# *Agave doctorensis* (Agavaceae), a new species from Sierra El Doctor, Querétaro, Mexico

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**Abstract**. **Agave doctorensis**, a new species from Sierra El Doctor, Querétaro, Mexico is described and illustrated. It is similar to *Agave montium-sancticaroli* but differs in having a dense, conical panicle; reflexed bracts; and filaments inserted at two levels. The new species occurs in rosette scrub and *Juniperus* forest.

**Key Words:** Filament insertion, Marginatae, panicle.

**Resumen**. Se describe e ilustra **Agave doctorensis**, una especie nueva de la Sierra El Doctor en Querétaro, México. Es similar a *Agave montium-sancticaroli*, pero con panículas densas, cónicas, brácteas reflejas y filamentos insertos en dos niveles. Crece en matorral rosetófilo y bosque de *Juniperus*.

In the most recent treatment of Agavaceae of Querétaro, Mexico (Magallán & Hernández, 2000), 35 taxa were recognized (31 species and four infraspecific taxa), 22 of which were species of *Agave*. Based on the number of species and the area, Querétaro is the third most diverse Mexican state for Agavaceae, with species occurring in different vegetation types, such as pine and oak forests, cloud forests, tropical deciduous and semideciduous forests, and creosote and cacti rosette scrub. Of the 22 recognized species, 16 were new records for the state, including for example, *A. desmettiana* Jacobi, *A. difformis* A. Berger, and *A. gentry* B. Ullrich. Widely used important species of *Agave* in Querétaro include *A. americana* L., *A. salmiana* Otto ex Salm-Dyck, both with great morphological variability probably due to human manipulation, because of their use for beverages (*pulque*), cooking, candies, fibers, forage, and in soil conservation. Another important species is *A. albomarginata* Gentry, which was originally described from a botanical garden, but whose natural distribution was recorded for the first time. Three of the *Agave* species were not identified because they did not key out in any of the available treatments. One of these is described here as a new species, belonging to the Marginatae group of Gentry (1982).

**Agave doctorensis** L. Hern. & Magallán, **sp. nov.** Type: Mexico. Querétaro, Mun. Cadereyta, Sierra El Doctor, bosque de *Juniperus*, Nov 2008, *L. Hernández 6094* (holotype: QMEX; isotypes: ENCB, IEB, MEXU, TEX, XAL) (Fig. 1)

Diagnosis: Plant with acaulescent rosettes, bearing 15–25 lanceolate to narrowly elliptic leaves; leaf margins covered with narrow lines of wax, marginal teeth 1 mm wide; inflorescence a dense, large, conical panicle; inflorescence bracts reflexed; filaments inserted at two levels on the flower tube.

Plants surculose, 1–1.2 m tall, rosettes open, 0.8–1 m wide. Leaves 15–25(–30) per rosette, 50–75(–95) × 4–9.5 cm wide at the middle, lanceolate to narrowly elliptic, rigid, smooth, pale green with foliar prints; leaf margins up to 1 mm wide, corneous, easily detached from the leaf, straight, toothed, reddish, covered with narrow lines of wax that can be lost with age, and in some cases when broken, appearing as trichomes; teeth 1–2(–8) × 1 mm, deltoid or hooked, bases wide, retrorse, separated 1.5–4 cm from each other along the leaf, brittle, flat, with small interstitial teeth, abundant close to the base, absent near the leaf apex, occasionally toothless; apex acuminate; terminal spine 2.7–4.3 cm, subulate, to straight, channeled in the center on the adaxial surface, slightly decurrent on the adaxial surface of the leaf, towards the middle, laterally decurrent towards the margins on the abaxial side. Panicle with compact branches,

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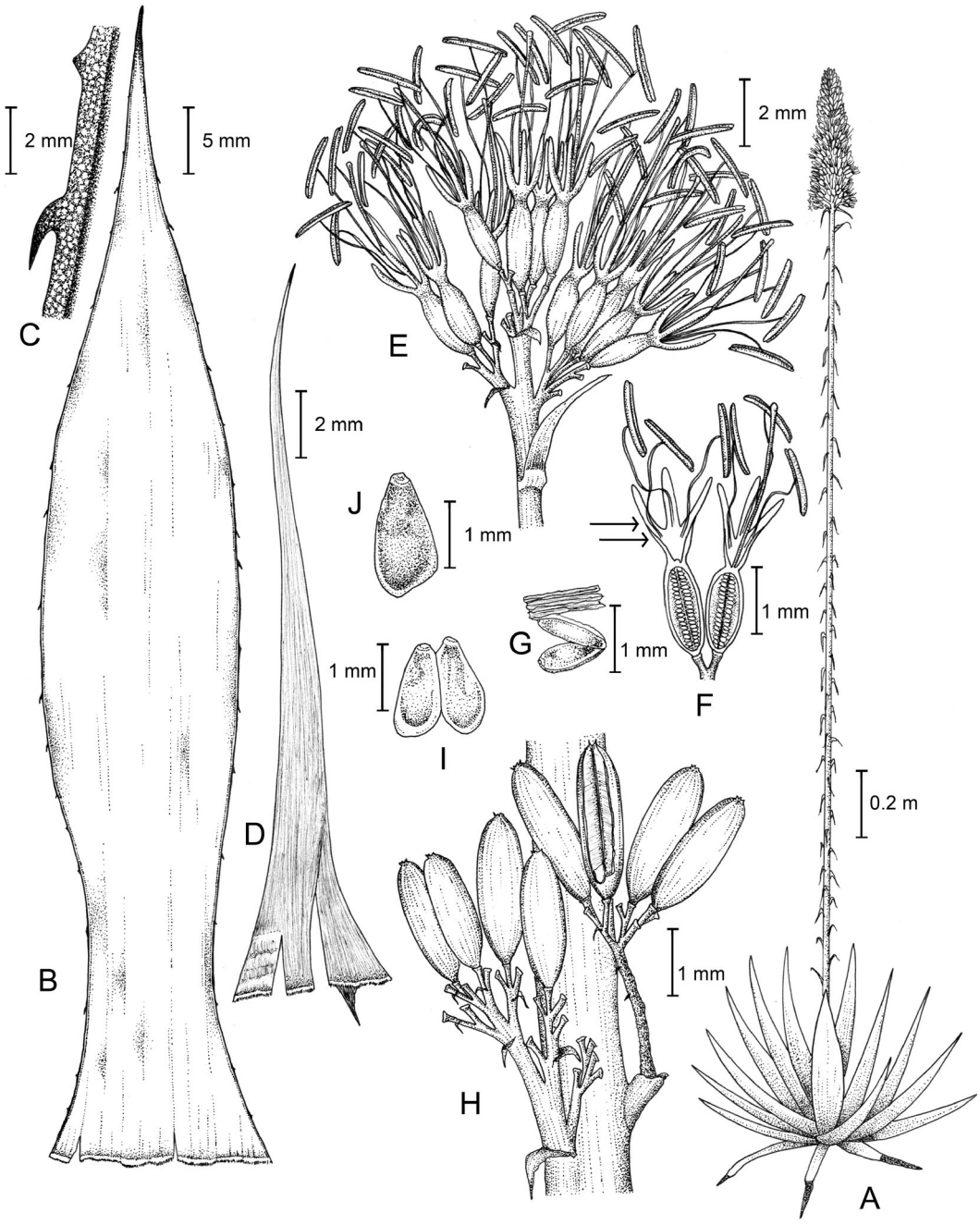


**Fig. 1.** *Agave doctorensis*. **A**. Habit, showing the rosette form, and the infructescence with the long peduncle. **B**. A lanceolate leaf. **C**. Leaf margin covered with lines of wax. **D**. Inflorescence bract. **E**. Inflorescence branches with groups of six or seven flowers. **F**. Longitudinal section of flowers, the arrows indicating stamen insertion at the tube mouth and at the tube base. **G**. Immature seeds, lateral view. **H**. Infructescence branches. **I**. Immature seeds. **J**. Mature seeds. Drawn from *Hernández 6094, Magallán y Hernández 57,* and *Magallán, et al. 361*.

peduncule 4.2–4.5 m long with the flowers covering 12–25% the length, large, conical; branches 70–80, 7 cm long basally to 1.8 cm long at the apex, dorsiventrally flattened, each branch bearing 6 or 7 flowers (occasionally 17 probably due to branch fusion, one main branchlet with 6 or 7 flowers, and two lateral branches with 2–5 flowers); inflorescence bracts 17–28 cm long, 2.5–6.5 cm wide at the base, largely acuminate, base triangular, papyraceous to chartaceous, reflexed, margins involute, beige to greenish, bearing a terminal spine, rigid, brown to reddish. Flowers 42–54 mm long, yellowish green; pedicels cylindric, 5–30 mm long; tube 4–10 × 5–8 mm, infundibuliform, tepals in two series, channeled, the external 13–23 × 16–25 mm, oblong to linear, 3–4 mm longer than the internal, margins involute; tepal apex dark brown to reddish, thick, inner series cucullate; filaments 35–45 mm, dorsiventrally flattened, inserted at two levels on the tube, external series 5–7 mm from the base of tube, inner series 4–6 mm from the base of tube; anthers 18–24 mm long, yellow; ovary (20–)24–28(33) mm, largely elliptic. Capsules 27–35 × 13–15 mm, usually oblong, mucronate, dark brown, perianth persistent almost to fruit maturity. Seeds 5–6 × 1–2 mm, lunulate to deltoid, shinny black.

*Distribution and ecology.*—Thus far, *Agave doctorensis* is known only from La Sierra del Doctor, part of the Sierra Madre Oriental, in the municipality of Cadereyta in the east-central zone of the State of Querétaro. The new species grows on gentle slopes and flatlands on a superficial calcareous substrate (INEGI, 1986) in rosette scrub with *Agave salmiana*, *A. americana*, *A. funkiana* K. Koch & C. D. Bouché, and *Condalia mexicana* Schltdl., and also in *Juniperus* forest with *Nolina* and *Opuntia* spp. at elevations between 2400 and 2600 m. Only a few patchy populations are known. However, within the populations individuals are abundant with an apparent stable age structure due to sexual and asexual reproduction.

*Ethnobotany.*—The inhabitants of the Sierra El Doctor refer to *Agave doctorensis* as *maguey mezote*. Ocassionally this species is cultivated in gardens for use in the regional beverages *aguamiel* and *pulque*, mainly prepared from the traditionally domesticated species *A. americana*, *A. mapisaga* Trel., and varieties of *A. salmiana*.

*Etymology.*—The species is named for the Sierra El Doctor where it is endemic.

**Additional specimens examinated. MEXICO**, **Querétaro: Mun. Cadereyta**, 1 km al E de Sombrerete, 20°47'N, 99° W, 2520 m, 12 May 1997, *Magallán y Hernández 57* (ENCB, IEB, MEXU, QMEX); Sombrerete. 20°47'11.8"N, 99°40'09.6"W, 2508 m, 3 Jun 2010, *Magallán, et al. 361* (IEB, MEXU, QMEX).

The division of the genus *Agave* (s. str.) into two subgenera, *Agave* with paniculate inflorescences and *Littaea* with spicate inflorescences (Gentry, 1982; Dahlgren et al., 1985), is

TABLE I
COMPARISON OF *AGAVE DOCTORENSIS* AND THE MORPHOLOGICALLY SIMILAR SPECIES FROM THE MARGINATAE GROUP. (DATA FROM BERGER, 1915; GENTRY 1982; GARCÍA-MENDOZA ET AL., 2007; AND HERBARIUM SPECIEMENS AT MEXU and QMEX).

| | *A. doctorensis* | *A. glomeruliflora* | *A. montium-sancticaroli* |
|---|---|---|---|
| Rosette height | 0.8–1.0 m | 0.2–0.7 m | 1.5–2.0 m |
| Number of leaves | 15–25 | 30–40 | 50–80(–100) |
| Leaf form | widely lanceolate | lanceolate | lanceolate |
| Leaf length: width | 6 times longer than wide | 8 times longer than wide | 9–10 times longer than wide |
| Margin teeth | 1–2(–8) mm | 5–10(–15) mm | 4–6 mm |
| Inflorescence branches | 70–80 | 40–50 | 80–140 |
| Inflorescence bracts | reflexed | erect | erect |
| Inflorescence | dense | lax | lax |
| Inflorescence shape | elongated cone | largely fusiform | fusiform |
| Area of inflorescence flower-covered | 25–30% | 50–60% | 50–60% |
| Flowers per branchlet | 6 or 7 | 10–14 | 10–20 |
| Inflorescence branchlets | 1 main branch, 2 laterals | 2 or 3 branches | umbel |
| Filament insertion | in two levels | at base of tepals | at apex of tube |
| Distribution | east-central Querétaro | Texas and N Coahuila | north-central Tamaulipas |
| Elevation | 2400–2600 m | 1250–1560 m | 150–800 m |

considered paraphyletic (Bogler & Simpson, 1996; Bogler et al. 2006). Because *Agave doctorensis* has a panicle it appears related to *A. glomeruliflora* (Engelm.) Berger and *A. montium-sancticaroli* García-Mend.

The new species differs from *Agave glomeruliflora* in having larger rosettes and leaves, and more inflorescence branches. *Agave doctorensis* differs from *A. montium-sancticaroli* by its smaller rosettes and leaves, and fewer inflorescence branches. The new species differs from both in having fewer leaves per rosette; wider, lanceolate leaves, narrower leaf margins with shorter teeth; a dense inflorescence with a conical shape; reflexed inflorescence bracts; fewer flowers per branch; and insertion of the filaments at two levels in the flower tube. The three species also differ in their distribution (Table I).

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