

# INCACLEOME: A NEW ANDEAN GENUS OF CLEOMACEAE

XAVIER CORNEJO,<sup>1,2</sup>

**Abstract.** Based on morphology, previous molecular studies, and a distinctive geographic pattern of distribution that is restricted to the Central Andes in South America, *Incacleome gen. nov.*, a Neotropical new genus segregated from *Andinocleome* (Cleomaceae), is here formally proposed. The respective three new combinations (*I. chilensis*, *I. limoneolens*, and *I. mathewsii*) and a key to the species are also provided.

**Keywords:** *Andinocleome*, central Andes, Chile, Cleome, Peru

**Resumen.** Con base en la morfología, estudios moleculares previos, y un distintivo patrón geográfico de distribución, esto es, restringido a los Andes Centrales en América del Sur, aquí se propone formalmente *Incacleome gen. nov.*, un nuevo género neotropical segregado de *Andinocleome* (Cleomaceae). Además, se proveen las respectivas tres nuevas combinaciones (*I. chilensis*, *I. limoneolens*, y *I. mathewsii*) y una clave de las especies.

**Palabras claves:** Andes centrales, *Andinocleome*, Chile, Cleome, Peru

Cleomaceae are a family that include ca. 32 genera and 270 species, principally from tropical and subtropical regions of both the Eastern and Western Hemispheres, but with a few genera from temperate regions (Iltis et al., 2011; Cardinal-McTeague et al., 2016; Bayat et al., 2018). It is characterized by the predominantly herbaceous to subshrubby habit, sometimes treelets, flowers with free stamens whose filaments at the base are inserted in floral nectaries, at the base of the gynophores, otherwise on androphores, a 1-locular ovary, usually exerted on an elongate gynophore, 2 to numerous ovules attached on 2 parietal placentas, fruit capsules, dehiscent or mostly dehiscent by 2 valves, with a lateral replum, an absent mesocarp, small seeds, 1–3 mm in diameter, usually with elaiosomes (see previous references). Phylogenetic studies have shown that the genus *Cleome* L. s.l., as traditionally circumscribed, is not monophyletic (Hall et al., 2002; Sánchez-Acebo, 2005; Hall, 2008; Inda et al., 2008; Barret et al., 2017; Roalson & Hall, 2017). The division of *Cleome* into segregate genera was first proposed in the nineteenth century (Candolle, 1824; Rafinesque, 1838), and expanded in the Flora of North America and Flora Mesoamericana during the past two decades (Iltis and Cochrane, 2007, 2014; Tucker and Vanderpool, 2010). Among those, *Andinocleome* was established as a new

genus, in which combinations for three species (*A. lechleri* (Eichler) Iltis & Cochrane, *A. magnifica* (Briq.) Iltis & Cochrane, and *A. pilosa* (Benth.) Iltis & Cochrane) were initially provided (Iltis and Cochrane, 2014). The remaining genera and species in the Cleomaceae, and the respective delimitation, have been formally recognized (Patchell et al., 2014; Soares Neto et al. 2017, 2018, 2020, 2022; McGinty and Roalson, 2020).

In the generic reorganization and nomenclatural synopsis of the Andean clade of Cleomaceae (McGinty and Roalson, 2020), *Andinocleome* comprises two clades, informally named as the Lechleri (*Adinocleome s.s.*) and the Chilensis clades, both regarded as morphologically similar (McGinty and Roalson, 2020). However, a detailed morphological examination of all species of both clades in herbarium and fresh material during the preparation for the study of Cleomaceae for the Flora of Ecuador (Cornejo and Cochrane, manuscript submitted) revealed a set of consistent characters (see Table 1) that make clear two well-defined genera. Therefore, the Chilensis clade is here formally recognized as a new South American genus of Andean origin, as previously discussed (McGinty and Roalson, 2020), and the proper combinations are presented here.

## TAXONOMY

**Incacleome** Cornejo, *gen. nov.*

TYPE: *Cleome chilensis* Candolle, Prodr. 1:238 (1824). Fig. 1–2.

Annual, often ephemeral herbs, 8 cm to 1 m tall; leaves 3–5(–7)-foliolate, tertiary veins inconspicuous; flowers always with 3-foliate bracts at least at the base of the rachis of the inflorescence; petals white or purplish; floral nectary disciform, slightly broader than the receptacle, centrally depressed adaxially, margins not wavy; anthers with 2 pollinic sacs.

Annual, often ephemeral herbs, unarmed; puberulent to pilose or glabrous. Leaves 3–5(–7)-foliolate, petiolate, exstipulate; folioles eucamptodromous, tertiaries inconspicuous on both sides. Racemes terminal and axillary, loose to dense, bracteate; bracts leafy, 3-foliate, at least at the base of the rachis. Flowers bisexual. Sepals free, narrowly lanceolate to linear lanceolate, straight at apex. Corolla with open aestivation at anthesis. Petals erect, narrowly clawed, adaxially fan-like arranged in a single row, white. Floral nectary symmetric, disciform, slightly

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<sup>1</sup> Herbario GUAY, Departamento de Botánica, Facultad de Ciencias Naturales, Universidad de Guayaquil, Av. Raúl Gómez Lince s.n. y Av. Juan Tanca Marengo (campus Mapasingue), Guayaquil, Ecuador; xcornejoquay@gmail.com

<sup>2</sup> <https://orcid.org/0000-0002-4081-4047>

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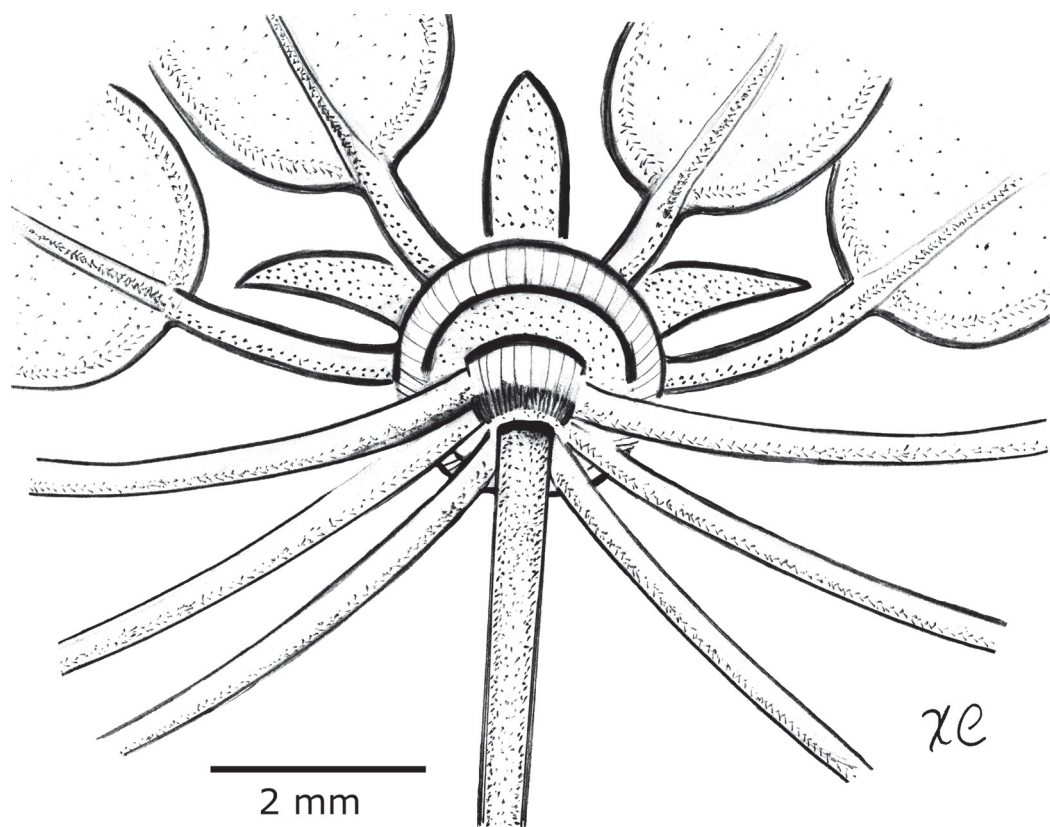
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FIGURE 1. Distribution map of *Incacoleome* Cornejo based on herbarium collections.

TABLE 1. Morphological differences between *Incacleome* and *Andinocleome*.

FEATURE	<i>INCACLEOME</i>	<i>ANDINOCLEOME</i>
habit	Annual herbaceous, often as dwarf to short herbs, 8 to 10 cm tall up to 1 m tall	Biannual to perennial subshrubs to treelets, 0.8 to 4.0 m tall
leaf venation	folioles eucamptodromous and tertiary veins inconspicuous on both sides	folioles brochydromous and tertiary veins sulcate above and conspicuously prominent beneath
floral bracts	always trifoliolate at least at base of inflorescence	usually simple, sometimes trifoliolate
shape of nectaries	disciform, 2–3 mm wide	massive bowl shape, subhexagonal, 5–10 mm wide, with 6 shallow infrastaminal depressions often separated by 6 radial interstaminal elevations or crests, fleshy, margins wavy or dentate
petal color	white or purplish-white	light green to yellowish or purple
number of polinic anther sacs	2	4
fruit valves	thin, foliaceous to thinly chartaceous	thick, coriaceous to subwoody
fruit style	acicular	usually short and thick or absent

FIGURE 2. *Incacleome* Cornejo. Close-up of disciform floral nectary, the six staminal filaments and central gynophore inserted at the base of the gynophore, four upright petals in adaxial arrangement, and three reflexed sepals (the fourth sepal not visible).

broader than the receptacle, centrally depressed adaxially. Androphore absent. *Stamens* 6, exerted, radially inserted in 1 whorl in the central summit of the floral nectary around gynophore at the base; anthers green to purple, connective narrowly oblong, pollen sacs 2. *Gynophore* sometimes  $\pm$  off centered. *Ovary* laterally  $\pm$  compressed, linear to narrowly oblong, acute at the apex; style present, acicular, stigma undeveloped. *Capsules* slender, cylindric, deflexed or pendulous, at maturity splitting bilaterally, valves foliaceous to thinly chartaceous, deciduous. Seeds suborbicular, with open cleft and cleft chamber filling elaiosome.

In the generic reorganization and nomenclatural synopsis of the Andean Clade (Cleomaceae; McGinty and Roalson, 2020), four genera were formally recognized based on molecular analysis: *Andinocleome*, *Cochranella*, *Podandrogyne*, and *Pterocleome*. *Andinocleome* comprises two clades: Lecheri (*Adinocleome s.s.*) and Chilensis. The former clade includes *Cleome lecheri* Eichler, the nomenclatural type. The Chilensis clade (also reported as the “Chilensis group” in McGinty and Roalson, 2020), whose name was taken from *Cleome chilensis*, was recognized as a separate genus, but the apparent lack of morphological evidence during that study did not warrant such recognition (McGinty and Roalson, 2020). Furthermore, it has been stated that *Andinocleome* s.l. has not been fully sampled and that with additional “molecular phylogenetic studies there is the possibility that the rest of *Andinocleome* will not be monophyletic with the removal of the chilensis group” (McGinty and Roalson, 2020). However, two of a total of three species of the Chilensis clade (including *C. chilensis*, the nomenclatural type of *Incacleome*) and all species known at the time (with only the exception of *A. magnifica*) from the Lecheri clade have been molecularly sampled (Soares Neto et al., 2020). The later molecular results reinforced the diphyletic status of *Adinocleome*, which is fully consistent with the distinctive generic morphological characters and geographic pattern of distribution discussed herein (i.e., that it is restricted to the Central Andean block in South America). During herbarium and, mainly, field study of *Andinocleome* for the taxonomic treatment of Cleomaceae in the Flora of Ecuador, a set of consistent morphological differences were found, that do not warrant maintaining the members of both clades under the same generic name. Those clear-cut differences led the author to recognize and propose *Incacleome* as a new genus. The morphological differences between *Incacleome* and *Andinocleome* are presented in Table 1.

**Etymology:** The generic name *Incacleome* means the Inca’s *Cleome* and refers, in an ethnohistorical sense, to the geographic extent of Tawantinsuyu during the Inca Empire (Stehberg and Sotomayor, 2012), which is very similar to that of the new genus.

**Habitat and distribution:** From Pacific coastal “lomas” (fog deserts) to ca. 3200 m in the high Andes of Chile to N Peru (Dept. Amazonas) in the central Andean block, South America.

*Incacleome* comprises three small herbs of Pacific to Andean xerophytic communities. The combinations are proposed here:

**1. *Incacleome chilensis*** (Candolle) Cornejo, *comb. nov.* Fig. 3.

Basionym: *Cleome chilensis* Candolle, Prodr. 1: 238 (1824).

TYPE: CHILE. without locality or date, *J. Dombey* 622 (Lectotype, designated by McGinty and Roalson, 2020: P [00076125], image seen).

Homotypic synonym: *Andinocleome chilensis* (Candolle) McGinty & Roalson, Phytotaxa 456: 262. 2020, *syn. nov.*

**Habitat and distribution:** From Pacific coastal “lomas” (fog deserts) to ca. 3200 m in high Andes, N Peru to Chile, on rocky and loose soils.

**2. *Incacleome limoneolens*** (J.F. Macbr.) Cornejo, *comb. nov.*

Basionym: *Cleome limoneolens* J.F. Macbr., Field Museum

Publ. Bot. 4: 169 (1929). TYPE: PERU. Junin: San Rafael, 4 April 1923, *J. F. Macbride* 3145 (holotype: F [0042683], image seen; isotypes: B [100242714], image seen; G [00226274], image seen; G [00226275], image seen; K [000220479], image seen; S [7315], image seen; US [00100483], image seen).

Homotypic synonym: *Andinocleome limoneolens* (J.F. Macbr.) McGinty & Roalson, Phytotaxa 456: 264. 2020, *syn. nov.*

**Habitat and distribution:** Andes of Peru, 1600–3000 m, on rocky and loose soils.

**3. *Incacleome mathewsii*** (Briquet) Cornejo, *comb. nov.*

Basionym: *Cleome mathewsii* Briquet, Ann. Conserv. & Jard. Genève 17: 374 (1914).

TYPE: PERU. Amazonas: Chachapoyas, ca. 2300 m, 1840, *A. Mathews* 3044 (Lectotype, designated by McGinty and Roalson, 2020: G [00226272], image seen; Isolectotypes: BM [000629067], image seen; F [fragment from G, F0042684F], image seen; G [00226273], image seen; GH [00042335], image seen; K [000220481], image seen; K [000220482], image seen; K [000220483], image seen; MO [1813093], image seen; P [P00741917], image seen; WIS [v0259057], image seen).

Homotypic synonym: *Andinocleome mathewsii* (Briquet) McGinty & Roalson, Phytotaxa 456: 264. 2020, *syn. nov.*

**Habitat and distribution:** Eastern Andes of northern Peru, ca. 2300 m. Known only from the type.

KEY TO THE SPECIES OF *INCACLEOME*

- 1a. Gynophore 4–6 mm. . . . . *I. mathewsii*  
 1b. Gynophore 12–30(–45) mm . . . . . 2  
 2a. Petals 7–10 mm . . . . . *I. chilensis*  
 2b. Petals 3–6 mm . . . . . *I. limoneolens*



FIGURE 3. Holotype of *Cleome chilensis*, the nomenclatural type, courtesy of Muséum national d’Histoire naturelle (MNHN)–Paris Herbarium (P).

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