

## A New Species of *Citharexylum* (Verbenaceae) from the Andean foothills of Peru

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**Abstract**—A new species of *Citharexylum* from the foothills of inter-Andean dry valleys in Peru, *Citharexylum peruvianum*, is described and illustrated herein. It is distinguished from other closely related species with caulinar spines (*C. andinum*, *C. flexuosum*, *C. herrerae*, *C. montevidense*, and *C. weberbaueri*), by inflorescence morphology, leaf size, and pubescence. The newly defined taxon has 15–40 flowered racemes, rachis 7–12 cm long, and coriaceous leaves, with the leaf blade being 4–6(8) × 2–3 cm and densely hirsute on the abaxial surface. A brief discussion on closely related species is provided. *Citharexylum peruvianum* is known exclusively from northwestern Peru, from the departments of Cajamarca, Lambayeque, and La Libertad. The species grows in the Andean foothills at mid-elevations between 1400 and 3000 m a. s. l., in rocky soils and on steep slopes with thorny scrubland. It is occasionally found in moist areas. This species has a restricted distribution and limited numbers of individuals, which will likely result in threatened status following formal review.

**Keywords**—Biodiversity, Neotropics, South America, taxonomy.

The Neotropical genus *Citharexylum* L. is thought to comprise almost 130 species (Atkins 2004). However, no comprehensive studies have ever been performed in the genus. Actually, there are almost 300 names under *Citharexylum*, many of them erected by Moldenke, who worked extensively in Verbenaceae to describe ca. 115 new *Citharexylum* taxa (Moldenke 1958a, b, c, d, 1959a, b, c). Nevertheless, no modern studies in the genus exist, with the exception of two new species descriptions (Méndez 2001; León de la Luz and Chiang 2004) and a treatment of the genus for the Flora of Cuba (Méndez Santos 2003). The genus has been treated in regional floras by Macbride (1960) for Peru, following Moldenke's treatment of the genus (Moldenke 1958a, b, c, d, 1959a, b, c), by López Palacios (1977) for Venezuela, by Múlgura et al. (2012) for Argentina, and by Rueda (Davidse et al. 2012) for Mesoamerica. *Citharexylum* has also been mentioned in botanical checklists or catalogues (e.g. Pool [1993] for Peru, Balick et al. [2000] for Belize, Múlgura et al. [2008] for southern South America, Liesner and Hirth [2014] for Bolivia).

*Citharexylum* are trees or shrubs, with or without spines, with flowers arranged in racemose inflorescences, and drupaceous fruits halfway enclosed by the calyx (Marx et al. 2010). The genus has been traditionally grouped in tribe Citharexyleae Briq., which united genera with drupaceous fruits, a trait that has recently proven to be homoplastic (O'Leary et al. 2012). Consequently, the genera included in this tribe have changed since Briquet erected it in 1895. Recently, Marx et al. (2010) recircumscribed the tribe to include *Citharexylum*, *Baillonia* Bocq., and *Rehdera* Moldenke. However, O'Leary et al. (2012) found no apparent synapomorphies for Citharexyleae sensu Marx et al. (2010).

Peru and Ecuador are known centers of endemism for Verbenaceae (O'Leary and Múlgura 2014; O'Leary and Moroni 2014). Andean geography has likely resulted in niche differentiation and speciation, functioning as a migration corridor for North American Verbenaceae derived from South American species (Frost et al. 2017).

During the revision of the genus for South America (O'Leary and Frost in prep.; O'Leary and Moroni 2018), a new species of *Citharexylum* was found that is distinct from any other known species of the genus. To verify the uniqueness of this new taxon, the type material of all the species of *Citharexylum* that

have ever been described for South America was thoroughly studied through the digital images of JSTOR Global Plants database (JSTOR 2017), from online access to herbaria B, K, NY, and P, or through digital images obtained by personal communication with herbarium curators from C, LE, S, and US. Furthermore, the protologues of all the species ever described in *Citharexylum* have been thoroughly studied and interpreted. We conclude that the studied material supports recognition of a new species as described and illustrated herein. *Citharexylum peruvianum* is discussed in the context of other morphologically similar species.

### TAXONOMIC TREATMENT

*Citharexylum peruvianum* N.O'Leary & Frost, sp. nov. TYPE: PERU. La Libertad (geographic error: label mentions Lambayeque [erroneously spelled Lambayaque]), carretera entre Trujillo y Laredo-Otuzco, entre Simbal y Sinsicat, 2000–3000 m, 26 Oct 1986, C. Díaz 2194 (holotype: NY!, isotype: MO 3609755!)

**Shrubs** 2–5 m high; stems erect, subtetragonous and hirsute when young, cylindrical and glabrous at maturity, with cauline spines 0.5–1.5 cm long, at the leaf axil. **Leaves** opposite, petioles hirsute, 0.8–1.5 cm long, blades elliptic, 4–6(8) × 2–3 cm, base acute, apex obtuse, sometimes emarginate, margin entire or sometimes serrate at the apex, coriaceous, adaxial face glabrous to puberulous, abaxial face densely hirsute mostly over veins, venation reticulate-foveolate. **Inflorescences** racemose, axillary, 2–6 per node, loosely 15–40 flowered 0.5–1 cm apart, rachis 7–12 cm long, puberulous to densely hispid; bracts triangular, 1 mm long, hirsute, deciduous; pedicel 1 mm long. **Calyx** cupuliform, in anthesis 2 mm long, in fruit 0.6–0.75 mm wide, externally puberulous, internally glabrous, margin truncate to slightly 5-mucronate, ciliate; **corolla** infundibular, tube 4 mm long, 5-lobate, lobes ovate, 2 × 2 mm, densely puberulous inside and out, on the inside white or creamy, sometimes slightly lilac, on the outside orange; **androecia** 4–5 stamens, or 4 stamens and 1 staminode, included, inserted in the apical part of the corolla tube, anthers almost sessile, thecae parallel; **gynoecia** 2-carpellate, ovary 4-locular, each locule uniovulate, style terminal, included, stigma shortly 2-lobed. **Fruits** drupaceous, ovoid, apiculate, greenish to pale orange when mature, 1.2–1.6 × 1–1.5 cm,

endocarp with two pyrenes, each pyrene 2-seeded; fruiting calyx persistent at the base of the fruit. Figures 1, 2.

**Distribution and Habitat**—*Citharexylum peruvianum* is known exclusively from northwestern Peru, from the departments of Cajamarca, Lambayeque, and La Libertad (Fig. 3). It has been collected in the foothills of inter-Andean dry

valleys, at mid-elevations between 1400–3000 m a. s. l., in rocky soils and on steep slopes with thorny scrubland, and also on moist areas.

**Etymology**—The specific epithet refers to the species distribution in Peru, not having been found in other countries at the moment.

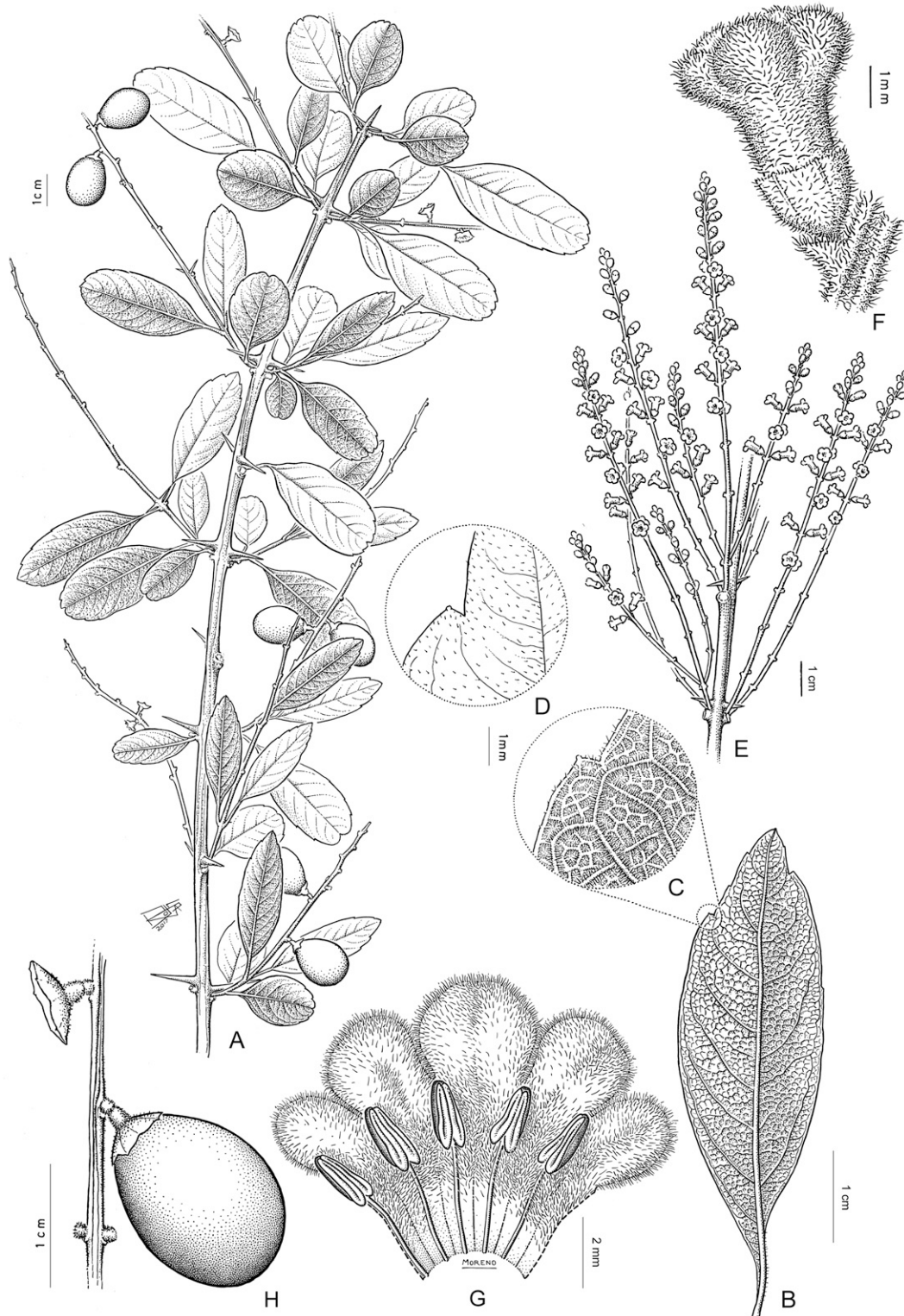


FIG. 1. *Citharexylum peruvianum*. A. Plant branch in fruit, general aspect. B. Leaf, abaxial surface. C. Detail of leaf abaxial surface. D. Detail of leaf adaxial surface. E. Detail of stem with inflorescences in anthesis. F. Flower with bract. G. Opened corolla showing androecia. H. Detail of rachis with fruit. A–D, H from Merello et al. 1060 (MO); E–G from Llatas Quiroz 1998 (SI).

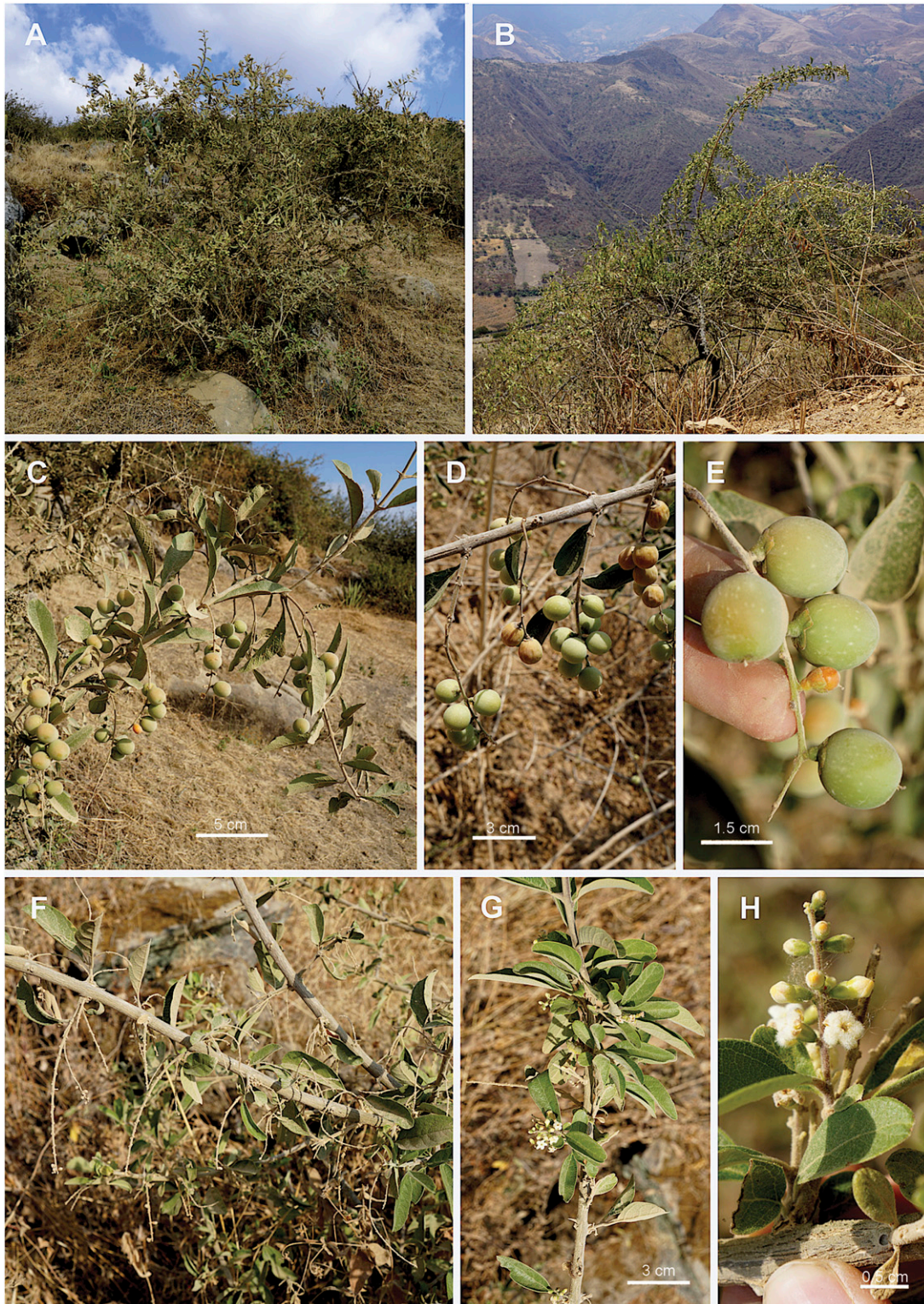


FIG. 2. *Citharexylum peruvianum*. A–B. Habitat. C–D. Fruiting individuals. E. Fruiting raceme, large fruits plus one small bright orange fruit. F. Axillary racemes, recently fallen flowers, not congested, distanced. G. Spiny stem with flowering racemes. H. Flowering raceme. A, C, E from *Frost and Tyson 99* (WTU); B, D from *Frost and Tyson 121* (WTU); F, G, H from *Frost and Tyson 100* (WTU).

**IUCN Red List Category**—*Citharexylum peruvianum* is known from five localities. Its conservation status is predicted to be data deficient according to IUCN criteria (IUCN 2012a, b, 2014a, b). However, we suspect that this species will likely qualify as threatened due to its narrow geographic distribution and limited population sizes.

**Phenology**—Flowering specimens were collected from July to November. Fruits were collected from August to February.

**Notes**—An interesting trait found in every fruiting individual collected by one of the authors (collections *Frost and Tyson 99, 100, 101, 131, 123*) is that one fruit per infructescence remained small and turned bright orange, the larger fruits



FIG. 3. Geographical distribution of *Citharexylum peruvianum*.

being just a pale, dull orange (Fig. 2E), even in different populations. These orange small fruits could be abortive.

The flower buds are orange at the tip, and in anthesis, the corolla lobes are orange on the outer side. *Citharexylum sulcatum* Moldenke, *C. flexuosum* (Ruiz & Pav.) D. Don, and *C. weberbaueri* Hayek are similar in that they each have orange corolla lobes at anthesis, but they are differentiated by the fact that their flower buds are purple at the tips.

**Diagnosis**—*Citharexylum peruvianum* is distinguished by its adaxial leaf surface being glabrous to puberulous (vs. glabrous in the closely related species), and its big fruits,  $1.2\text{--}1.6 \times 1\text{--}1.5$  cm, being smaller than  $1.2 \times 1$  cm in the rest of the related species (Table 1). This new taxon can be recognized by its shrubby habit (reaching 2–5 m in height), its spiny stems,

coriaceous leaves that are densely hirsute on the abaxial surface, and racemes with 15–40 flowers, with a rachis 7–12 cm long.

*Citharexylum montevidense* (Spreng.) Moldenke shares the coriaceous leaves and spiny stems described above; though not all *C. montevidense* specimens have spines. The new taxon can be differentiated from *C. montevidense* because the latter are generally small trees (5–12 m in height), while the former are shrubs (2–5 m in height). Furthermore, in *C. peruvianum* leaves are smaller,  $4\text{--}8 \times 2\text{--}3$  vs.  $4\text{--}18 \times 2\text{--}5$  cm in *C. montevidense*, and the abaxial surface of the leaf is densely hirsute in *C. peruvianum* while in *C. montevidense* it is glabrous or slightly pilose on veins or in vein junctions. The fruits in *C. montevidense* are smaller:  $1\text{--}1.2 \times 0.8\text{--}1$  vs.  $1.2\text{--}1.6 \times 1\text{--}1.5$  cm in *C. peruvianum*. *Citharexylum montevidense* grows in southern Brazil, northern Argentina, Uruguay, and Paraguay (Paranaense influence area) and *C. peruvianum* is endemic to the Andean regions of northwestern Peru (Table 1).

*Citharexylum peruvianum* can also be confused with *C. weberbaueri*, which also possesses spiny stems and coriaceous leaves. However, *C. peruvianum* and *C. weberbaueri* can be differentiated on the basis of leaf blade size ( $4\text{--}8 \times 2\text{--}3$  cm vs.  $1\text{--}3 \times 1$  cm, respectively), inflorescence structure (racemes with 15–40 flowers with a 7–12 cm long rachis vs. racemes with 3–6 flowers with a 1–2 cm long rachis, respectively), and fruit size ( $1.2\text{--}1.6 \times 1\text{--}1.5$  cm vs.  $0.4\text{--}0.6 \times 0.4\text{--}0.6$  cm, respectively) (Table 1).

The rest of the Andean spiny shrubs, *C. andinum*, *C. flexuosum*, and *C. herrerae* are different because all three possess chartaceous to membranaceous leaves, being coriaceous in *C. peruvianum*. Additionally, racemes are shorter and fruits are much smaller in the remaining Andean spiny shrub species than in *C. peruvianum* (Table 1). Furthermore, leaves of these species are glabrous, except some *C. flexuosum* specimens which can be hirsute on veins of the abaxial face, though never densely hirsute as in *C. peruvianum*.

**Specimens Examined**—Peru.—CAJAMARCA: Contumazá, Las Chirimoyas, San Benito-Yetón, 1700 m, 3 Feb. 1985, A. Sagástegui 12489 (MO). Contumazá, carretera Cascas-El Chorillo, 1400 m, 22 Aug. 1994, M. Merello et al. 1060 (MO). Contumazá, San Martín-Singarrán, 3 Nov. 1979, Sagástegui 9421 (MO). Contumazá, Road San Benito-Yetón, between kilometer 45 and Yetón, 17 Sep. 2016, Frost and Tyson 121 and 123 (USM, WTU).—LA LIBERTAD: Otuzco, road from Simbal to Sinsicap, a few kilometers before Sinsicap, 9 Sep. 2016, Frost and Tyson 99, 100 and 101 (USM, WTU). Otuzco, Hda. Membrillar, 1670 m, 3 Jun 1951, López Miranda 648 (US).—LAMBAYEQUE: Lambayeque, Colaya, 5 Jul. 1986, Llatas Quiroz 1998 (SI).

TABLE 1. Comparison of morphological characters and geographical distribution range of *Citharexylum peruvianum* and the closely related *Citharexylum* species. Bold text indicates diagnostic characters for the new species.

Character	<i>C. peruvianum</i>	<i>C. montevidense</i>	<i>C. weberbaueri</i>	<i>C. andinum</i>	<i>C. flexuosum</i>	<i>C. herrerae</i>
Leaf texture	Coriaceous	Coriaceous	Coriaceous	Chartaceous or membranaceous	Chartaceous or membranaceous	Chartaceous or membranaceous
Flowers per raceme	15–40	20–40	3–6	5–9	5–15	5–12
Rachis length (cm)	7–12	10–15	1–2	1–3	3–8	1–3
Leaf size (cm)	$4\text{--}8 \times 2\text{--}3$	$4\text{--}18 \times 2\text{--}5$	$1\text{--}3 \times 1$	$2\text{--}3 \times 0.8\text{--}1.4$	$2\text{--}6 \times 1\text{--}3$	$1\text{--}2.5 \times 0.3\text{--}1$
Leaf adaxial face	<b>Glabrous to puberulous</b>	Glabrous	Glabrous	Glabrous	Glabrous	Glabrous
Leaf abaxial face	Densely hirsute	Glabrous, pilose on veins or on vein junctions	Densely hirsute	Glabrous	Glabrous, hirsute only on veins	Glabrous
Fruit size (cm)	<b><math>1.2\text{--}1.6 \times 1\text{--}1.5</math></b>	$1\text{--}1.2 \times 0.8\text{--}1$	$0.4\text{--}0.6 \times 0.4\text{--}0.6$	$0.5 \times 0.5$	$0.6 \times 0.5$	$1 \times 0.8$
Habit	Shrub	Tree	Shrub	Shrub	Shrub	Shrub
Plant height (m)	2–5	5–12	1–5	1–3	3–5	1–3
Geographic distribution range	Andean	Paranaense	Andean	Andean	Andean	Andean

KEY TO THE SPECIES OF *CITHAREXYLUM* WITH CAULINE SPINES

1. Leaves chartaceous or membranaceous ..... 2
2. Leaves with adaxial face glabrous and abaxial face hirsute on veins, blades larger: 2–6 × 1–3 cm and inflorescences conspicuous with a rachis up to 8 cm long ..... *C. flexuosum* (Ruiz & Pav.) D. Don
2. Leaves glabrous on both faces, blades smaller: 1–3 × 0.3–1.4 cm and inflorescences inconspicuous with a brief rachis up to 3 cm long ..... 3
3. Stems and branches acutely tetragonal when young and at maturity, young branches spiny at the apex, with caulinar spines up to 1.5 cm ..... *C. herrerae* Mansf.
3. Stems and branches tetragonal only when young, terete at maturity, young branches not spiny at the apex, with or without caulinar spines up to 1 cm ..... *C. andinum* Moldenke
1. Leaves coriaceous ..... 4
4. Leaves smaller, 1–2 (3) × 1 cm; inflorescences 3–6 flowered, rachis 1–2 cm long; fruits 0.4–0.6 × 0.4–0.6 cm ..... *C. weberbaueri* Hayek
4. Leaves larger, 4–18 × 2–5 cm; inflorescences with more than 15 flowers, rachis 7–15 cm long; fruits 1–1.6 × 0.8–1.5 cm ..... 5
5. Shrubs 2–5 m high, leaves smaller 4–8 × 2–3 cm, adaxial face glabrous to puberulous, fruits 1.2–1.6 × 1–1.5 cm, abaxial face densely hirsute, plants endemic from northern Peru ..... *C. peruvianum* N. O'Leary & Frost
5. Small trees 5–12 m high, leaves larger 4–18 × 2–5 cm, adaxial face glabrous, abaxial face glabrous, pilose on veins or in the vein junctions, fruits 1–1.2 × 0.8–1 cm, plants from northern Argentina, southern Brazil, Uruguay, and Paraguay ..... *C. montevidense* (Spreng.) Moldenke

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## AUTHOR CONTRIBUTIONS

NO'L contributed to the recognition of this new entity in the context of her knowledge of South American *Citharexylum* species, which she has studied for the past eight years. LF recognized and collected this entity in the field, and discovered it was different from previously described taxa. Each author independently reached the conclusion that this entity represented a new taxon, resulting in the collaborative work presented here.

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