



## Typification of the name *Opuntia soederstromiana* (Cactaceae), a new record for the Flora of Colombia

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### Abstract

*Opuntia soederstromiana* is recorded in Colombia for the first time. Botanical explorations were carried out in eastern Colombia sub-xerophytic enclaves, as well as examination of specimens deposited at the herbaria AZUAY, COL, GH, NY, QCA, QCNE, UPTC, and US was made. Lectotypes for the names *O. dobbieana* (here treated as heterotypic synonym of *O. soederstromiana*) and *O. soederstromiana* are designated on specimens preserved at US and NY. A detailed and expanded morphological description of *O. soederstromiana*, as well as data about type, habitat, conservation status, selected iconographies, and distribution area were given. The number of *Opuntia* species recorded in Colombia has increased to 10. A key for identification of *Opuntia* species occurring in the departments of Boyacá and Santander (Colombia) was also provided.

**Keywords:** endemism, lectotype, morphology, Opuntieae, semi-arid region

### Introduction

The genus *Opuntia* Miller (1754: without page) is the most diverse in the Opuntioideae subfamily, comprising ca. 300 species mostly distributed in America, from southern Canada to northern Argentinian Patagonia (Kiesling & Ferrari 2005, Hunt 2016). Nine species have been reported in Colombia, where they are distributed in sub-xerophytic bushes and dry forests, at 576–2867 m a.s.l. (see e.g., Porras-Flórez *et al.* 2017a). The genus is characterized by generally flattened branches, artifacts or cladodes, presence of glochids in areoles, seeds covered by a bony funicular aril (Stuppy 2002, Oakley & Kiesling 2016). Identification of the species is difficult because an high intra- and interpopulation morphological variability occurs, especially concerning color, shape and size of cladodes, and spines. Moreover, hybridization and polyploidy are common in the genus (Gibson & Nobel 1986, Majure *et al.* 2012, Majure *et al.* 2017, Porras-Flórez *et al.* 2017a). Recently, new floristic records have been reported in countries such as Brazil (Köhler *et al.* 2018).

*Opuntia soederstromiana* was first collected by Ludovic Söderstrom (Britton & Rose 1919) and it has been considered endemic to Ecuador, on Andes in arid habitat, between 1000 and 2700 m of altitude (Muriel 2008). It is characterized being very spiny in the young cladodes, with reddish or pink spines at the base, petals with varied coloration, from yellow, orange to red (Britton & Rose 1919, Madsen 1989). It is octoploid, and forms hybrids with *Opuntia ficus-indica* (Linnaeus 1753: 468) Miller (1768) and *Opuntia pubescens* Wendland *ex* Pfeiffer (1837: 149) (Baker 2002, Majure *et al.* 2012).

The aim of this work is to typify and record *Opuntia soederstromiana* in Colombia for the first time, contributing to the knowledge of cactological diversity in northern South America.

## Materials and methods

The research was carried out field surveys in the following Colombian municipalities: Corrales, Cucaita, Paz de Río, Ráquira, Soatá, and Villa de Leyva (department of Boyacá, altitude range: 1450–2650 m), and Los Santos (department of Santander, altitude range: 832–1718 m) (Porrás-Flórez *et al.* 2017b) (Fig. 1). Cladodes were collected preferably during flowering and fruiting times, as well as data about sexual and vegetative characters was annotated according to Moreno (1984), Font-Quer (2001) and Fuentes-Pérez *et al.* (2009). Relevant literature (protologue by Britton & Rose 1919 included) was consulted (Madsen 1989, Anderson & Eggli 2005, Hunt *et al.* 2006), as well as exsiccata deposited at the Herbaria AZUAY, COL, GH, NY, QCA, QCNE, UPTC, and US (acronyms according to Thiers 2020 [continuously updated]).

Coordinates of collected samples and herbarium material were mapped using the program ArcGIS 10.3.1 (ESRI 2015) using the Datum WGS84 and the Extent of Occurrence (EOO) were calculated using the program GeoCAT (Bachman & Moat 2012), following the IUCN Red List criteria (IUCN 2019).

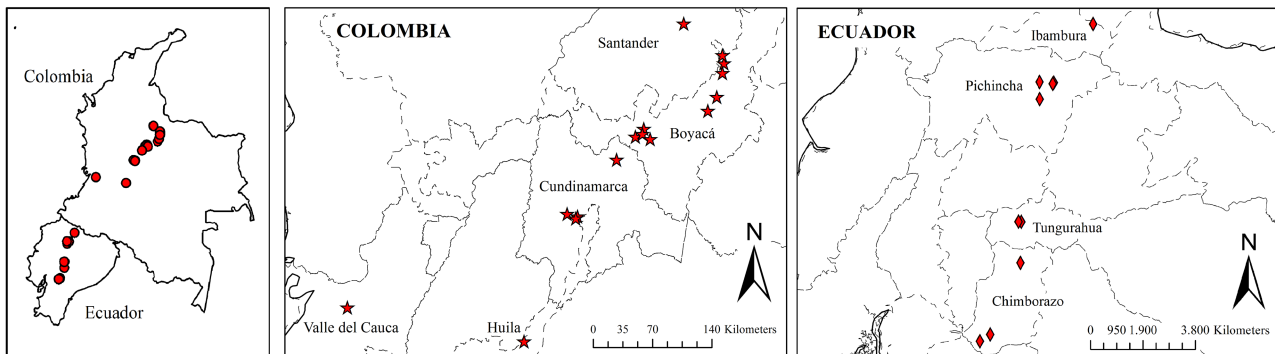


FIGURE 1. Distribution map of *Opuntia soederstromiana*.

## Results

### *Opuntia soederstromiana* Britton & Rose (1919: 221, Figure 294).

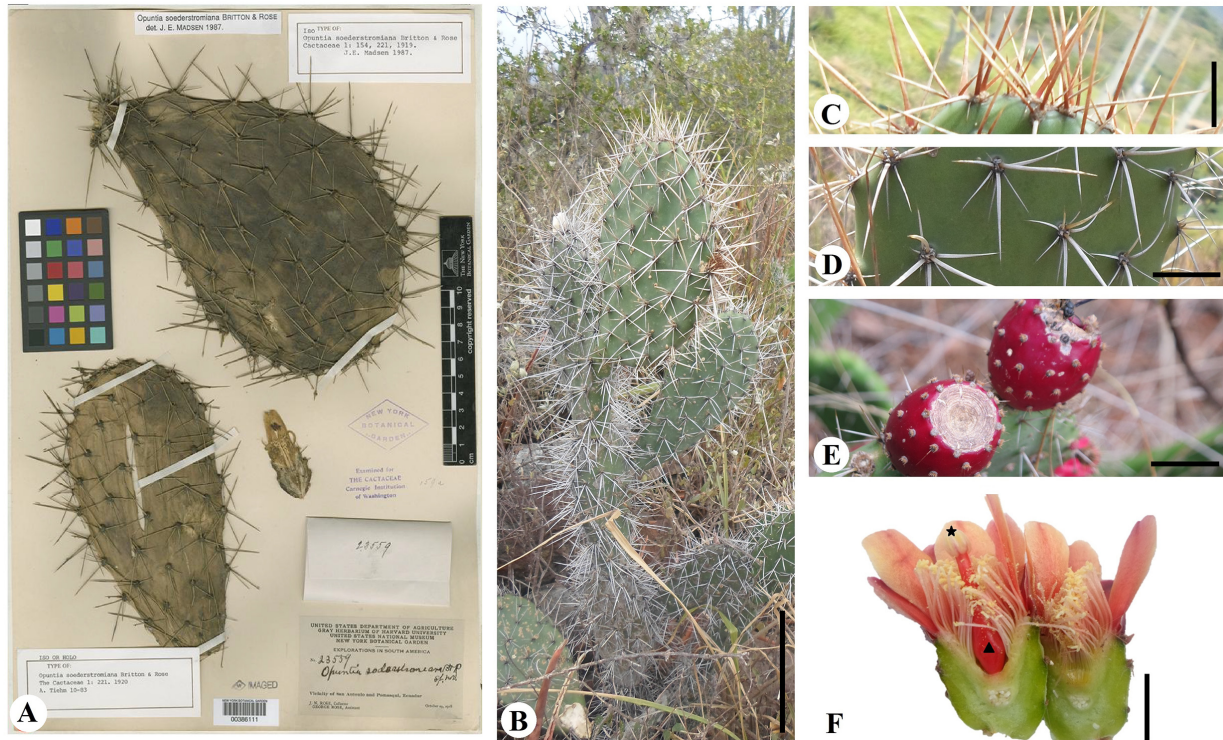
Lectotype (designated here):—ECUADOR, Quito, nr. San Antonio and Pomasqui, 29 October 1918, *Rose & Rose* 23559 (NY00386111!, Fig. 2A, image available at <http://sweetgum.nybg.org/science/vh/specimen-details/?irn=597009>; isolectotype US00037350!, image available at <https://collections.nmnh.si.edu/search/botany/>).

= *Opuntia dobbieana* Britton & Rose (1919: 225, Figure 301).

Lectotype (designated here):—ECUADOR, Quito, Province of Chimborazo, vicinity of Huigra, mostly on the Hacienda Licay, October 1918, *Rose et al.* 22201 (US00037352!, image available at <https://plants.jstor.org/stable/history/10.5555/al.ap.specimen.us00037352>; isolectotypes at GH00063191! ([https://kiki.huh.harvard.edu/databases/specimen\\_search.php?start=0&family=&gen=&sp=&infra=&author=&year=&typestatus=&cltr=&collectornumber=&country=&yearcollected=&state=&county=&loc=&substrate=&habitat=&host=&provenance=&barcode=GH00063191](https://kiki.huh.harvard.edu/databases/specimen_search.php?start=0&family=&gen=&sp=&infra=&author=&year=&typestatus=&cltr=&collectornumber=&country=&yearcollected=&state=&county=&loc=&substrate=&habitat=&host=&provenance=&barcode=GH00063191)), NY00386080! (<http://sweetgum.nybg.org/science/vh/specimen-details/?irn=103919>), NY00386081! (<http://sweetgum.nybg.org/science/vh/specimen-details/?irn=103920>), , US00180395! ([https://plants.jstor.org/stable/10.5555/al.ap.specimen.us00180395?searchUri=filter%3Dname%26so%3Dps\\_group\\_by\\_genus\\_species%26Basc%26Query%3Dopuntia%2Bdobbieana](https://plants.jstor.org/stable/10.5555/al.ap.specimen.us00180395?searchUri=filter%3Dname%26so%3Dps_group_by_genus_species%26Basc%26Query%3Dopuntia%2Bdobbieana)).

**Extended description** (Figs. 2–3):—*Growth habit*: erect. *Height*: 1.0–3.5 m high. Orientation of the artifacts or cladodes: Orthotrope and plagiotrope. *Trunk*: spiny, 0.4–1.0 m high and 9.0–10.0 cm in diameter. *Young cladodes*: obovate to elliptical, 17–35 × 11–15 cm, green-light, sometimes green-dark. *Areoles*: rounded, brown-light to reddish, 0.1 cm high and 0.5–2.5 cm in diameter, separated from each other 3.0–3.5 cm. *Spines*: some retrorse, 6–7 in the middle part of the cladode; 1–2 central spines, arranged at different angles, subulated and acicular when the cladodes are very young, white with a reddish-light base, 1.0–4.2 cm long; 2–6 radial spines, adpressed, subulated, 1.0–4.0 cm long. *Adult cladodes*: same way as young artifacts, 20–35 × 11–21 cm, dark-green. *Areoles*: slightly protruding, 1.0–2.0 mm high, 3.0–5.0 mm in diameter, rounded, brown, with some trichomes, separated from each other between 3.5–5.0 cm. *Spines*: 8–10(–12) in the middle part of the cladode, some retrorse and spirals, 1–2 central

spines, sometimes 3, arranged at different angles, subulated, white with light-yellow tip, 2.0–5.0 cm long; *radial* spines 2–6(–8), oriented at different angles, subulated, 1.0–4.0 cm long. *Flowers*: terminals, actinomorphic, bisexual, sessile, 5.0–7.0 cm long, perianth 3.0–4.0 cm in diameter, inferior ovary, 0.4–0.7 cm in length, campylotropous ovules, tuberculated hypanthium, 2.0–3.8 cm long, in the external part presents glochids, 0.5 cm long and short spines not larger than 1 cm; dull brown-red and thick *sepals*, 0.5–1.0 cm long, yellow to red and thin *petals*, medium 1.5–2.5 cm long, internal 2.5 to 3.0 cm in length; subulated *style*, red to red-light, 2.5 cm long; plurilobulate stigma, light-green, rarely yellow, 0.5–0.7 cm long; yellow stamens, 0.8–1.0 cm in length. *Pseudofruit*: complex, indehiscent, obloid, red-purple hypanthium and pericarp, not tuberculated hypanthium, with areoles and short spines; 4.5–6.5 × 3.0–4.2 cm. *Seed*: covered by a bony funicular aril, white-yellowish, 0.4–0.5 cm in diameter.



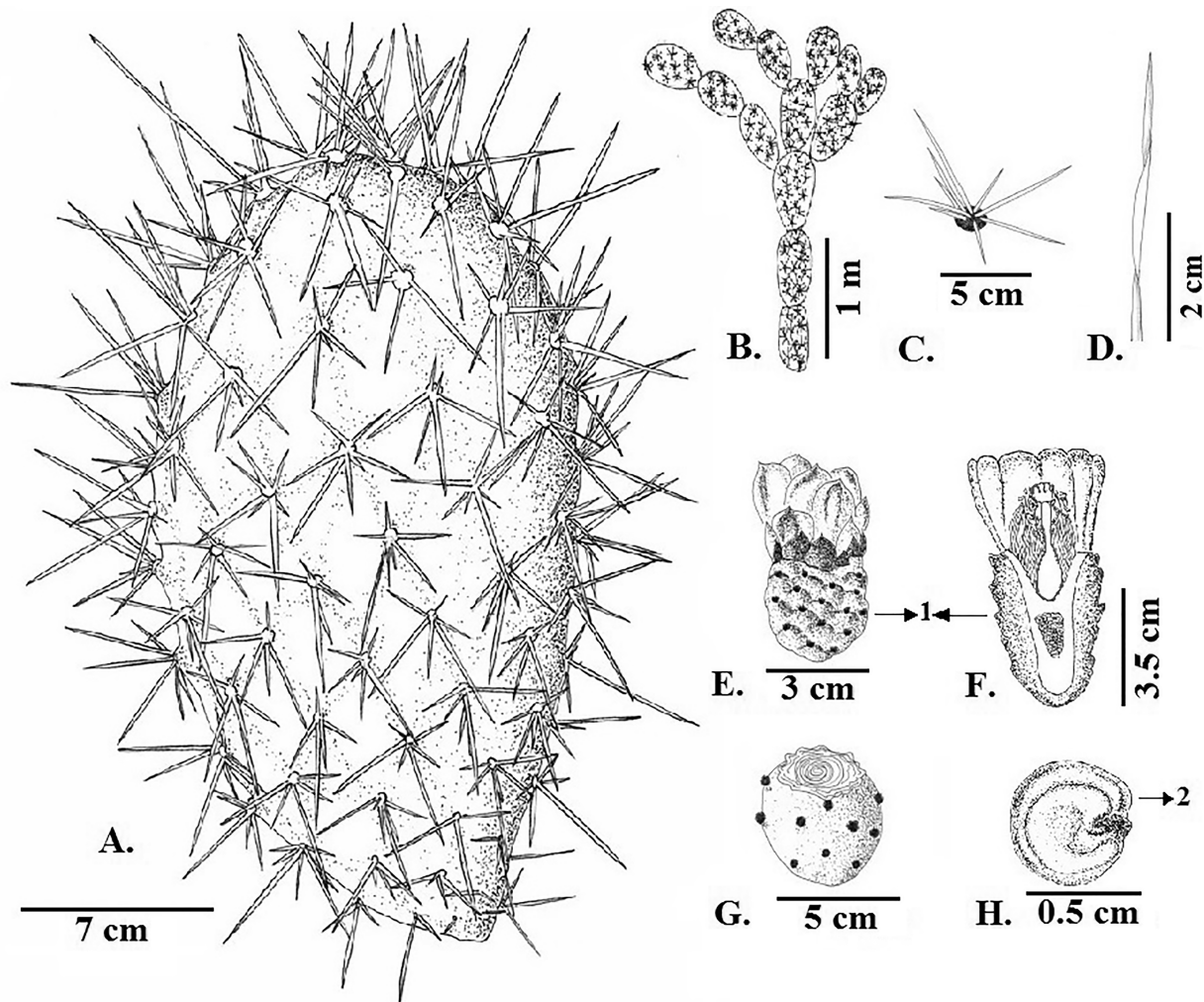
**FIGURE 2.** Herbarium material and spines arrangement of *Opuntia soederstromiana*. **A.** Lectotype (NY00386111). **B.** Erect plants (scale bar = 25 cm). **C.** Young cladode apex with reddish spines (scale bar = 2.0 cm). **D.** Retrorse radial spines in the adult cladode (scale bar = 3.5 cm). **E.** Pseudofruit reddish with areoles and spines (scale bar = 2.0 cm). **F.** Star: plurilobulate stigma; triangle: subulated style (scale bar = 2.0 cm) (photos by D. Porras-Flórez).

**Iconographies:**—Madsen (1989: 59, Fig. 13), Anderson & Egli (2005: 477, Fig. 477A), Hunt *et al.* (2006: 494, Fig. 494.7).

**Distribution and habitat:**—*Opuntia soederstromiana* is distributed in northern South America in Colombia and Ecuador, generally plentiful above 2000 m (Fig. 1). In Colombia it is distributed in the Andean region sub-xerophytes enclaves, mainly in the Eastern mountain range, in the departments of Boyacá, Cundinamarca and Santander, Huila in the-Central mountain range and Valle del Cauca in the western mountain range Cordillera; altitude range: 770-2900 m. The species grows on the edge of the road, in cardonal, sub-xerophytic bushes associated with Asparagaceae (*Agave* L., *Furcraea* Vent.), Boraginaceae (*Cordia* L., *Heliotropium* L.), Burseraceae (*Bursera* Jacq. ex L.), Cactaceae (*Mammillaria* Haw., *Melocactus* Link & Otto), Clusiaceae (*Clusia* L.), Fabaceae (*Acacia* Mill., *Lupinus* L., *Pithecellobium* Mart., *Prosopis* L.), Lamiaceae (*Lepechinia* Willd.), Poaceae (*Agrostis* L., *Andropogon* L., *Aristida* L.), Pteridaceae (*Cheilanthes* Sw.), Solanaceae (*Cestrum* L., *Lycianthes* Hassl.), Verbenaceae (*Citharexylum* B.Juss., *Duranta* L., *Lantana* L., *Lippia* L.), on flat or slightly sloping terrain, 10°, on shallow soils, 20% leaf litter and with a stony between 20% and 70% (Albesiano *et al.* 2003, González 2014).

In Ecuador, it is located in the provinces of Chimborazo, between Huigra and Sibambe; Cotopaxi, Esmeraldas, Imbabura, Manabí and Pichincha, altitude range: 1200-3100 m in vegetable formations, Dry Deciduous Forest, Semi-deciduous Dry Forest, and dry spiny bushes, Northern Inter Andean low mountain dry forest, along with other cacti species such as *Trichocereus macrogonus* var. *pachanoi* (Britton & Rose 1920: 134) Albesiano and R. Kiesling (2012: 32) and *Opuntia pubescens* (Aguirre *et al.* 2006, Loaiza & Morrone 2011).





**FIGURE 3.** Vegetative and reproductive morphology. **A.** Adult cladode with spines that intersect. **B.** Erect growth habit, with orthotrope and plagiotrope cladodes. **C.** Areoles with arrangement of the spines at different angles, some radials are retrorse. **D.** The spines of adult cladode are spirals. **E.** Flower with tuberculated hypanthium (1) and areoles with reddish glochids, sepals (dark) and petals (light). **F.** Cross section of the flower, ovary, subulate style. **G.** Pseudofruit with reddish glochids. **H.** Seed with lignified aril (2) (drawing by D. Porras-Flórez).

**Typification of the name *Opuntia soederstromiana*:**—Britton & Rose (1919: 221) described *O. soederstromiana* through a detailed description, the provenance (“collected at San Antonio, Province of Quito, Ecuador”), the collectors (“Rose and George Rose”), the date of collection (“October, 29 1918”), and the number of collection (“No. 23559”).

Two herbarium sheets, which are part of the original material for *Opuntia soederstromiana* (Art. 9.4 of ICN, Turland *et al.* 2018), i.e. syntypes (Art. 9.6 of ICN), were found (NY00386111 and US00037350). In fact, the plants beared on these two sheets, which morphologically match the protologue by Britton & Rose (1919: 221), have original labels which information match the geographical data reported in the protologue, as well as the collectors, the date of collection, and the collection number. We here designate the NY00386111 as lectotype of the name since this specimen is better preserved. The lectotype corresponds to the current concept of the species (see e.g., Madsen 1989, Anderson & Eggli 2005, Hunt *et al.* 2006).

**Typification of the name *Opuntia dobbieana*:**—The protologue Britton & Rose (1919: 225) consisted of a detailed description, the provenance (“Common in dry places from Huigra to Sibambe, Province of Chimborazo, Ecuador”), the collector, and date of collections [“Collected by J. N. Rose and George Rose, August to November 1918 at Huigra (No. 22201, type); at Sibambe, August 29 (No. 22434)”]. As reported by Britton & Rose (l.c.), the species epithet is dedicated to John Dobbie, general manager of the Guayaquil and Quito. Despite the occurrence of the term “Type”, since more than one specimen was traced (see discussion just below) as marked with the collection number 22201, they are syntypes (Art. 9.6 of ICN) and a lectotypification is required (Art. 9.3 of ICN).

Five herbarium sheets, which label data match those indicated in the protologue by Britton & Rose (1919: 225), were found, i.e. GH00063191, NY00386080, NY00386081, US00037352, and US00180395. All these specimens are marked with the number of collection “22201”, and morphologically match the Britton & Rose’s original description. We here designate the US00037352 as the lectotype of the name *Opuntia dobbieana*, the other four specimens being isolectotypes.

According to Madsen (1989), the name *Opuntia dobbieana* is to be considered as heterotypic synonym for *O. soederstromiana*, because various characters i.e.: the erect growth habit, the obovate cladodes to elliptical and large (20–40 cm), distance between the areoles of 2.5–3.5 cm, maximum number of spines per areole 12 and 3.0–4.0 cm long, white, long flowers, 5.0–7.0 cm, hypanthium of the red pseudofruit of 5.0–6.5 cm long.

**Taxonomic notes:**—*Opuntia soederstromiana* has been confused with the following species: *Opuntia bisetosa* Pittier (1936: 42), *Opuntia elatior* Miller (1768: without page), *Opuntia pittieri* Britton and Rose (1919: 188), and *Opuntia schumannii* Weber ex Berger (1904: 34). However, *O. soederstromiana* displays both vegetative and reproductive different characters, such as the shape and length of the cladodes (obovate to elliptical and 17–35 cm long), colour of the base of the spines in young cladodes (pink hue), number and length of spines in mature cladodes [10(–12) and up to 5 cm long], flower size and color of the petals (up to 7 cm long and yellow to red tepals within the same individuals).

**Conservation status:**—In Ecuador *Opuntia soederstromiana* was assessed by Loaiza (2017) as Least Concern (LC). In Colombia, the extent of occurrence (EEO) calculated were 60134,508 Km<sup>2</sup>. On the basis of the criterion B1 (IUCN 2019), in Colombia for populations located in the Andean region, in Boyacá, Cundinamarca, Huila and Santander, we assessed *O. soederstromiana* as Least Concern (LC).

**Key for identification of *Opuntia* species in the departments of Boyacá and Santander:**—A diagnostic key concerning the species occurring in the Chicamocha river canyon, semi-arid region of La Candelaria desert and between the municipalities of Cucaita and Villa de Leyva (Porrás-Flórez *et al.* 2017a) follows:

1. Reclining plants, up to 27 cm long. Cladodes are oriented parallel to the surface of the soil ..... *O. depauperata*
- Erect plants, up to 6.0 m high. Perpendicular and diagonal cladodes to the soil surface.....2
2. Adult plants up to 36 cm long. Cylindrical cladodes and somewhat flattened, 1.0–1.5 cm in diameter ..... *O. pubescens*
- Adult plants greater than 100 cm tall. Elliptical, obovate and rounded cladodes, 5.0–23 cm wide.....3
3. Glochids 5.0–10 mm long. Discolored spines, with brown stripes. Pseudofruits turbinated, purple and with few areoles, up to five, in the widest part of the pseudofruits ..... *O. dillenii*
- Glochids 1.0–2.0 mm long. Concolorous spines, no brown stripes. Pseudofruits obloids or ellipsoids, red or yellow and with many areoles, more than five, in its widest part.....4
4. Adult cladodes over 40(–50) cm long .....5
- Adult cladodes less than or equal to 40 cm long.....6
5. Areoles with 0–1 spine. Short central spines, 0.2–1.0 cm, white. Hypanthium of the pseudofruit yellow and yellow-orange pericarp ..... *O. ficus-indica*
- Areoles with more than one spine. Long central spines, 1.1–3.5 cm, yellow-light to yellowish white. Hypanthium of the pseudofruit and pericarp red-purple..... *O. pittieri*
6. Areoles 1–2 mm high in the middle of the young cladodes and with three spines .....7
- Areoles immersed (less than 1 mm high) in the middle of the young cladodes and with more than three spines.....8
7. Spines mostly brown-dark, occasionally yellow to white ..... *O. schumannii*
- Spines usually white, sometimes with yellow base.....9
8. Up to five spines per areoles in the middle part of the young cladode, totally white, equal to or less than 3.5 cm long ..... *O. quitensis*
- 8–10 (–12) spines per areole in the middle part of the young artifact, white with pink base, greater than 3.5 (–5.0) cm in length.... *O. soederstromiana*
9. Spines up to 4 cm long, most do not reach to intersect with the spines of the neighboring areoles ..... *O. pennellii*
- Spines up to 6 cm long, and the vast majority intersect ..... *O. caraccasana*

**Specimens examined:**—COLOMBIA. Dpto. Boyacá: Mpio. Corrales, Vrd. Didamon, 2493 m, 5°49’43”N–72°50’52.06”W, 31 July 2014, Porrás-Flórez *et al.* 20 (UPTC). Mpio. Cucaita, 19 March 2004, Fernández-Alonso 21511 (COL0003216); Vrd. Cuesta, 16 August 2019, Porrás-Flórez and Hernández 95 (UPTC); Vrd. Centro, 21 August 2019, Hernández and Porrás-Flórez 01 (UPTC); Vrd. Cuesta en Medio, 22 August 2019, Porrás-Flórez and Hernández 97 (UPTC). Mpio. Paz de Río, Vrd. Corral Falso, 2213 m, 29 July 2014, Porrás-Flórez *et al.* 14 (UPTC); Vrd. Catamo, 17 February 2017, Porrás-Flórez *et al.* 57 (UPTC); Vrd. Portillo, 19 February 2017, Porrás-Flórez *et al.* 58 (UPTC). Mpio. Ráquira, Vrd. Roa, 2170 m, 15 February 1986, Calcagno *et al.* 67 (COL000175980). Mpio. Sáchica, Vrd. Espinal, 16 February 1986, Calcagno *et al.* 77 (COL000175964). Road to Mpio. Sátiva, near the coal mines, 19 February 2017, Porrás-Flórez *et al.* 59 (UPTC). Mpio. Soatá, Vrd. La Costa, 1557 m, 6°20’17.81”N–72°39’35”W, 1

October 2014, *Porrás-Flórez et al.* 32 (UPTC); camino a la Vrd. La Jabonera, 1616 m, 14 July 2015, *Porrás-Flórez et al.* 81 (UPTC). Mpio. Susacón, Vrd. Guaymoral, 2221 m, 6°25'11"N–72°67'75"W, 17 July 2015, *Porrás-Flórez et al.* 93 (UPTC); *ibidem*, 6°24'43"N–72°68'9"W, 2369 m, 17 July 2015, *Porrás-Flórez et al.* 94 (UPTC). Road to Mpio. Tipacoque, 1871 m, 15 July 2015, *Porrás-Flórez et al.* 84 (UPTC); *ibidem*, 6°40'75"N–72°67'92"W, 1837 m, 15 July 2015, *Porrás-Flórez et al.* 86 (UPTC); *ibidem*, 6°34'97"N–72°67'61"W, 1925 m, 16 July 2015, *Porrás-Flórez et al.* 91 (UPTC). Mpio. Villa de Leyva, 2170 m, 15 February 1986, *Calagno et al.* 67 (COL000175980); after the Candelaria River, 2160 m, 15 February 1986, *Calagno et al.* 68 (COL000175974); Vrd. Roa, 2230 m, 26 February 1989, *Méndez and Becerra* 285 (COL000175994); Vrd. Candelaria oriente, 2197 m, 1 July 2014, *Porrás-Flórez et al.* 2 (UPTC); Vrd. Candelaria occidente, 2189 m, 3 July 2014, *Porrás-Flórez et al.* 5 (UPTC). Dpto. Cundinamarca: C. Bogotá, Savannah of Bogotá, between Soacha and Chusacá, 2600 m, 22 May 1944, *Dugand* 3554 (COL000175962). Mpio. Bojacá, Vrd. Barro Blanco, 2900 m, 3 May 2006, *Holguín-Galvis* 1 (COL000220694). Mpio. Mosquera, near the lake La Herrera, 2750 m, 1 August 1968, *Soejarto* 310 (COL000161112); dry valley between Mosquera, on road to La Mesa, 2500–2600 m, 31 July 1976, *Gentry* 17111 (COL000161049); La Herrera lake region, 2600–2800 m, 21 March 1985, *Vink and Wijninga* 56 (COL000161110); *ibidem*, 2600–2800 m, 11 April 1985, *Vink and Wijninga* 240 (COL000175970); La Herrera sector, 2600 m, 19 March 1992, *Sánchez et al.* 2098 (COL000161127); Mondoñedo, Mondoñedo-La Herrera zone, 2600 m, 21 October 2004, *Fernández-Alonso et al.* 22688 (COL); Vrd. San José, 2516 m, 23 February 2015, *Jaimés-Cárdenas* 1 (COL). Mpio. Ubaté, road Ubaté to Chiquinquirá before Susa, 15 November 1986, *Calagno et al.* 66 (COL000175971). Dpto. Huila: Mpio. Colombia, Vrd. Boca de la Zanja, 770 m, 16 April 2010, *Rubiano et al.* 102 (COL). Dpto. Santander: Mpio. Los Santos, North sector of Los Santos Mesa, Vrd. El Pozo, 28 September 2004, *Fernández-Alonso* 22107 et al. (COL000345149). Dpto. Valle del Cauca: Venticias de Dagua (currently called Tuncela), 900 m, 10 November 1962, *Saravia et al.* 1393 (COL000161008). ECUADOR. Prov. Imbabura: Ibarra Cantón, Ambuquí, 00°26'N–77°59'W, 1800 m, 8 December 1990, *Cerón and Montesdeoca* 12574 (QCNE 67132). Prov. Pichincha: Cantón Quito, 0°1'N–78°09'W, 2070 m, 15 October 1988, *Cerón* 5242 (QCNE24984); Guayllabamba parish, Mitad del Mundo-Michingui road, 2100 m, 00°01'S–78°19'W, 14 January 1991, *Cerón and Montesdeoca* 13133 (QCNE81750), *ibidem*, 00°01'S–78°21'W, 1850 m, 17 March 1991, *Cerón and Montesdeoca* 13718 (QCNE141067); Vicinity of San Antonio and Pomasqui, 29 October 1918, *Rose and Rose* 23539 (GH00063194). Guayllabamba parish, 5 km from Guayllabamba River, 5 June 1985, *Baker* 6185 (QCA26423). Prov. Chimborazo: Cantón Guano, km 1 from Guano, 22 September 1985, *Madsen* 61010 (QCA26449). Prov. Tungurahua: 19 September 2001, *Minga* 458 (AZUAY); Cantón Ambato, Quinta La Liria, 1°13'28"S–78°37'11"W, 16 August 2001, *Minga et al.* 458 (AZUAY212256).

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## References

- Aguirre, Z., Linares-Palomino, R. & Kvist, L.P. (2006) Especies leñosas y formaciones vegetales en los bosques estacionalmente secos de Ecuador y Perú. *Arnaldoa* 13 (2): 324–350.
- Albesiano, S. & Kiesling, R. (2012) Identity and neotypification of *Cereus macrogonus*, the type species of the genus *Trichocereus* (Cactaceae). *Haseltonia* 17: 24–34.  
<https://doi.org/10.2985/1070-0048-17.1.3>
- Albesiano, S., Rangel-Churio, J.O. & Cadena, A. (2003) La vegetación del cañón del río Chicamocha (Santander, Colombia). *Caldasia* 25 (1): 73–99.
- Anderson, E.F. & Eggl, U. (2005) *Das grosse kakteen-lexikon*. Ulmer, Stuttgart, 744 pp.
- Bachman, S. & Moat, J. (2012) GeoCAT-an open source tool for rapid Red List assessments. Available from: <http://geocat.kew.org>



(accessed 17 June 2020)

- Baker, M.A. (2002) Chromosome numbers and their significance in some Opuntioideae and Cactoideae (Cactaceae) of mainland Ecuador and Peru. *Haseltonia* 9: 69–77.
- Berger, A. (1904) New or noteworthy plants: Opuntias. *The gardeners chronicle ser. 3* 35 (890): 34.
- Britton, N.L. & Rose, J.N. (1919) *The Cactaceae: Descriptions and illustrations of plants of the cactus family*, vol. 1. Carnegie Institution, Washington, 236 pp.
- Britton, N.L. & Rose, J.N. (1920) *The Cactaceae: Descriptions and illustrations of plants of the cactus family*, vol. 2. Carnegie Institution, Washington, 239 pp.
- ESRI-Environmental Systems Research Institute. (2015) *ArcGIS 10.3. 1 for desktop. Versión 10.3.1*. Redlands, California.
- Font-Quer, P. (2001) *Diccionario de Botánica, 2ª ed.* Península, Barcelona, 1244 pp.
- Fuentes-Pérez, M., Terrazas, T. & Arias, S. (2009) Anatomía floral de cinco especies de *Opuntia* (Opuntioideae, Cactaceae) de México. *Polibotánica* 27: 89–102.
- Gibson, A.C. & Nobel, P.S. (1986) *The cactus primer*. Harvard University, Cambridge, 298 pp.
- González, F. (2014) *Villa de Leyva florece: Guía ilustrada de las plantas de Villa de Leyva y alrededores*. Panamericana, Bogotá, 412 pp.
- Hunt, D.R. (2016) *CITES Cactaceae checklist, 3ª ed.* Royal Botanic Gardens, Londres, 174 pp.
- Hunt, D.R., Taylor, N.P., Charles, G. & International Cactaceae Systematics Group (2006) *The new cactus lexicon, vol. 1*. Dh Books, Milborne Port, 527 pp.
- IUCN (2019) *Guidelines for using the IUCN Red List Categories and Criteria: version 14*. Prepared by the Standards and Petitions Subcommittee of the IUCN Species Survival Commission, 113 pp. Available from: <http://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed: 22 June 2020).
- Kiesling, R. & Ferrari, O. (2005) *100 Cactus Argentinos*. Albatros, Buenos Aires, 128 pp.
- Köhler, M., Font, F. & Souza-Chies, T.T. (2018) First record of *Opuntia rioplatense* (Cactaceae) for the Brazilian Flora. *Phytotaxa* 379 (4): 293–296.  
<https://doi.org/10.5962/bhl.title.46288>
- Linnaeus, C. (1753) *Species plantarum*, vol. 1. L. Salvius, Stockholm, 560 pp.
- Loaiza, C.R. (2017) *Opuntia soederstromiana* (amended version of 2013 assessment). The IUCN Red List of Threatened Species 2017, Cambridge U.K. Available from: <https://www.iucnredlist.org/species/152719/121606841> (accessed: 19 September 2019)
- Loaiza, C.R. & Morrone, J.J. (2011) Análisis panbiogeográfico de algunas Cactaceae del Ecuador. *Gayana Botánica* 68 (2): 220–225.  
<http://dx.doi.org/10.4067/S0717-66432011000200013>
- Madsen, J.E. (1989). Cactaceae, cap. 45. In: Harling, G. & Andersson, L. (Eds.) *Flora of Ecuador*. Universidad Católica del Ecuador, Stockholm and Quito, pp. 44–63.
- Majure, L.C., Puente, R., Griffith, M.P., Judd, W.S., Soltis, P.M. & Soltis, D.E. (2012) Phylogeny of *Opuntia* s.s. (Cactaceae): clade delineation, geographic origins, and reticulate evolution. *American Journal of Botany* 99 (5): 847–864.  
<https://doi.org/10.3732/ajb.1100375>
- Majure, L.C., Judd, W.S., Soltis, P.S. & Soltis, D.E. (2017) Taxonomic revision of the *Opuntia humifusa* complex (Opuntieae: Cactaceae) of the eastern United States. *Phytotaxa* 290 (1): 1–65.  
<http://dx.doi.org/10.11646/phytotaxa.290.1.1>
- Miller, P. (1754) *The Gardeners Dictionary, ed. 4*, vol. 2. Published by the author, London, without pagination.
- Miller, P. (1768) *The Gardeners Dictionary, ed. 8*, vol. 2. Published by the author, London, without pagination.
- Moreno, N. (1984) *Glosario botánico ilustrado*. Instituto Nacional de Investigaciones sobre Recursos Bióticos, México, 300 pp.
- Muriel, P. (2008) La diversidad de ecosistemas en el Ecuador. In: De la Torre, L., Navarrete, H. & Muriel, P. (Eds.) *Enciclopedia de las plantas útiles del Ecuador*. Herbario QCA & Herbario AAU, Quito & Aarhus, pp. 28–38.
- Oakley, L. & Kiesling, R. (2016) A new series of the genus *Opuntia* Mill. (Opuntieae, Opuntioideae, Cactaceae) from Austral South America. *Haseltonia* 22: 22–30.  
<https://doi.org/10.2985/026.022.0105>
- Pfeiffer, L. (1837) *Enumeratio diagnostica cactearum hucusque cognitarum*. Sumtibus Ludovici Oehmigke, Berlin, 192 pp.
- Pittier, H. (1936) Certain Cactaceae of Venezuela: New and old species of *Opuntia* and *Melocactus*. *Journal of the Washington Academy of Sciences* 26 (2): 42–45.
- Porras-Flórez, D., Albesiano, S. & Arrieta-Violet, L. (2017a) El género *Opuntia* (Opuntioideae–Cactaceae) en el departamento de Santander, Colombia. *Biota Colombiana* 18 (2): 111–131.  
<https://doi.org/10.21068/c2017.v18n02a07>
- Porras-Flórez, D., Albesiano, S. & Arrieta-Violet, L. (2017b) *Tratamiento taxonómico de la subfamilia Opuntioideae (Cactaceae) en los departamentos de Boyacá y Santander-Colombia*. Undergraduate thesis. Universidad Pedagógica y Tecnológica de Colombia, 58

pp.

Stuppy, W. (2002) Seed characters and the classification of the Opuntioideae. *Succulent Plant Research* 6: 25–58.

Thiers, B. (2020 [continuously updated]) *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. Available from: <http://sweetgum.nybg.org/science/ih/> (accessed 19 September 2019)

Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.H., Li, D.Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F. (2018) International code of nomenclature for algae, fungi, and plants (Shenzhen Code): Adopted by the Nineteenth International Botanical Congress, Shenzhen, China, July 2017. *Regnum Vegetabile* 159: 1–254.

<https://doi.org/10.12705/Code.2018>