to Oaxaca were conducted in 2018 to collect specimens. The studied material was compared with other species with similar morphology, a comparative table was prepared, and a distribution map included. The conservation status of the species based on field observations according to the IUCN Red List criteria is presented.

Key results: A new species of *Gonolobus* from southeastern Oaxaca, Mexico, with large green corollas, is described herein. A description and images of the new species are provided. *Gonolobus cthulhui* is morphologically similar to *G. leianthus* and *G. pancololote*, but differs by its black-tipped and widely ovate to suborbicular sepals, pubescent diagonal pattern on the corolla lobes, and thinner and discontinuous faucal annulus. An Endangered (EN) conservation category is suggested for this species.

Conclusions: This discovery highlights Oaxaca as the second state, after Chiapas, with most species of *Gonolobus* (19 spp.), and Mexico as a center of diversity for the genus, with 44 species recorded, of which 52.2% are endemic to the country.

Key words: endemic species, *Gonolobus leianthus*, *Gonolobus pancololote*, Lovecraft.

Resumen:

Antecedentes y Objetivos: En México, el género *Gonolobus* actualmente está representado por 43 especies. *Gonolobus* ha sido estudiado en algunas floras regionales y continuamente se describen novedades taxonómicas. En este contexto, durante la revisión del material de herbario y colectas realizadas en el estado de Oaxaca, se encontró un ejemplar que no pudo ser asignado a ningún *Gonolobus* descrito en México y Mesoamérica. Por ello, el objetivo de este trabajo fue describir una nueva especie de *Gonolobus* de Oaxaca.

Métodos: Se revisaron 11 herbarios y cinco colecciones virtuales, y en 2018 se realizaron varios viajes de campo a Oaxaca para recolectar especímenes. El material estudiado se comparó con otros de morfología similar, se elaboró una tabla comparativa y se incluyó un mapa de distribución. Se presenta el estado de conservación de la especie, según los criterios de la Lista Roja de la UICN y observaciones de campo.

Resultados clave: Se describe una nueva especie de *Gonolobus* del sureste de Oaxaca, México, con grandes corolas verdes. Se proporciona una descripción e imágenes de la nueva especie. *Gonolobus cthulhui* es morfológicamente similar a *G. leianthus* y *G. pancololote*, pero se diferencia por sus sépalos de punta negra y ampliamente ovados a suborbiculares, el patrón diagonal pubescente en los lóbulos de la corola y el anillo faucal más delgado y discontinuo. Se sugiere una categoría de conservación en peligro (EN) para esta especie.

Conclusiones: Este descubrimiento destaca a Oaxaca como el segundo estado, después de Chiapas, con más especies de *Gonolobus* (19 spp.), y a México como un centro de diversidad para el género, con 44 especies registradas y 52.2% de las especies endémicas del país.

Palabras clave: especie endémica, *Gonolobus leianthus*, *Gonolobus pancololote*, Lovecraft.

¹Universidad Nacional Autónoma de México, Facultad de Ciencias, Departamento de Biología Comparada, Laboratorio de Plantas Vasculares. Apdo. postal 70-282, 04510 Cd. Mx., Mexico.

²Author for correspondence: leonardoac@ciencias.unam.mx

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Introduction

Gonolobus Michx. (Apocynaceae, subfamily Asclepiadoideae, subtribe Gonolobinae) comprises ca. 150 species in the Americas (Rosatti, 1989; Stevens, 2001a, 2009; Krings and Xiang, 2004; Krings, 2008; McDonnell et al., 2018) and it is the most species-rich genus in the subtribe, followed by *Matelea* Aubl. (sensu Endress et al., 2018) with approximately 75 species. The members of *Gonolobus* are climbing herbs or vines, with a corolla that often has a faucal ring (corolline corona) surrounding the gynostegial corona, which is adnate to the base of the gynostegium and the corolla; one distinctive attribute is the dorsal and fleshy appendix of the anther (Stevens, 2009; Morillo, 2015).

Krings et al. (2008) noted that *Gonolobus* s.s. has a substitution of thymine by guanine at the position 279 of the *trnL-F* intergenic spacer, which is considered a molecular synapomorphy in that locus. In the last two decades, *Gonolobus* has been revised in some treatments of the Americas, such as Brazil (BFG, 2020), Lesser Antilles (Krings, 2007), Nicaragua (Stevens, 2001b), southeastern United States of America (Krings and Xiang, 2004), West Indies (Krings, 2008), but it requires further evaluations to clarify its systematics.

Gonolobus is currently represented by 43 species in Mexico, growing mainly in deciduous and tropical forests that characterize the Pacific and Atlantic states of the country (Alvarado-Cárdenas et al., 2020a, b; 2021a). There are no reports that the plants are cultivated as ornamental, but some produce edible fruits (Mapes and Basurto, 2016; Alvarado-Cárdenas et al., 2020b). The genus has been studied in some regional floras (e.g., Juárez-Jaimes and Lozada-Pérez, 2003; Stevens, 2001a, 2009; Cortez, 2018), and taxonomic novelties are being continuously described (Stevens and Montiel, 2004; Stevens, 2005; Juárez-Jaimes et al., 2009; Alvarado-Cárdenas et al., 2020b; 2021a).

Along with the review of the herbarium material and collections made in the state of Oaxaca, a specimen that could not be assigned to any described *Gonolobus* in Mexico and Mesoamerica was found, even though this material showed morphological similarity with *G. pancololote* (Sessé & Moc.) L.O. Alvarado (= *G. megalocarpus* P.G. Wilson) (Alvarado-Cárdenas et al., 2021b) and *G. leianthus* Donn. Sm. due to their similar-sized, green flowers. Therefore, the

objective of this work was to describe a new species. It is described here and images and a distribution map are provided, as well as comparative table with morphologically similar species.

Material and Methods

The herbarium specimens were studied in the herbaria ENCB, FCME, FEZA, HGOM, HUAP, IBUG, IEB, MEXU, OAX, SERO, and UAMIZ (Thiers, 2021), as well as virtual collections from the George B. Hinton Herbarium (JSTOR, 2021), Royal Botanic Gardens (K, 2021), NY (NY, 2021), TROPICOS (TROPICOS, 2021), and Herbaria of the University of California (UC, 2021). Leaf terminology is based on Hickey (1973), the indumentum descriptions on Harris and Harris (1994), and the corona terminology on Liede and Kunze (1993) and Kunze (1995). The distribution map was prepared with herbarium records, mapped using QGIS v. 3.26 (QGIS, 2020). When georeferencing was needed, Google Earth (2022) was used.

The authors conducted several field trips in Oaxaca state in 2018 to collect specimens of the species described herein. The collections were deposited in the herbaria FCME of the Facultad de Ciencias, Universidad Nacional Autónoma de México (UNAM) and MEXU of the Instituto de Biología, UNAM. The leaves and flowers were collected and fixed in 70% alcohol solution. Then, they were dissected and measured using a stereomicroscope (Nikon C-Leds, SMZ445, Tokyo, Japan). These specimens were compared with those of other species of *Gonolobus* with similar morphology.

The conservation status of the new species is provided, applying the IUCN Red List criteria (IUCN, 2019). Collection points were mapped with GeoCAT (Bachman et al., 2011), with a cell width of 2 km, to assess the extent of occurrence (EOO) and the area of occupancy (AOO). The observations about the observed populations and the quality of the habitat are included.

The species concept of Templeton (1989) was followed, recognizing a species as “the most inclusive population of individuals that have the potential for phenotypic cohesion through intrinsic cohesion mechanisms.” Although the concept is based on a framework of population genetics, it does not discard other cohesive factors to explain the recognition of the species, such as the



geographic distribution, phenotypic variability restrictions, and ecological restrictions that constitute the manifestation of morphological and habitat distinctiveness.

Results

Taxonomy

Gonolobus cthulhui L.O. Alvarado, K. Maya M. & M.G. Chávez, sp. nov. Figs. 1, 2, 3.

TYPE: MEXICO. Oaxaca, San Miguel del Puerto, Santa María Xadani, a 100 metros del camino del Rancho Dioon, hacia finca cafetalera, sobre ladera, 15°58'59.436"N, 96°05'35"W, 20.VI.2018 (fl.), *K. Maya et al. 46* (holotype: FCME!, isotype: MEXU!).

Gonolobus cthulhui is morphologically similar to *G. leianthus* and *G. pancololote* because of their similar size and green corollas and white margined corolla lobes. The new species differs from these taxa by its black-tipped and widely ovate to suborbicular sepals, its pubescent diagonal pattern on the corolla lobes, and thinner and discontinuous faucal annulus.

Herbaceous perennial vines; latex white; stems with mixed pubescence, glandular capitate trichomes present, ca. 0.05 mm long, spreading, eglandular trichomes, hirsute, 0.5-1 mm long, in two lines along the internodes, but most dense at the nodes; leaf blades ovate to oblong-ovate, 9.2-12.3(-15.3) × 4.3 5-6.7(-11) cm, base cordate, lobes 1.4-2.1(-2.9) long, apex acute to rounded, abruptly acuminate, acumen narrowly obtuse, 6-9 mm long, adaxial surface with glandular capitate trichomes at the base, eglandular trichomes scattered along the midvein, abaxial surface pubescent, without glandular-capitate trichomes, eglandular trichomes adpressed, margins entire, colleters 4-6, 0.5-0.8 mm tall; petioles 4.2-8.1(-11.5) cm long, sparsely pubescent, trichomes most dense along the adaxial ridges, glandular capitate trichomes spreading, ca. 0.1 mm long, eglandular trichomes ascending (some retrorse), 0.3-0.4 mm long; stipular colleters absent; inflorescences racemiform; peduncles (1.6-)2.5-4.7 cm long, indumentum as on the petioles or more sparse; pedicels 2.1-2.8 cm long, in-

dundentum as on the petioles, sometimes with scattered long trichomes; bracts lanceolate to elliptic-lanceolate, 7-11 × 1.9-2.5 mm, persistent, glabrous, abaxial surface sometimes pubescent, glandular capitate trichomes absent, eglandular trichomes antrorse, ca. 0.2 mm long; sepals 5, widely ovate to suborbicular, 8-11 × 6.4-7 mm, green, apices obtuse, black, margins glabrous, adaxial and abaxial surface glabrous; colleters 1-2 per sinus; corolla green, lobes 5, narrowly ovate-lanceolate, 1.8-2 × 0.8-1 cm, slightly overlapping at the base, adaxial surface pubescent diagonally distributed, eglandular trichomes to 0.12 mm, abaxial surface glabrous, apex black, faucal annulus (corolline corona) interrupted, 5 thin ridges, 0.15-0.2 mm wide, opposite to each corolla lobe sinus, short-hispid; gynostegial corona of fused staminal and interstaminal parts, single, erect-fimbriate; anther with laminar dorsal appendage, 1.6-1.7 × 1.4-1.5 mm, obovate in general view, apex bilobed, erect; style-head 4.5-5 mm diameter, deeply angulate (star-shape), apex yellow, probably secretory, stipe ca. 0.5 mm; pollinaria with corpuscula 0.2-0.3 mm long, pollinia borne horizontally, oblong-ovate ca. 1.1 × 0.4 mm; follicles ovoid, ca. 12.8 × 6.1 cm (immature), non-winged, glabrous; seeds not seen.

Distribution and habitat: *Gonolobus cthulhui* is endemic to the state of Oaxaca, where it occurs in tropical subcaducifolious forest and perturbed areas derived thereof, growing from 300 to 580 m a.s.l. (Fig. 4).

Phenology: flowering from June to August, fruiting from October to December (Fig. 2).

Etymology: the name refers to the fictional character of Cthulhu, a primigenial god described in Lovecraft's short horror story "The Call of Cthulhu". According to Lovecraft, the name is impossible to pronounce because it comes from an alien language; however, it is suggested to be pronounced "ka-thoo-loo". The authors use the name in order to, as Zilli et al. (2005) pointed out, highlight the unknown beings living on our planet.

Conservation status: this species is restricted to a minimal area of southeastern Oaxaca State, Mexico



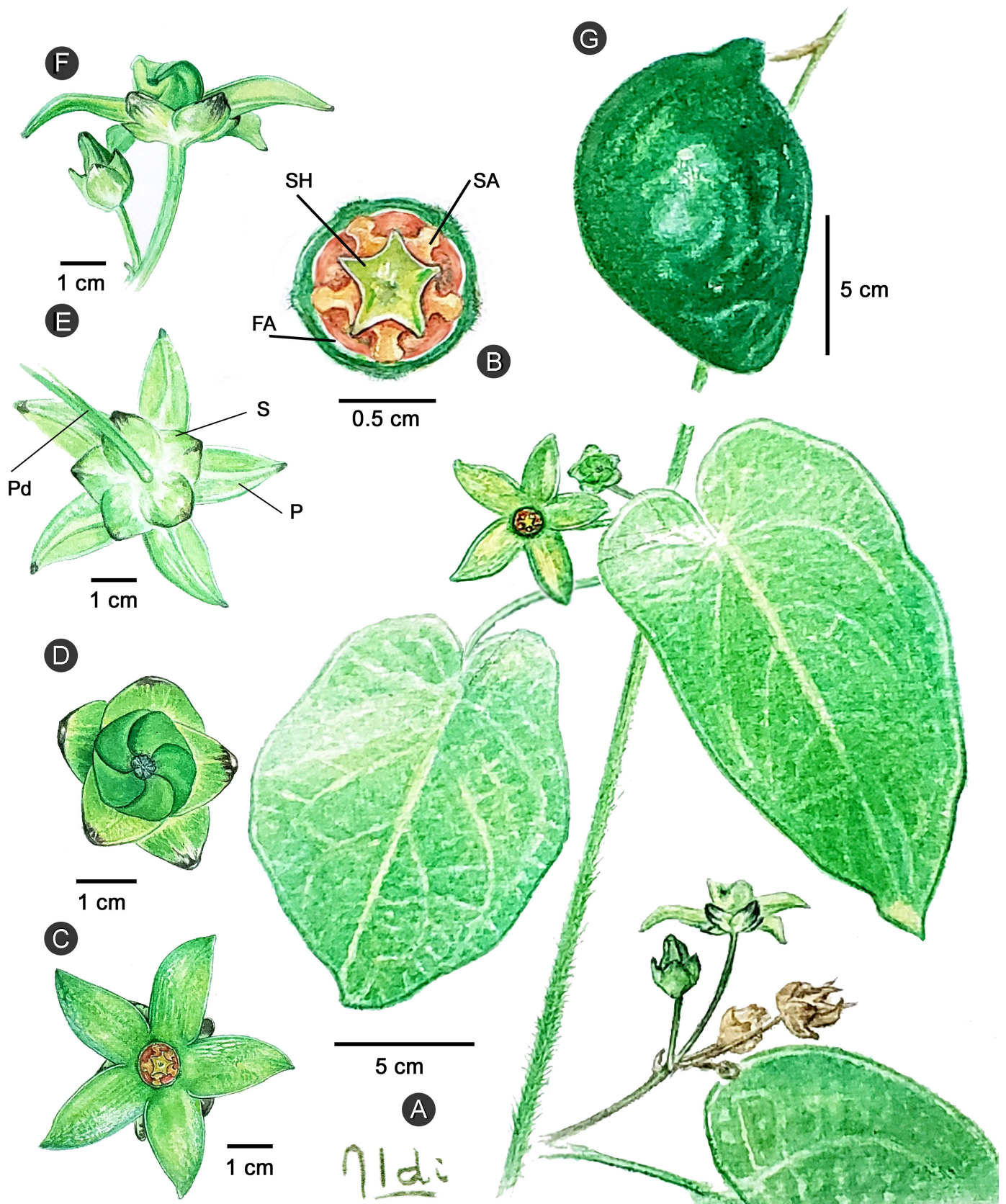


Figure 1: *Gonolobus cthulhui* L.O. Alvarado, K. Maya M. & M.G. Chávez. A. branch with leaves and inflorescences; B. detail of the gynostegium; C. apical view of the flower; D. adaxial view of floral bud, showing corolla bud in the center surrounded by sepals; E. basal view of the flower; F. lateral view of the flower; G. follicle (K. Maya et al. 46, FCME). Abbreviations: FA=faucal annulus, P=petal, Pd=pedicel, SA=staminal appendage, SH=stylar head, S=sepal.

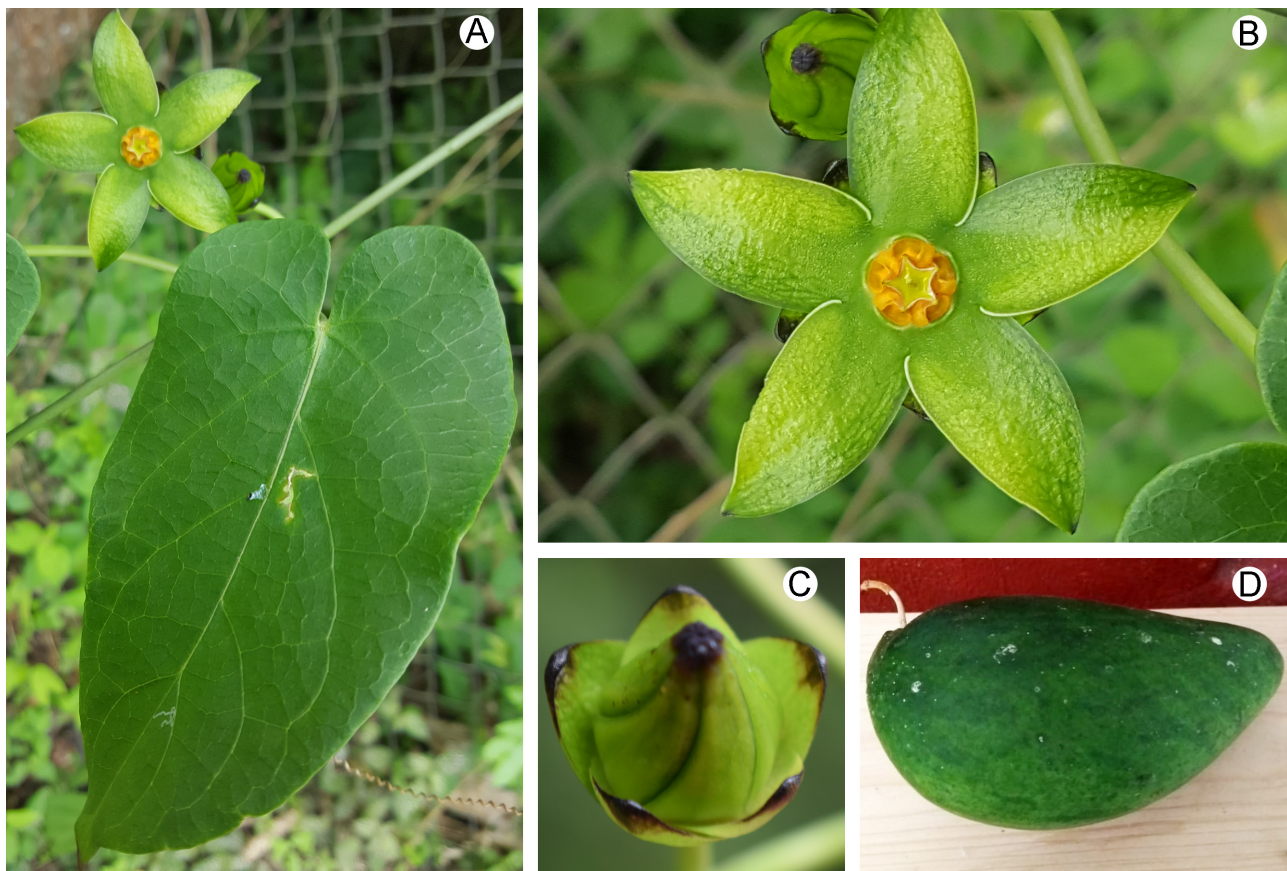


Figure 2: *Gonolobus cthulhui* L.O. Alvarado, K. Maya M. & M.G. Chávez. A. leaf and flower; B. flower; C. floral bud; D. fruit.

($EOO=2383\text{ km}^2$, $AOO=12\text{ km}^2$; Fig. 4). The plants have been collected in four localities in Oaxaca and appear to tolerate some anthropogenic impact, growing on the fences of the houses associated with subperennial forest. Local people cook the fruits to prepare a soup, and this activity could affect the future of the population dynamics of the species. The information about the distribution, abundance, and uses of this species is limited, but the inclusion of this species in the category of Endangered is recommended (En; B2abi) (IUCN, 2019).

Additional specimens examined: MEXICO. Oaxaca, municipio San Pedro Ocotepéc, 18.1 km al N de San Pedro Mixtepec carretera a Oaxaca, 16.14°N, -97.041°W, 820 m, 01.VIII.1984, R. Torres 5802 (MEXU). Municipio Santa María Xadani, finca cafetalera Montecarlo, a 8 km al N de Santa María Xadani, entrando por Zimatán, 16.007°N, -96.05°W, 1200 m, 15.VII.1992, A. Campos 4775 (MEXU). Municipio Santo Domingo Tehuantepec, recorrido de El Limón a El Mi-

lagrito, El Limón está a 17 km al O de Tehuantepec entrando por Hierba Santa, 08.VII.1985, C. Martínez 47 (MEXU).

Additional specimens examined of the compared species of *Gonolobus*: ***Gonolobus leianthus***. BELIZE. Distrito Toledo, Southern Maya Mountains, Bladen Nature Reserve, area around “AC Camp” helicopter landing site, along the upper part of the Bladen Branch, 16.48917°N, -88.87°W, 250 m, 9.V.1996, G. Davidse 35729 (MEXU). GUATEMALA. Departamento Alta Verapaz, Cubilquitz, H. F. Tuerckheim 8243 (holotype: US). MEXICO. Chiapas, municipio Las Margaritas, orilla del río, comunidad Poza Rica, 16.159444°N, -92.4052°W, 350 m, 14.VIII.1994, A. Chamé 276 (MEXU); colonia Maravilla Tenejapa, 2.VI.1986, A. Méndez 9063 (MEXU). Municipio Motozintla, Calera, 15.385°N, -92.27917°W, IV.1945, E. Matuda s.n. (MEXU). Municipio Ocosingo, El Encaño a 3.2 km al NO de Naité, 16.7811°N, -91.0625°W, 220 m, 20.IX.2002, G. Aguilar et al. 2959 (MEXU); a 1 km al NE de Naha, camino a El La-



Figure 3: *Gonolobus cthulhui* L.O. Alvarado, K. Maya M. & M.G. Chávez and morphologically similar species. *Gonolobus cthulhui*. A. flower; B. flower center detail; C. flower bud; D. abaxial view of the flower; E. corolla lobe detail. *Gonolobus leianthus* Donn. Sm. F. flower; G. flower center detail; H. flower bud; I. abaxial view of the flower; J. corolla lobe detail. *Gonolobus pancolote* (Sessé & Moc.) L.O. Alvarado. K. flower and floral bud; L. flower center detail; M. flower bud; N. lateral view of the flower; O. corolla lobe detail. Polygon (E, J) and ellipse (M, N) showing the pubescence. Abbreviations: FA=Faucal annulus, WM=white margin. Specimens consulted: A-E. *Maya et al.* 46 (FCME); F-G, H. Vega (*Naturalista*, 2022e); H, B. Holst (*Naturalista*, 2022f); I-J. *Calzada 3575* (XAL); K-L, E. López Patiño (*Naturalista*, 2022d); M, F. A. Urzua (*Naturalista*, 2022c); N, *Hinton 454* (K000465534); O, *Sessé et al.* 828 (MA).

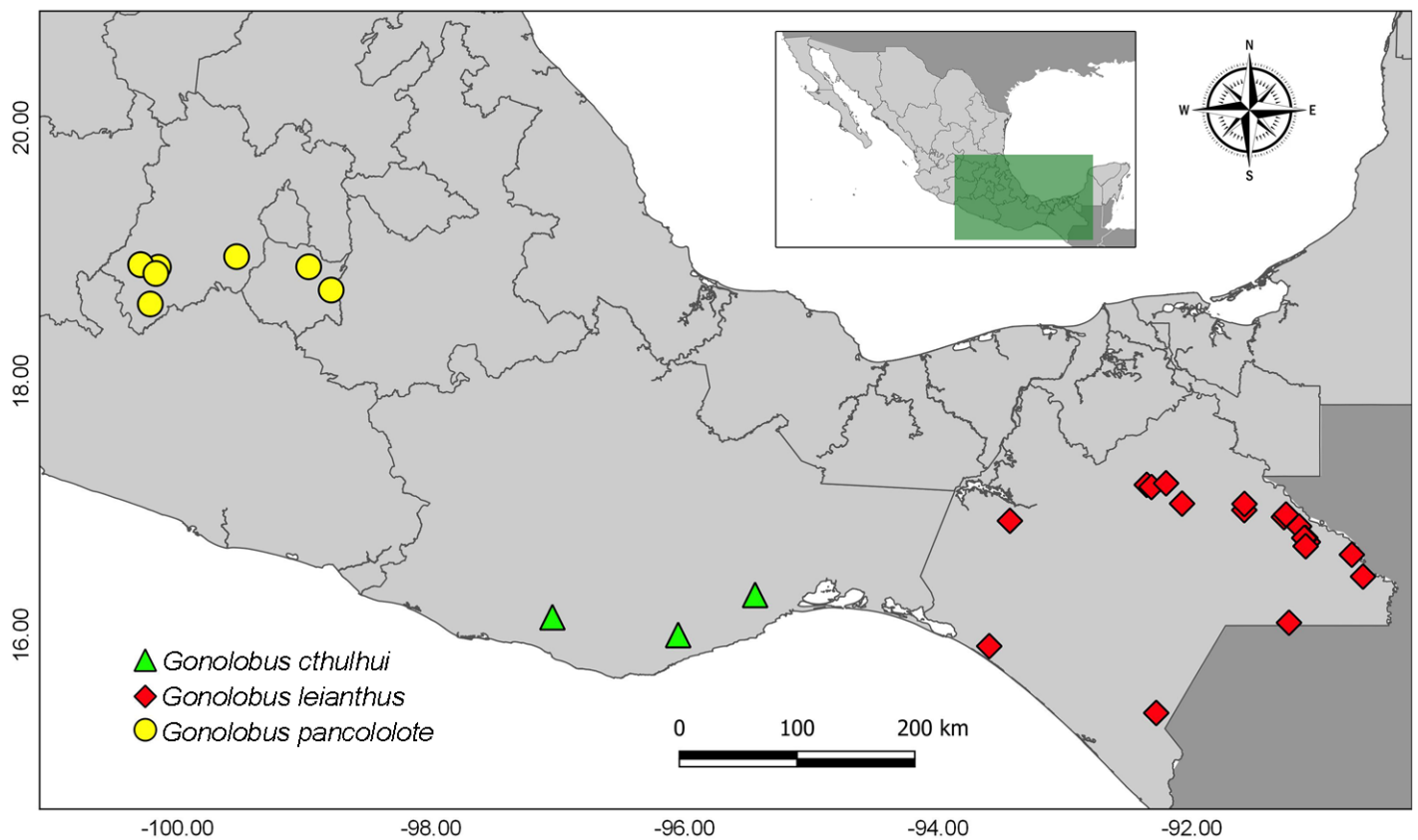


Figure 4: Distribution map of *Gonolobus cthulhui* L.O. Alvarado, K. Maya M. & M.G. Chávez, *G. leianthus* Donn. Sm., and *G. pancololote* (Sessé & Moc.) L.O. Alvarado. See text for list of exsiccatae.

candón, 16.98472°N, -91.58444°W, 845 m, 22.IX.2002, *G. Aguilar 3017* (MEXU); a 3.8 km al SE del Paraíso, 16.93°N, -91.27111°W, 14.X.2002, *G. Aguilar 3500* (MEXU); a 0.1 km del módulo de Bonampak, 16.76611°N, -91.10222°W, 358 m, 28.XI.2002, *G. Aguilar 4459* (MEXU); a 1.77 km al NO del Paraíso, 16.95°N, -91.255°W, 364 m, 03.VII.2003, *G. Aguilar 7284* (MEXU); a 4.8 km al SE de Nuevo Guerrero, 16.9572°N, -91.2505°W, 338 m, 23.V.2002, *D. Álvarez 1407* (MEXU); a 2 km al NE del poblado de Lacanjá, 16.765°N, -91.1167°W, 342 m, 29.VIII.2003, *D. Álvarez 6264* (MEXU); a 5 km al O de Lacanjá - Chansayab, 16.93028°N, -91.27139°W, 400 m, 14.X.2002, *J. Calónico 24365* (MEXU); 1 km antes del Río Lacanjá, viniendo de San Javier, 16.7°N, -91.1°W, 400 m, 10.VI.1990, *M. González 1111* (MEXU); 200 m al sur de Lacanjá - Chansayab, 16.7°N, -91.1°W, 400 m, 09.X.1990, *M. González et al. 1186* (MEXU); la comunidad Lacandona de Lacanhá - Cahnsayab, se localiza a 130 km al sureste de Palenque, por la carretera fronteriza hasta el crucero San Javier, después de 8 km hacia el oeste, 16.73300°N,

-91.08300°W, 400 m, 9.V.1995, *S. Levy 385* (MEXU); en la zona Marqués de Comillas, a 6 km al SE de Ejido Benemérito de las Américas, con rumbo a Flor de Cacao, 16.46056°N, -90.64778°W, 160 m, 8.X.1984, *E. Martínez 8040* (MEXU, MO); 19 km al NW de Crucero Corozal, camino a Palenque, 600 m, 8.IX.1985, *E. Martínez 13457* (MEXU, MO, TEX); a 16 km al NW de Boca Lacantum camino a Palenque, 16.63306°N, -90.73583°W, 220 m, 4.XI.1985, *E. Martínez 14785* (MEXU, MO); 14 km N of Ocosingo, 1080 m, 22.IX.1988, *W. D. Stevens 25808* (MEXU, MO); 7 km N of Naja, 17.033°N, -91.583°W, 760 m, 24.IX.1988, *W. D. Stevens 25882* (MEXU). Municipio Ocozocoautla de Espinosa, 18-20 km North of Ocozocoautla along the road to Mal Paso, 16.9°N, -93.43333°W, 800 m, 18.VIII.1972, *D. E. Breedlove 27113* (MEXU, MO, NY, TEX). Municipio Pantelhó, km 2-8 al SW de Pantelhó sobre el camino de terracería a Chenalhó, 700 m, 18.V.1972, *I. Calzada 3575* (MO, XAL). Municipio Tonalá, Cerro Tres Picos, 15.9116667°N, -93.59638889°W, 1400 m, 10.VI.1986, *E. Martínez 18573* (MEXU). Municipio

Tzimol, entre Tzimol y Ejido J. Mújica, 840 m, 08.IX.1998, *E. Martínez 31163* (MEXU). Municipio Yajalón, K'ak'ate'el, 17.16667°N, -92.31667°W, 1100 m, 15.VII.1982, *A. Méndez 4446* (MEXU); Arroyo del banco del Crava, 17.18389°N, -92.35389°W, 700 m, 25.VIII.1983, *A. Méndez 6503* (MEXU). Veracruz, municipio Hidalgotitlán, Brecha Hnos. Cedillo - La Escuadra, *W. Márquez R. 318* (XAL). ***Gonolobus pancololote***. MÉXICO. Estado de México, municipio Tejupilco, sin localidad, *G. B. Hinton 454* (GBH, K), *G. B. Hinton 7141* (GBH, K). Municipio Temascaltepec, sin localidad, *G. B. Hinton 1381* (GBH, K, UC), Luvianos, 10.IV.1934, *G. B. Hinton 5899* (GBH, K), 26.X.1934, *G. B. Hinton 7164* (GBH, K). Morelos, municipio Yautepec, Oaxtepec, 1400 m, 7.VIII.1983, *D. H. Lorence 4300* (MEXU). Probably Estado de México, sin localidad, *M. Sessé et al. 828* (Holotype: MA).

Additional Naturalista observations of the compared species of *Gonolobus*: ***Gonolobus leianthus***. MEXICO. Chiapas, municipio Maravilla Tenejapa, selva Maya, 16.096549°N, -91.231582°W ([Naturalista, 2022a](#)). Municipio Yajalón, Sierra de Chiapas, 17.195982°N, -92.201493°W ([Naturalista, 2022b](#)). ***Gonolobus pancololote***. MEXICO. Estado de México, municipio Jantetelco, Jantetelco, 18.719624°N, -98.786989°W ([Naturalista, 2022c](#)). Municipio Tlatlaya, Tlatlaya, *López 27340862* ([Naturalista, 2022d](#)).

Discussion

Gonolobus is very distinctive within Gonolobinae, distinguished by its dorsal appendages on the anthers, faucal ring, and longitudinally winged fruits. In Mexico, considered one of its centers of diversity ([Alvarado-Cárdenas et al., 2020a, b](#)), it is present throughout the country, except in Baja California Sur. With *G. cthulhui* as a new addition, a total of 44 species are known in the country with endemism of ca. 52%. Oaxaca is corroborated as the second state with the most species of *Gonolobus* (19), after Chiapas (21) ([Alvarado-Cárdenas et al., 2020a](#)).

Gonolobus cthulhui shows a morphological resemblance with *G. pancololote* and *G. leianthus*. They all share sepals with dark spots, and showy green flowers with one corolla lobes with a white margin (Figs. 1,2,3). The new species is distinguished by having differences in the attributes of the sepals, shape, and pubescence of the corolla

lobes, and morphology of the faucal annulus, as well as its distribution (Table 1). The sepals of *G. cthulhui* are widely ovate to suborbicular (vs. oblong-lanceolate to ovate in *G. pancololote* and widely ovate in *G. leianthus*), with a black macula at the apex (vs. brown macula sometimes occupying half or more of the sepal in *G. pancololote* and *G. leianthus*). Another character to differentiate between species is the type and distribution of the pubescence on the flower. [Stevens \(2009\)](#) used the distribution of trichomes in his species key from Mesoamerican *Gonolobus*. Our observations support the utility of the pubescence in the corolla as a taxonomically relevant. *Gonolobus cthulhui* has the corolla lobes glabrous abaxially and pubescent in a diagonal stripe on the adaxial face (Fig. 3C-E). *Gonolobus pancololote* has a hirsutulous patch at the base of the abaxial face and is glabrous adaxially (Fig. 3M-O). In *G. leianthus*, the corolla lobes are glabrous abaxially, and adaxially have a fringe of tiny papillose trichomes on the right margin (Fig. 3H-J). The faucal annulus is another relevant structure to separate species since it can be present or absent, or with variable dimensions ([Krings, 2008](#); [Stevens, 2009](#)). In the specimens of *G. cthulhui*, the faucal annulus is inconspicuous (0.15-0.2 mm wide) and not continuous (vs. conspicuous (0.4-0.6 mm wide, and continuous in the other two species) (Fig. 3B, G, L).

In *G. cthulhui*, the apex of the stylar head is markedly angular, star-shaped (vs. pentagonal angled or slightly sinused in *G. leianthus*), and the staminal dorsal appendages have erect margins giving an appearance of being narrowly oblong and are yellow-orange (vs. patent, elliptical and yellowish-brown to reddish in *G. leianthus*) (Fig. 3B, G, L).

Additionally, the distribution of these taxa is a cohesive factor in explaining the recognition of the species due to its habitat restriction ([Templeton, 1989](#)). The new species is presented as microendemic to Oaxaca, limited to the southeastern part of the state (Fig. 4). This area is restricted to the east by the Isthmus of Tehuantepec and to the north by the Sierra Madre del Sur, both of them very important abiotic barriers ([Peterson et al., 1999](#); [García, 2006](#); [Alvarado-Cárdenas and Juárez-Jaimes, 2012](#); [Martínez-Domínguez et al., 2020](#)). *Gonolobus pancololote* is distributed in the central part of the country, in the states of Mexico and Morelos, whereas *G. leianthus* is

Table 1: Comparison of diagnostic morphological characters of *Gonolobus cthulhui* L.O. Alvarado, K. Maya M. & M.G. Chávez, *G. leianthus* Donn. Sm., and *G. pancololote* (Sessé & Moc.) L.O. Alvarado.

Character	<i>Gonolobus cthulhui</i> L.O. Alvarado, K. Maya M. & M.G. Chávez	<i>Gonolobus leianthus</i> Donn. Sm.	<i>Gonolobus pancololote</i> (Sessé & Moc.) L.O. Alvarado
Sepal lobes shape	widely ovate to suborbicular	widely ovate	oblong-lanceolate to ovate
Sepal lobes size (mm)	8-11 × 6.4-7	8.1-19 × 5.8-11	8-11 × 4.8-6.5
Sepal color	green with black to dark brown tips	green with brown tips	green with brown tips
Corolla lobes shape	ovate-lanceolate	oblong-lanceolate	lanceolate to ovate-lanceolate
Corolla lobes pubescence abaxial surface	glabrous (Fig. 3D)	glabrous (Fig. 3H)	hirsutulous at the base (Fig. 3P)
Corolla lobes pubescence adaxial surface	pubescence diagonally distributed (Fig. 3E)	pubescent and papillose on the right margin (Fig. 3H-J)	glabrous (Fig. 3P)
Faucal annulus	inconspicuous (0.15-0.2 mm wide) and interrupted (Fig. 3B)	conspicuous (0.4-0.6 mm wide) and continuous (Fig. 3G)	conspicuous (0.5-0.65 mm wide) and continuous (Fig. 3L)
Stylar head shape	star shape (Fig. 3B)	pentagonal angled or slightly sinused (Fig. 3G)	star shape (Fig. 3L)
Winged fruit	no	yes	no

found in the state of Chiapas, ranging from Mexico to Nicaragua (Fig. 4).

Author contributions

LOAC, KGMM, and MGCH contributed to field collection, herbarium revision, analysis of the results and to the writing of the manuscript. KGMM processed herbarium material. MGCH estimated the extent of occurrence (EOO) and the area of occupancy (AOO) for the species, and she made the map.

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