
Agave temacapulinensis (Agavaceae), a New Ditepalous Species from the Los Altos Region, Jalisco, Mexico

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ABSTRACT. *Agave temacapulinensis* A. Vázquez & Cházaro (Agavaceae) is described and illustrated from Jalisco, Mexico. The new species belongs to *Agave* L. subg. *Agave* and is a member of the Ditepalae group, sensu Gentry. It is related to *A. wocomahi* Gentry in terms of its rosette size, solitary habit in most cases, the smooth texture of the leaves, the red-tipped dimorphic tepals, and the deep floral tube. *Agave temacapulinensis* differs from *A. wocomahi* in having light gray, glaucous rosettes (vs. dark green to glaucous green); short acuminate leaves (vs. long acuminate); crenate margins (vs. straight to undulate) with smaller marginal teeth (8–10 mm vs. 10–20 mm); larger panicles (5.5–6.5 m vs. 3–5 m) with more lateral branches (16 to 18 vs. 8 to 15); and smaller seeds (5–6 × 3–4 mm vs. 7 × 4.5–5 mm).

RESUMEN. Una nueva especie, *Agave temacapulinensis* A. Vázquez & Cházaro (Agavaceae), es descrita e ilustrada de Jalisco, Mexico. Pertenec a *Agave* L. subg. *Agave* y corresponde al grupo Ditepalae sensu Gentry. La especie está relacionada con *A. wocomahi* Gentry en términos de tamaño de roseta, hábito no surculoso en la mayoría de los casos, textura suave de las hojas, tépalos dimórficos con puntas rojizas y tubo floral profundo, pero difiere de ésta última por poseer rosetas de color glauco-gris claro (vs. verde oscuro-verde glauco); hojas cortamente acuminadas (vs. largamente acuminadas); márgenes crenados (vs. rectos a ondulados); con dientes más pequeños (8–10 mm vs. 10–20 mm); panículas más grandes (5.5–6.5 m vs. 3–5 m) con

más ramas laterales (16 a 18 vs. 8 a 15); y semillas más pequeñas (5–6 × 3–4 mm vs. 7 × 4.5–5 mm).

Key words: *Agave*, Ditepalae, IUCN Red List, Jalisco, maguey blanco, Temacapulín, western Mexico.

Western Mexico is the richest center of diversity of the genus *Agave* L., with 37 species (Vázquez-García et al., 2007). In North America the most species-rich regions are in Mexico, specifically in the states of Oaxaca with ca. 30 species (García-Mendoza, 2004), Jalisco with 28 species (Vázquez-García et al., 2007), and Durango with 27 species (González-Elizondo et al., 2009).

Two species of *Agave* are native to the Río Verde canyon at the El Zapotillo dam project area, both from the Cañadas de Obregón and Mexicacán municipalities in the Los Altos region of Jalisco. *Agave angustifolia* Haw. is a wide-ranging century plant from Mexico to Costa Rica, confined to volcanic, basaltic rocks. The second, an undescribed species, is confined to calcareous outcrops at the ecotones between the *Juniperus* L. forest, thorn forest, and *Taxodium* Rich. gallery forest. Initial observations on the vegetative populations of this undescribed *Agave* were recorded by Ingeniero Oscar Valencia at Acasico, Mpio. Mexicacán, in 2009 (Miguel Cházaro, pers. comm.). On 5 May 2010, flowering specimens collected in the vicinity of Palmarejo, Mpio. Cañadas de Obregón (Vázquez-García & Cházaro 9070, IBUG, MEXU), revealed its medium-sized panicles with dimorphic tepals, allow-

ing its placement in *Agave* subg. *Agave* as a distinct new species of group Ditepalae sensu Gentry.

Agave temacapulinensis A. Vázquez & Cházaro, sp. nov. TYPE: Mexico. Jalisco: Cañadas de Obregón, Bajío de Temacapulín, camino hacia Palmarejo, 1670 m, 10 June 2011 (fl., cult. at Vázquez-García's home), *Vázquez-García with Cházaro 9092* (holotype, IBUG; isotypes, MEXU, MICH, MO). Figure 1.

Species nova *Agave wocomahi* Gentry similis, sed ab ea foliis glauco-griseis (vs. atroviridibus vel glaucis) breviter (vs. longe) acuminatis margine crenato (vs. recto vel undulato) dentibus minoribus (8–10 vs. 10–20 mm longis), panicula majore (5.5–6.5 vs. 3–5 m alta) ramis lateralibus numerosioribus (16 ad 18 vs. 8 ad 15) et semina minoribus (5–6 × 3–4 vs. ca. 7 × 4.5–5 mm) differt.

Rosettes 80–115 × 172 cm, open, closed or compact, single to occasionally surculose, glaucous to light gray, with 20 to 25 leaves. Leaves 55–90 × 10–20 cm, ovate to lanceolate, well armed, firm and smooth; margin crenate; marginal teeth 8–10 × 7 mm, variously flexed, usually upward and born from broad bases, 15–21 mm apart from each other at mid-leaf, 12–29 mm apart distally, closely dentate (6–10 mm apart) proximally; apical spine 35–45 × 9 mm, flexuous, black to bluish gray, channeled and long-decurrent. Inflorescence an open panicle, stalk 5–6.5 m tall, 17 cm diam. at the base; with 16 to 18 lateral branches in upper 2/5 of stalk, the lateral flowering branches (composite umbels) 20–22 cm long (including the flowers) × 16–17 cm wide, reddish to yellowish green at anthesis (the lateral fruiting branches 44–49 × 38–40 cm), the bracts 20 × 3 cm, triangular, persistent, mostly reflexed, scabrous, 4–11 cm apart. Flowers 50 to 70 per lateral branch (composite umbel), 60–71 × 12 mm, reddish at the tip in bud and bright yellow at anthesis. Floral tube 9–15 × 8–9 mm, equal to or longer than tepals; tepals dimorphic, drying leathery, persisting erect, the outer tepal lobes 10–15 × 5–6 mm, the apices red, corneous, the inner tepal lobes 12–13 mm long, with white indumentum (puberulent) and galeate at apex; thinner at the margins and a prominent longitudinal central keel abaxially, along almost the entire tepal lobe, except at the apex; stamens with filaments inserted unequally in mid-tube, those of the outer tepals inserted 1 mm higher, at 10 mm above the receptacle, yellow; anthers 21 × 2.5 mm, linear, yellow; ovary 17 × 5 mm, the neck 7 × 3 mm, style slender, yellow, the stigma clavate, trilobate and glandular, longer than the stamens post-anthesally. Fruit a capsule 40–51 × 14–18 mm, oblongoid to obovoid, stipes 2–8 mm, carpels 40–51 × 13–16 mm;

seeds 5–6 × 3–4 mm, subcircular to semicircular or triangular, black, shiny, and wingless.

Distribution and ecology. *Agave temacapulinensis* has only been found in the Río Verde drainage at the municipalities of Cañadas de Obregón and Mexitacán; therefore, it appears endemic to the state of Jalisco. *Agave temacapulinensis* grows in calcareous outcrops, at ecotones between the *Juniperus*, thorn, and *Taxodium* gallery forests, at elevations of 1600–1700 m. Associated species include *J. coahuilensis* (Martínez) Gaussen (Cupressaceae), *Prosopis laevigata* (Humb. & Bonpl. ex. Willd.) M. C. Johnst. (Fabaceae), *Yucca australis* (Engelm.) Trel. (Agavaceae), *Taxodium mucronatum* Ten. (Taxodiaceae), *Vachellia schaffneri* (S. Watson) Seigler & Ebinger (Mimosaceae), *Stenocereus queretaroensis* (F. A. C. Weber) Buxb., *Opuntia jaliscana* Bravo, *Mammillaria sempervivi* DC., *M. densispina* (J. M. Coult.) Orcutt (all Cactaceae), and *Lobelia laxiflora* Kunth (Campanulaceae). In the municipality of Jalostotitlán, a few individuals of *A. temacapulinensis* were found growing in a backyard, but none occurred as a wild population there.

The deep floral tube of *Agave temacapulinensis* holds large amounts of nectar. The flowers were heavily visited by four different species of hummingbirds from 7:30 AM to 9:30 AM and less frequently during the rest of the day. Usually only one individual hummingbird visited a flower at a time. The flowers were also visited by two or more individuals of bats from 8 PM to 11 PM. The tepals of this species are erect and become firm and leathery, perhaps to protect the nectar or to provide a platform for bats to hold onto. However, this assumption is yet to be tested.

Phenology. *Agave temacapulinensis* was observed in flower from May to June; fruiting began in June.

Etymology. The species is named after the village Temacapulín, a small town that will be severely impacted by the El Zapotillo dam project.

Ethnobotany. *Agave temacapulinensis* is locally known as maguey blanco at the Mexitacán municipality (Vázquez-García, pers. obs.), where it is used to relieve internal pain from contusions and as an anti-inflammatory alternative. The leaves of *A. temacapulinensis* are used to envelop fish in cooking.

IUCN Red List category. The habitat of *Agave temacapulinensis* is heavily degraded, with the vegetation cover mostly depleted for agricultural and livestock expansion. However, a greater threat

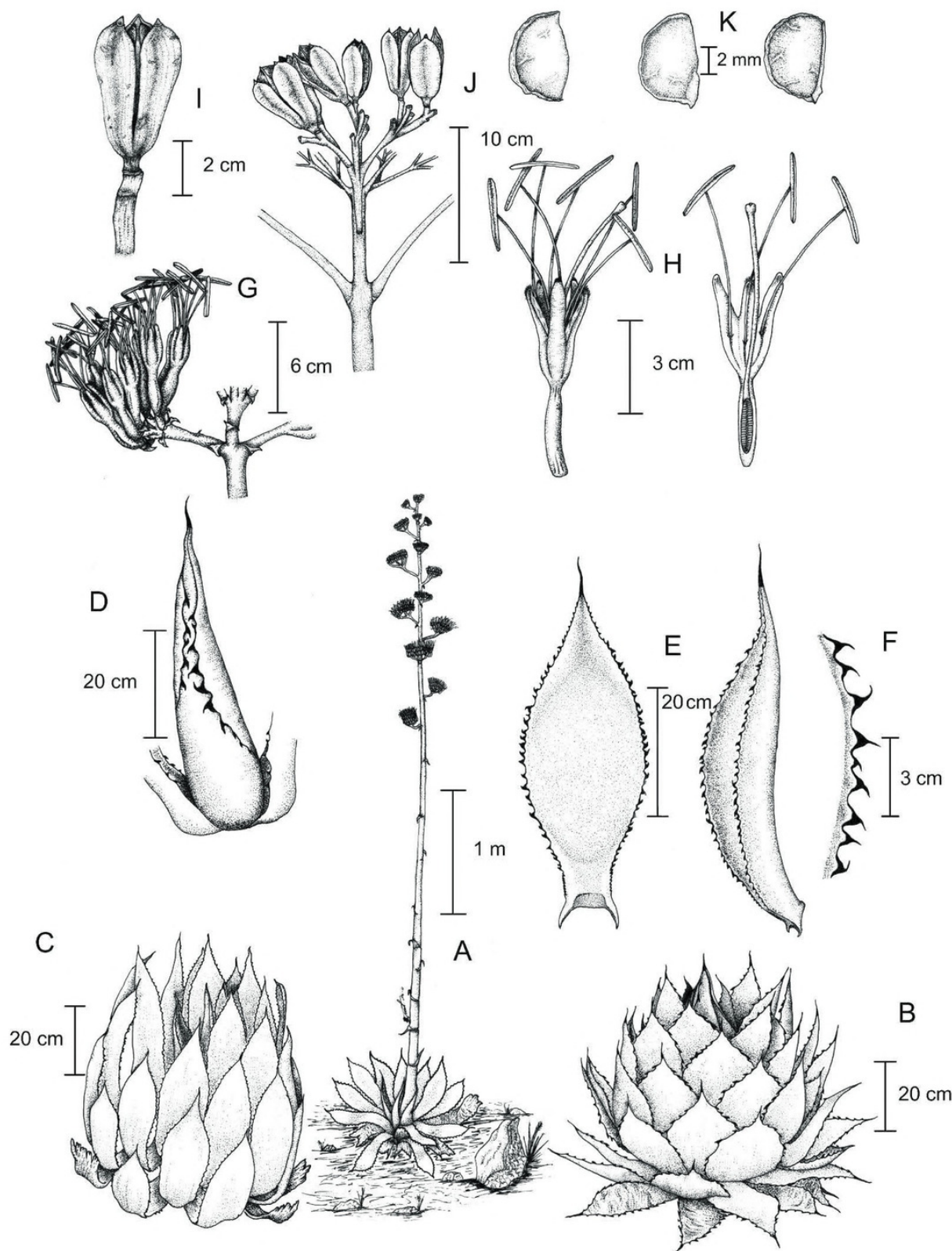


Figure 1. *Agave temacapulinensis* A. Vázquez & Cházaro. —A. Flowering plant (Vázquez-García with Cházaro 9070 [IBUG]). —B, C. Rosettes (from Bajío de Temacapulín; photographs by Jesús Trujillo and Antonio Vázquez, respectively, 2011). —D. Central leaves. —E. Left, adaxial leaf surface; right, lateral view of leaf. —F. Blade margin (D–F from Sagrado Corazón de Jesús, Mexiticacán; photographs by Antonio Vázquez, 2011). —G. Peduncle with flowers. —H. Left, lateral view of flower; right, longitudinal section (G and H from Vázquez-García with Cházaro 9092 [IBUG]). —I. Mature capsule. —J. Peduncles with capsules. —K. Seeds, lateral view (I–K from Vázquez-García with Cházaro 9098 [IBUG]).

Table 1. *Agave temacapulinensis* contrasted with related species of the Ditepalae group sensu Gentry. Data for *A. wocomahi* and *A. durangensis* from Gentry (1982).

Characters or environmental factors	<i>A. temacapulinensis</i>	<i>A. wocomahi</i>	<i>A. durangensis</i>
Habit	single to occasionally surculose	single	single to surculose
Rosette color	glaucous to light gray	dark green to glaucous green	glaucous gray
Leaf texture	smooth	smooth	rough
Margin shape	crenate	straight to undulate	crenate, mammillae
Teeth	8–10 mm, variously flexed, usually upward	10–20 mm, downflexed tips below mid-blade	10–20 mm, variously flexed
Spine	35–45 mm, flexuous, channeled above, long-decurrent, black to bluish gray	30–60 mm, stout, flattened or hollowed in a broad groove above, short or long-decurrent, black to bluish gray	40–60 mm, strong, broadly channeled above, pruinose gray over brown
Panicle	5.5–6(6.5) m	3–5 m	7–8 m
Lateral flowering branches	16 to 18	8 to 15	18 to 30
Capsules	40–51 × 14–18 mm	50–60 × 15 mm	45–60 × 16–18 mm
Seeds	5–6 × 3–4 mm	7 × 4.5–5 mm	4.5–6 × 3.5–4.5 mm
Elevation	1600–1700 m	1400–2500 m	1700–2600 m
Mean annual rainfall	553–700 mm	1076 mm	483.5 mm
Flowering peak	May–June	July–Sep.	July–Sep.
Habitat	calcareous substrate, <i>Juniperus</i> forest, thorn forest, and <i>Taxodium</i> gallery forest	calcareous substrate, pine-oak forest	volcanic (basaltic) substrate,* grassland, pine-oak forest, and occasionally tropical dry forest*

* Data from González and Galván (1992).

to these populations is the El Zapotillo dam project, which may flood nearly its entire habitat. *Agave temacapulinensis* is locally abundant, but is regionally rare. Thus, the new species is recommended for listing under the Mexican endangered species act (NOM-059-SEMARNAT, 2010) under the Special Protection category. A preliminary assessment of the conservation status of *A. temacapulinensis*, in accordance with the IUCN Red List Categories and Criteria (IUCN, 2001), suggests this species should be included in the category of Critically Endangered (CR), based on population reduction estimated to be greater than 80% projected for the near future (up to 10 years), based on direct observation. This conservation assessment is also based on a decline in area of occupancy, the extent of occurrence, and habitat quality, since the El Zapotillo dam project may flood almost its entire native habitat, as well as actual and potential levels of exploitation. The known extent of the occurrence of *A. temacapulinensis* is approximately 90 km² (between 102°42'–102°48'W and 21°09'–21°14'N), its area of occupancy is less than 10 km², the habitat is severely fragmented, and there are continuing declines in the observed number of mature individuals, their area of occupancy, and habitat quality.

Discussion. *Agave temacapulinensis* shares characters typical for the informal species group Ditepalae, sensu Gentry, which include the light glaucous rosettes, dimorphic tepals, and deep floral tube (Table 1). The new species is morphologically similar to *A. wocomahi*, in terms of the rosette size, solitary habit in most of the observed cases, smooth texture of leaves, and red-tipped, dimorphic tepals. *Agave temacapulinensis* differs from *A. wocomahi* in having the rosettes glaucous to light gray (vs. dark green to glaucous green), the leaf margins crenate (vs. straight to undulate), the leaf marginal teeth 8–10 mm (vs. 10–20 mm), the flowering stalks 5.5–6.5 m (vs. 3–5 m), the lateral branches more numerous, with 16 to 18 (vs. 8 to 15), the smaller seeds 5–6 × 3–4 mm (vs. 7 × 4.5–5 mm). *Agave temacapulinensis* has a flowering peak in late spring to early summer and grows in the ecotones between *Juniperus*, thorn, and *Taxodium* gallery forests, with a mean annual rainfall of 553–700 mm. This contrasts with *A. wocomahi*, which has a flowering peak in mid- to late summer and grows in pine-oak forest, with a mean annual rainfall of 1076 mm (Gentry, 1982; McVaugh, 1989). The new species is also morphologically similar to *A. durangensis* Gentry, in terms of overall size (80–115 cm tall) and color (glaucous to gray) of the rosettes, the red-tipped, dimorphic flowers, as well as the size

of the capsules ($4\text{--}5.1 \times 1.4\text{--}1.8$ cm vs. $4.5\text{--}6 \times 1.6\text{--}1.8$ cm, respectively) and seeds ($5\text{--}6 \times 3\text{--}4$ mm vs. $4.5\text{--}6.0 \times 3.5\text{--}4.5$ mm). However, the new species differs from the latter in having leaves with a smooth texture (vs. rough), marginal leaf teeth 8–10 mm (vs. 10–20 mm), as well as the flowering stalk 5–6.5 m (vs. 7–8 m), and lateral branches only 16 to 18 (vs. 18 to 30). *Agave temacapulinensis* has a flowering peak in late spring to early summer and grows at 1600–1700 m on calcareous substrate in the ecotones between *Juniperus*, thorn, and *Taxodium* gallery forest. This contrasts with *A. wocomahi*, which has a flowering peak in mid- to late summer and grows at 1700–2600 m, and occurs on volcanic basaltic substrate in open grassland, pine-oak, or tropical dry forest (Gentry, 1982; McVaugh, 1989).

Hernández-Vera et al. (2007) previously determined a specimen as belonging to the Ditepalae species group, sensu Gentry, from Lagos de Moreno, Jalisco, as *Agave wocomahi* (Hernández-Vera et al. 39; IBUG). However, that specimen has not been found at IBUG, and thus cannot be verified. Furthermore, additional material from the boundaries of Lagos de Moreno and Ojuelos, Jalisco, are identified as *A. asperima* Jacobi by Vázquez-García et al. (2007), which is a common Chihuahuan Desert species, also abundantly found in the state of Aguascalientes (De La Cerda, 2004). Thus, it is not clear for now if *A. temacapulinensis* represents the first or the second record of group Ditepalae for Jalisco. Further fieldwork and fertile material are needed to clarify this matter.

Paratypes. MEXICO. **Jalisco:** Mpio. Cañadas de Obregón, camino de Palmarejo a Cofradía, 1690 m, 5 May 2010 (fl.), Vázquez-García with Cházaro 9070 (IBUG, MEXU); Mpio. Cañadas de Obregón, Barranca del Río Verde, entre Temacapulín y Palmarejo, 12 June 2010 (fr.), Cházaro with López-V. 9817 (IBUG, IEB, XAL) [distributed as *Agave americana* var. *expansa* (Jacobi) Gentry]; Mpio. Cañadas de Obregón, camino El Zapotillo al Río Verde, 24 Apr. 2011 (st.), Vázquez-García with Cházaro 9093 (IBUG); Mpio. Cañadas de Obregón, Bajío de Temacapulín, camino hacia Palmarejo, 1670 m, 24 Apr. 2011 (fr.), Vázquez-García with Cházaro 9098 (IBUG); Mpio. Jalostotitlán, 30 Apr. 2011 (sterile, cult.), Vázquez-García with Cházaro 9099 (IBUG); Mpio. Mexxicacán, márgenes del Río Acasico, 24 Apr. 2011 (sterile), Vázquez-García with Cházaro 9094 (IBUG).

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