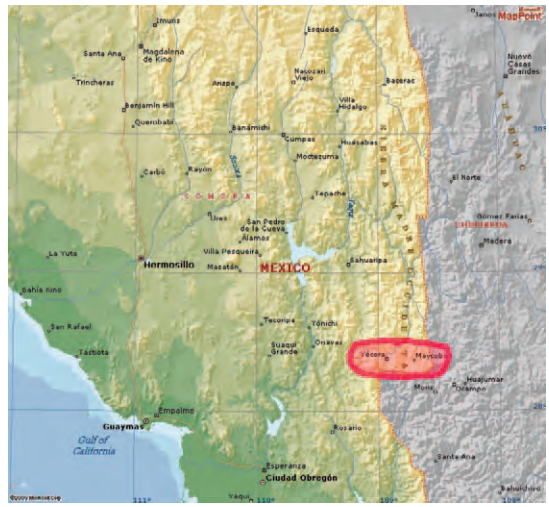
Agave parviflora subspecies *densiflora*

A newly found treasure from the Sierra Madre in Eastern Sonora, Mexico

In the early 1980s, while still a student at the University of Arizona, I found work in the windowless, subterranean lair called the herbarium, which is basically a library of dried plants. It was there that I first became entranced by the stories spun by my co–worker, George Yatskievych, of the beautiful and intriguing plants found near the town of Yécora in the Sierra Madre Occidental, east–central Sonora, Mexico. George spun tales of the many hummingbird and butterfly–attracting plants as well as the rich variety of little–seen cacti and succulents. During spring break of 1982, George and I decided to venture into the rugged mountains of eastern Sonora with the hopes of reaching the now near–mythical plant paradise of the Yécora area.



The valiant explorers headed east out of Hermosillo on Mexico's Highway 16, which at that time looped up into the mountains through the towns of San Nicolas, Nuri, and Santa Ana before returning to the lowlands near Ciudad Obregon. Upon reaching San Nicolas we inquired about the road to Yécora, and were told to "follow the school bus." We proceeded along a bumpy, rutted, one lane dirt road at a snail's pace, barely hopeful of reaching our goal some 40 km away. After driving for what seemed like several hours, we concluded that somewhere, we missed a turn and had actually crossed into Chihuahua without ever seeing Yécora. Dejected, we turned back, and started the long trek back to the paved highway and civilization.

Fast forward 16 years to 1998, when my friend Art Douglas rekindled the desire to visit the Yécora area and the mountains of east–central Sonora with stories of rich, lush vegetation, and an interesting mix of agaves in the region (Map 1). I had heard Tom Van Devender and Ana Lilia Reina had begun an intensive survey of the Municipio (county) de Yécora in 1995, so I sought his advice. Tom fueled my desire to make another attempt at reaching Yécora by telling me of a new logging road that cut through the mountains. So I recruited a couple of traveling buddies, Ron Gass and Dave Palzkill, and set off to explore the spot I'd missed seeing nearly 20 years before.

We easily found the new logging road paved through the mountains. And although a full day's drive from Tucson, Yécora was actually easy to find. We spent much of the next day scouring the immediate vicinity, looking primarily for *Agave wocomahi* and a few other treasures as we slowly

DIAGNOSIS & DESCRIPTION

Agave parviflora* Torr. subspecies *densiflora G. Starr & T.R.Van Devender, *subspec. nov.* Planta perennis, prolifera, rosettis plietesialibus, acaulis, rosula parva, compacta, 30 cm alta, 35–40 cm diametro; foliis 15 cm longis, 1.8–1.9 cm latis, spina terminalis 5–8 mm longa; inflorescentia 2.0–2.1 m alta; flores 16–18 mm longi, ovarium 5–8 mm longum, perianthii tubo 5–7 mm longum, tepala 2–3 mm longa, filamenta 12–13 mm longa.

Holotype: Mexico: Sonora: Municipio de Yécora. Tributary of Arroyo Los Pilares near bridge, 24.7 km west of Maycoba on MEX 16, oak woodland with scattered pines in shady, narrow, steep stream canyon, 28°23′40″N 108°47′35″W, 1300 m elevation, uncommon (3–4 clumps) cloning (1–5 suckers) rosettes on indurated mudflow deposits in 3–4 steep box canyons in same area, plants flowering at 30–40 cm diameter, *A.L. Reina G. 98–1892, T.R. Van Devender,* 26 Sep 1998. Holotype: ARIZ, isotypes: DES, MEXU, MO, USON.

Paratypes: Sonora: Municipio de Yécora Restaurant La Palmita, 9.5 km west of Restaurant Puerto de la Cruz on MEX 16 (KM 258 east of Cd. Obregón), north side of Mesa del Campanero, oak woodland, 28°22′18″N 109°03′53″W; 1460 m elevation, uncommon on edge of arroyo, *Rubén Coronado* (*A.L. Reina 2004–589A, T.R. Van Devender*, ARIZ), 26 May 2004; Cueva Ahumada, Rancho El Trigo, 15.3 km (by air) southwest of Maycoba, rocky grassland; 28°18′59″N 108°47′31″W (NAD 27, MEXICO); 1423 m elevation, rare to locally uncommon spicate agave on Baucarit formation volcanic mud flow deposits; inflorescence ca. 1.65 m, *A.L. Reina G. 2008–184, T.R. Van Devender, Z. Espinosa–G.*; ARIZ, photovouchers: ARIZ, ASU, DES, HCIB, MEXU, TEX, USON, UTEP), 14 May 2008.

Additional locality: Sonora: Municipio de Yécora: Rancho La Pinosa, 10.3 km west of Maycoba on MEX 16, ca. 1.5 km north of highway; pine–oak forest; 28°24′47″N 108°43′24″W, 1600 m elevation, on rocky hill slopes and rock outcrops with *A. polianthiflora*, flowers yellow, *R.S. Felger 94–228, M.F. Wilson, G.M. Ferguson, M.E. Fishbein, S. McMahon*, (specimens confiscated at border), 4 July 2004.

worked our way further and further from town. We stopped at seemingly every *Agave polianthiflora*, *Agave shrevei* and *Agave wocomahi* we encountered on our route, and late in the afternoon reached an intriguing outcropping with many nooks and crannies just begging to be explored. As the sunlight was fading, I spotted what I took to be *Agave schidigera*, which was not recorded from the area. I collected a handful of seed as allowed by the import permit, and grew a few plants. These were short–lived agaves which flowered within four years and provided enough material to determine that we actually had a new subspecies of *Agave parviflora* on our hands.

Unique flora of Municipio De Yécora

As a result of Tom and Ana Lilia's field work in the Municipio de Yécora there has been a significant increase in the knowledge of this area. The Municipio encompasses 3300 km^2 and ranges from foothill thornscrub at 460–550 m elevation near Curea, tropical deciduous forest from 500–1160 m, a mosaic of oak woodland from 1050–1700 m, and pine–oak forest from 1220–2240 m. Grassland occurs in high valleys at 1200–1700 m, and mixed–conifer forest with Durango Fir (*Abies durangensis*) is restricted to 1900–2100 m in Barranca El Salto on the west side of Mesa del Campanero.

The flora of Yécora is substantially more diverse than the floras of the Huachuca Mountains and other Arizona "sky island" ranges. The region harbors some 1696 plant taxa and is rich in endemic species and taxonomic novelties. Many new species have been discovered and described from the Municipio de Yécora since 1995, including *Boerhavia traubae*, *Croton yecorensis*, *Eleocharis yecorensis*, *Erigeron reinana*, *Menodora yecorana*, *Mimulus yecorensis*, *Pectis vandevenderi*, *Pinus yecorensis*, *Portulaca yecorensis*, and *Tridax yecorana*. We add another to this botanically rich area by describing a new subspecies of *Agave parviflora*. We also provide an expanded description of *Agave parviflora* and revise the key to section Parviflorae.

KEY TO THE GROUP PARVIFLORAE

1. Flowers small, 12–25 mm long; the filaments inserted at or near the base of the tube 2
1. Flowers larger, 30–42 mm long; filaments inserted above the base of the tube..... 6

2. Flowers 12–18 mm long; the tepals much shorter than or about as long as the tube 3
2. Flowers 18–25 mm long; the tepals twice as long as the tube 5

3. The tube twice as long as the tepals; flowers not reflexed 4

1 & *2* The small rosette of *Agave parviflora* has thick, dark green leaves with distinctive white "bud prints" on both the top and bottom surfaces and uniformly curled white marginal fibers.

3. The tube and tepals about equal in length; flowers reflexed. . . . . *A. parviflora* ssp. *flexiflora*

4. Flowers 2–4 per node, leaves 6–10 cm long, 0.8–1.0 cm wide . . . . . *A. parviflora* ssp. *parviflora*.
4. Flowers up to 6–8 per node, leaves 15 cm long, 1.8–1.9 cm wide. . . . . *A. parviflora* ssp. *densiflora*.

5. Leaves larger, 20–30 cm long, 1.5–2.0 cm wide, 40–70 leaves per mature rosette, margins without denticles . . . . . *A. toumeyana* var. *toumeyana*
5. Leaves smaller, 6–15 cm long, 0.6–0.8 cm wide, 100–200 leaves per mature rosette, margins denticulate below mid–leaf . . . . . *A. toumeyana* var. *bella*

6. Flowers pinkish red, tube 22–32 mm long; leaves linear lanceolate, 10–20 cm long, 1.0–1.3 cm wide . . . . . *A. polianthiflora*
6. Flowers yellow, tube 9–14 mm long; leaves linear, 20–50 cm long, 0.7–2.5 cm wide. 7

7. Leaves yellowish green to green, narrowly linear, 20–50 cm long, 0.7–1.2 cm wide . . . . . *A. schottii* var. *schottii*
7. Leaves deep green, linear, 20–50 cm long, 1.7–2.5 cm wide. . . . . *A. schottii* var. *trealesei*

Expanded description for *Agave parviflora*

Agave parviflora is a small, single, or caespitose rosette succulent to 10–15 cm tall by 15–40 cm across (Fig. 1). The dark green leaves are 6–15 cm long by 0.8–1.6 cm wide with conspicuous white stripes, white filiferous margins, and a weak–subulate terminal spine 5–8 mm long. The 1.0–2.1 meter inflorescence is loosely to densely covered with small, pale yellow to light greenish–yellow flowers, 12–18 mm long. The ovary is 4–8 mm long by 3–5 mm wide; neck 1–2 mm long; tube 5–7 mm long; tepals 2–3 mm long by 1.5–4 mm wide, the outer slightly longer than inner, the inner constricted near the tube and nearly orbicular; filaments 10–13 mm long, pinkish red, inserted at base of tube; anthers yellow, 5–6 mm long (Fig. 2); capsules orbicular, 6–8 mm long by 6–10 mm wide, sessile to short pedicellate, with a short beak. Seeds half rounded; wedged like an orange segment: thinner on the inner edge, thickened on the outer, curved edge; 3–3.5 mm long by 2–2.5 mm across.

An overview of the Parviflorae Group

Agave expert Howard Gentry (1982) outlined the Parviflorae section of *Agave* with just four species, two subspecies and one variety, for a total of seven taxa. The name Parviflorae is derived from parv– the Latin for small and flor– Latin for flower, and is in reference to the small flowers of all the species in the section. The group's distribution lies within Arizona, New Mexico, Sonora, and Chihuahua. With this new subspecies of *Agave parviflora*, the total number of taxa (species and subspecies) is now eight.

Parviflorae is distinguished by the small, highly modified flowers, each with a relatively elongated tube compared to the tepals. *Agave parviflora* has the shortest tube at 5 mm long with the tepal length of 2–3 mm, while *A. polianthiflora* has the longest tube at 22–32 mm with the tepal length of 4–7 mm. This flower shape is linked to specific pollinators. Schaffer and Schaffer (1977) indicate that carpenter bees and bumblebees pollinate both *Agave parviflora* and *A. toumeyana*, while Howell (1972) states that bats and bees visit the flowers of *A. schottii*. The long, tubular, red flowers of *Agave polianthiflora* are obviously pollinated by hummingbirds, which I have seen visiting those highly specialized flowers with regularity when my own plants are in bloom.

All the species in the group are small plants, ranging from 15–40 cm across. Some dwarf forms of *Agave toumeyana* var. *bella* and *Agave parviflora* ssp. *parviflora* make the smallest rosettes in the group, reaching 15–20 cm across, barely filling out a 15 cm (6 inch) nursery pot, but with the addition of subspecies *densiflora* the maximum size range for *Agave parviflora* is increased to about 40 cm wide. Although the size ranges from 20–30 cm across, *Agave polianthiflora* rarely fills out a typical 20 cm (8 inch) nursery pot, and rivals *A. parviflora* for the distinction of being the smallest plant in the group. Individual rosettes of *Agave schottii* and *A. toumeyana* both reach 30–50 cm across but can make clusters to 60–80 cm in diameter. Each has narrow, light green to dark green, white–bud–printed leaves variously shaped from linear (the same width from base to apex) to lanceolate (slightly wider below the middle) to oblanceolate (slightly wider above the middle). Leaf margins are minutely toothed at the base or lack teeth completely, instead having white marginal fibers. Terminal spines are small and weak, easily breaking off in fingers of

3 A plant of *Agave parviflora ssp. densiflora* with a developing inflorescence. *4* *Agave parviflora* ssp. *densiflora* has flowers in clusters of 6–8 densely packed along the shaft instead of the flower clusters of 2–4 on the more laxly flowered shaft of typical *Agave parviflora*. *5* Flowers and inflorescence of *A. parviflora ssp. parviflora*, for comparison with those of *ssp. densiflora* in Fig. 4.

unsuspecting victims. Inflorescences are racemose or spicate, meaning the flowers are either solitary and on short pedicels attached to the main stalk or in groups of 2–8 with those groups on short stalks that are attached to the main stalk.

Species descriptions and habitat notes

Agave parviflora

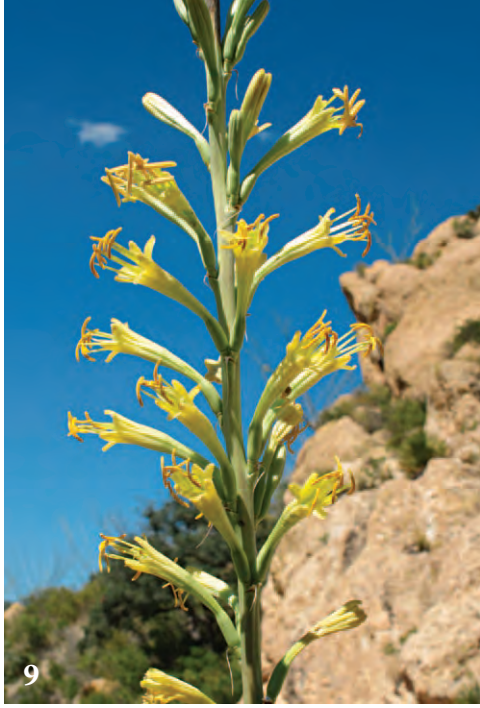
Agave parviflora was originally described by physician, systematist, and botanical author John Torrey

6 Although difficult to distinguish from *A. parviflora* without the flowers, *Agave polianthiflora* leaves tend to be more acuminate at the tip and widest at or below the middle. *7* The distinctive red flowers readily separate *Agave polianthiflora* from all other members of the Parviflorae.

(1859), from a specimen collected by Arthur Schott, a German born scientist, while accompanying William Emory on an 1855 survey of the US–Mexico border. It mostly occurs west of Nogales in Coronado National Forest, Santa Cruz County, Arizona. The plants are generally single (rarely do they produce offsets) with the small rosettes reaching just 10–15 cm tall by 15–40 cm across. The dark green leaves are widest at or above the middle, and beautifully bud printed in white on both surfaces. The margins are decorated with conspicuous white fibers that grow up and generally curl back towards the base. *Agave parviflora* ssp. *parviflora* is often hidden among short grama grasses (Fig. 2), in gravelly clay soil of volcanic origin, or on bare, rocky slopes and ledges in oak woodlands and grasslands from 600–1400 meters (2000–4600 feet) elevation.

In 1972, Gentry named a population from near Huasabas (270 km southeast of the Pajarito Mountains) in northeastern Sonora as *A. parviflora* subspecies *flexiflora*, which differs from subspecies *parviflora* in having downward flexed flowers, longer tepals, and frequently longer leaves. This subspecies is found tucked in among boulders in grasslands and oak woodland from about 600–1200 meters (2000–4000 feet) elevation.

Our new taxon is placed as a subspecies of *Agave parviflora* based on the flower dimensions and the filament insertion at the base of the tube. It is distinguished from subspecies *parviflora* and subspecies *flexiflora* by its larger leaf size (Fig. 3) and more densely crowded flower stalk, from which its name is derived (Fig. 4, 5). The few known populations of subspecies *densiflora* consist of few plants that are found growing at the base of large granitic boulders east of Yécora in southeastern Sonora. This locality extends the range of *Agave parviflora* by about 175 km kilometers south. This subspecies grows in grassland and oak woodland from 1300–1600 meters (4265–5250 feet) elevation.



8 The leaves of *Agave schottii* are longer with more taper towards the tip than those of *A. parviflora*, with thinner, more irregular marginal fibers, while the rosette has a more open appearance. *9* Even though the green and yellow flowers of *Agave schottii* have a similar shape, they attract bees and bats as pollinators, instead of hummingbirds like the showy red, tubular flowers of *Agave polianthiflora*.

Agave polianthiflora

Agave polianthiflora, described by Gentry (1972), is small agave common in the Yécora area. The plants have single or multiple small rosettes reaching 8–20 cm tall by 12–30 cm across. Linear lanceolate leaves are 10–20 cm long by 1–1.3 cm wide, widest at or near the middle, white bud printed on both surfaces, the margins with minute teeth near the base and conspicuous white fibers in the upper half (Fig. 6). The spicate inflorescence can get about two meters tall and is loosely covered in the upper half with 4 cm long, pinkish red, tubular, hummingbird–attracting flowers (Fig. 7).

Plants of *Agave polianthiflora* grow on exposed rocky outcrops in pine and oak forests between 1220–1980 meters (4000–6500 feet) elevation mostly in the Sierra Madre Occidental of western Sonora and eastern Chihuahua with a couple localities further east in central Chihuahua.

Agave schottii

John Torrey (1859) first described what we now know as *Agave schottii* as *A. geminiflora* var. *sonorae*. George Engelmann (1875) determined that the plant in question was an entirely different species and named it for Arthur Schott, collector of the original specimen.

These plants are highly caespitose and form large clumps up to one meter or more across. Individual rosettes are 30–50 cm across, with linear, straight, or slightly curved leaves (Fig. 8). Leaf margins are toothless, instead having sparse, thin, brittle fibers while the terminal spine is short, thin, weak, and brittle. The spicate inflorescence reaches about 2–2.5 meters with 4 cm long, yellow flowers in the upper half of the shaft (Fig. 9). The variety *treleasei* is on shaky ground at best, differing from typical *A. schottii* by the, "larger, deep green, thicker, wider leaves" (Gentry 1982).

Agave schottii is found in grassland and oak woodland in southern Arizona, extreme southwestern New Mexico and northern Sonora from 884–2000 meters (2900–6560 feet) elevation.

Agave toumeyana

William Trelease (1920), at one time the director of the Missouri Botanical Gardens, described *Agave toumeyana* from a specimen collected by James Toumey in the Pinal Mountains of central Arizona.

Another caespitose species, *Agave toumeyana* can form clumps 60–90 cm across. Individual rosettes reach 15–40 cm tall and 20–60 cm across, with many thin, light green to medium green leaves. Leaves are linear lanceolate, straight, or slightly curved, white bud–printed on both surfaces, very

10 The rosettes of *Agave toumeyana,* as seen here on the Barnhardt Trail in Arizona, are denser with more leaves, and the marginal fibers are thinner and less uniform than those of *A. parviflora* and *A. polianthiflora*.

minutely serrulate along the margin at the base, and with thin, white fibers from the middle towards the tip. Leaf length varies from 15–46 cm long by about 1.5–2 cm wide, tapering to the 1–2 cm long terminal spine (Fig. 10). The slender, spike–like inflorescence appears in late spring to early summer, reaches 1.5–2.5 meters tall, and is covered with 2.5 cm–long greenish and white flowers in the upper one–third of the shaft. Variety *bella* differs in that the rosette is smaller (10–40 cm across) and more compact, with numerous white markings on the leaves. Some nurseries are busy selecting forms that are the most dwarf and most densely covered with white on the leaves.

Agave toumeyana is found only in central Arizona, from 1960–5575 feet elevation, growing on limestone and volcanic rock with high–desert vegetation, into chaparral, and even creeping into the lower elevation pine tree habitats. The variety *bella* is found on open, gravelly to rocky slopes with desert scrub, chaparral and juniper woodlands, between 2625–5575 feet elevation in mountains of central Arizona.

Growing *Agave parviflora* ssp. *densiflora*

Agave parviflora ssp. *densiflora* has narrow, dark green leaves decorated with intricate white markings. Leaves lack teeth along the edges, instead being adorned with thin, white, curly fibers and a short, yet sharp terminal spine. As with many agave species, this one can be grown in full sun, although in the hot climate of Phoenix, it benefits from light afternoon shade in the summer. The moderately fast growing plant can reach its mature size of 30 cm tall by 35–40 cm across anywhere from 5–10 years, depending on the amount of water it receives. The plants require very little water once established in the landscape, being able to survive with minimal summer supplemental water in Tucson, where the average annual rainfall is about 27–30 cm (11–12 inches). The key to growing them successfully seems to be to keep the soil from becoming soggy for an extended period. The plant blooms in the spring and early summer and has typical *Agave parviflora* flowers; however it is readily distinguished from typical *A. parviflora* by the larger leaf and plant size, and the greater number of flowers in the inflorescence.

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