



**1.** *Kumara plicatilis* (*Aloe plicatilis*) in cultivation in Arroyo Grande, San Luis Obispo County. This South African species grows spectacularly well in coastal California. Most of my favourite wineries and breweries on the Central Coast (e.g. Red Soles, Barrel House) do not have cacti or succulents at their tasting rooms, but a few like Timbre Winery, pictured here, not only have this nice *Kumara plicatilis*, but other gems like *Agave colorata* and a flowering-sized specimen of *Aloidendron dichotomum*.

Depending on how liberally one counts, there are either four or five species of cacti and succulents native to the area immediately surrounding the Cuyama River, often within 50 m of the river that forms the boundary between San Luis Obispo County and Santa Barbara County in California: *Cylindropuntia bernardina* (*C. californica* var. *parkeri*), a prickly pear that I am tentatively calling *Opuntia mojavensis*, *Hesperoyucca whipplei*, *Dudleya pulverulenta*, and, finally, *D. caespitosa* where waters from the river enter the Pacific. I also describe what *O. mojavensis* actually is and whether it is the species here.

## Introduction

Again, we chose to spend part of our sabbaticals in the charming, old fashioned, little surfing town of Cayucos, in a little house on the beach. Cayucos is in San Luis Obispo County, about halfway along the Pacific coast between Los Angeles and San Francisco. This meant six months of paradise on the Central Coast of California, where the weather, food, and drink could not be better, albeit shortened by the coronavirus pandemic. There is nothing like sitting on your back deck, looking up from writing, to see dolphins jumping or better yet, dolphins surfing.

<sup>1</sup>email: root.gorelick@carleton.ca

Most days we saw sea lions and sea otters from the back deck and living room. It does not get much better than stand-up paddle-boarding on the Pacific and having a pod of grey whales surface all around you, spy-hopping, while you smell their breath.

But, as perfect as this was, especially compared with Canada in the depths of winter, Cayucos has no native cacti or succulents. While Cayucos can be dry, sometimes it can be quite wet. During two weeks from late November to early December 2019, Cayucos got 22 cm (8.5 inches) of rain. There are some amazing cultivated succulents here, especially those formally known as aloes, such as *Kumara plicatilis* (L.) G.D. Rowley and *Aloidendron dichotomum* (Masson) Klopper & Gideon F. Smith (Figs. 1–2). There were



2. *Aloidendron dichotomum* (*Aloe dichotoma*) in cultivation just above the beach in Cayucos. *Aloe arborescens* and an *Agave* are visible in the background.



3. *Carpobrotus chilensis*, the scourge of coastal California, in Cayucos. I chose the prettiest photo I could find of this introduced noxious weed that covers almost every square meter of dunes, right down to the high water mark. Even more beguiling, during walks on the beach, our dog has a predilection for defecating in stands of this plant at the water's edge, making clean-up more difficult than if she simply pooped on the sand, and as if these ice plants need more organic fertilizer.

several invasive ice plants, such as the monstrously large *Carpobrotus chilensis* N.E. Brown, *C. edulis* (L.) N.E. Brown, and *Conicosia pugioniformis* N.E. Brown, as well as the more diminutive *Drosanthemum*



4. *Drosanthemum floribundum* just above the high water mark in Cayucos. Unlike other introduced mesembs, this species is not as common nor as invasive, although here is growing on a rock-face upon which nothing else grows.



5. *Dudleya caespitosa*, a charming native plant (finally), a few hundred meters from the Pacific Coast at Montaña de Oro State Park in Los Osos, San Luis Obispo County. This species also grows at the mouth of the Santa Maria River, so technically could be considered a fifth succulent species found along the Cuyama River.

*floribundum* Schwantes (Figs. 3-4). Even towns surrounding Cayucos mostly lack native cacti or succulents, except for *Dudleya caespitosa* (Haworth) Britton & Rose (Fig 5). I saw lots of cacti and succulents on the western half of the drive between Ontario and California, but hardly any while on the Central Coast of California, which is disappointing because I see plenty of cultivated cold-hardy cacti in my yard in Ontario, at least when not snow-covered.

*Cylindropuntia californica* var. *parkeri*  
= *Cylindropuntia bernardina*

Soon after arriving in Cayucos, I was visiting with Chuck Woodard, a great naturalist employed by the California Parks department. Working in San Luis Obispo County, he does not know cacti very well, at least not as well as he knows birds and trees. He showed me a photo of a cholla from near Hemet in Riverside County and asked which species it was (Fig 6). Given that most of my time in the desert has been in Arizona and New Mexico, I tentatively surmised that this was the California cholla, *Cylindropuntia californica* (Torrey & A. Gray) F.M. Knuth. A quick check verified that this was *Cylindropuntia californica* var. *parkeri* (J.M. Coulter) U. Guzmán, whose proper name should be *Cylindropuntia bernardina* (Engelmann ex Parish) M.A. Baker, Cloud-Hughes & Rebman. I also checked maps showing locations of herbarium records of this taxon in order to verify that it was indeed native to Hemet. It is. To my surprise, there were also herbarium records of *Cylindropuntia californica* var. *parkeri* in San Luis Obispo County, albeit in the far southeastern corner of the county where I had never before traveled. In San Luis Obispo County, most people are by the Pacific, either along Highway 1, aka the Cabrillo Highway or Pacific Coast Highway (e.g. Pismo Beach and Morro Bay), or slightly inland along Highway 101, aka El Camino Real (e.g. the towns of San Luis Obispo and Paso Robles near the upper Salinas River valley, which has amazing wines). By contrast, the eastern half of the county is very sparsely populated.

Herbarium records and notes kindly provided to me by Dave Keil of California Polytechnic State University at San Luis Obispo indicated that in San Luis Obispo County *Cylindropuntia californica* var. *parkeri* (*Cylindropuntia bernardina*) is only found near the Cuyama River. The western (downstream) end of the Cuyama River is a very deep narrow channel — albeit usually with shallow waters — cutting through the small but relatively steep Sierra Madre Mountains, which are part of the Transverse Ranges. The eastern (upstream) end of the Cuyama River, at least along the San Luis Obispo/Santa Barbara County border is a broad shallow river valley that is up to 8 km (5 miles) across, especially at the upstream end near the town of Cuyama. Most records of *C. bernardina* were from the wide-open upstream end of the valley, albeit with a few reports of it from the downstream end after the river valley drastically narrows. Nonetheless, as I will discuss below, the westernmost 15 miles (24 km) of the Cuyama River are worth stopping to see because



6. *Cylindropuntia bernardina* (*C. californica* var. *parkeri*) near Hemet, Riverside County (photo Chuck Woodard), in the photo that motivated this article once I realized this taxon's range extended into southeastern San Luis Obispo County. Notice the nice rib formation on this plant and how vertical those ribs are, which is not the case for all specimens of this taxon.

of their profusion of three other succulent species: *Dudleya pulverulenta* (Nuttall) Britton & Rose, *Hesperoyucca whipplei* (Torrey) Trelease, and something I am tentatively calling *Opuntia mojaviensis* Engelmann & J.M. Bigelow, many of which grow right along the river and Highway 166. Regardless, the Cuyama River is very much the northwestern range limit for *C. bernardina*. The heart of the distribution of this species is in the San Bernardino Mountains of southwest San Bernardino County (as seems appropriate), the Peninsular Ranges (named for the Baja Peninsula) of western Riverside County (including Hemet, which motivated this article), much of San Diego County, and northern Baja California.

The Cuyama River forms the southern boundary of San Luis Obispo County, separating it from its southern neighbor Santa Barbara County. State Highway 166 heads east (upstream) following the Cuyama River beginning very close at the Pacific Ocean — although the river changes names to the Santa Maria River downstream of the confluence of the Cuyama and Sisquoc Rivers. Highway 166 continues upstream



7. *Cylindropuntia bernardina* along Wasioja Road east of Davis Canyon, which is west of New Cuyama, Santa Barbara County. This is a huge cultivated specimen that is about 3 m tall (10 ft) at a locality from which herbarium records exist.

along the Cuyama River until the intersection with Highway 33 (Highway 33 heads south to Ojai and Ventura). Highway 166 crosses the Cuyama River many times over the course of the 75 miles (121 km) between Highways 101 and 33.

At least nowadays, *Cylindropuntia bernardina* is rare near Highway 166 and the Cuyama River. Reports of *C. bernardina* near the various Santa Barbara County canyons with creeks or arroyos flowing south into the Cuyama River, especially west of the town of New Cuyama, did get me to some impressive stands of this plant (Fig. 7). But these all seemed to be of cultivated origin, possibly grown from nearby native plants. I found *C. bernardina* near gates, along with introduced exotics, such as *Opuntia microdasys* (Lehmann) Pfeiffer and *Agave americana* L. The problem may have been that much of the surrounding land has been taken over by cattle ranching, grape vineyards, and oil extraction. Nearby undeveloped lands, especially in the canyons seemed too tree-lined for cacti. That said, the cultivated or semi-cultivated specimens that I saw of *C. bernardina* west of New Cuyama and south of the Cuyama River, near Davis Canyon, were impressive, being 3 meters (10 ft) tall,



8. *Cylindropuntia bernardina*, same plant as the previous figure, showing both mature and immature fruits. Note ribs do not form on this specimen.



**9.** Another huge specimen, approximately 3 m (10 ft) tall, of *Cyllindropuntia bernardina*, also from a locality with herbarium records. This plant is along Highway 166 at the southern terminus of Chimineas Ranch Road. The parking lot and gate to the Chimineas South Unit of the Carrizo Plains Ecological Reserve are approximately 300 m (1,000 ft) east of here. This specimen was probably planted by humans.

with several hundred long plump erect branches and many fruits. Some of the fruits were still green in January, while others had lost turgour pressure and were light-brown, indicating that fruits ripen here circa New Years (Fig. 8).

There were equally impressive specimens of *C. bernardina* along Highway 166 where it intersects Chimineas Ranch Road (Figs. 9–10), i.e. farther west and north of New Cuyama than the previous plants. These specimens were also about 3 meters tall (10 ft), with hundreds of plump erect branches and many turgid green fruits and dried light-brown fruits (Figs. 11–12). But again, these seemed to be cultivated, growing alongside *Opuntia microdasys* and *Agave americana*, as well as what I am tentatively calling *Opuntia mojavensis* that typically grows a bit farther west along Highway 166, i.e. downstream along the Cuyama River. The cultivated nature of these plants seemed odd because I was searching in places mentioned by herbarium records. Perhaps these plants at the end of Chimineas Ranch Road and those near Davis Canyon were native stands that had been saved from plowing or grazing. Nonetheless, I suspect these



**10.** Same plant of *Cyllindropuntia bernardina* as the previous figure. Note the adjacent *Opuntia mojavensis* in fruit and the introduced *Opuntia microdasys*, the latter of which is a Mexican endemic.

specimens have been receiving some care in that they were often over 3 meters tall (10 ft), whereas *Flora of North America* (Pinkava 2003a) says that this species is usually less than 1.5 m tall (5 ft). However, admittedly, these plants' locations alongside roads might supplement their water supply from run-off...but see the next two paragraphs for contrary evidence.



**11 & 12.** Same plant of *Cyllindropuntia bernardina* as previous two figures. Note mature and immature fruits and lack of well-defined ribs.



**13 & 14.** *Cyllindropuntia bernardina* growing in a side-channel of the Cuyama River in San Luis Obispo County, near the town of Cuyama. This plant is definitely not cultivated. It is only 1.2 m tall (4 ft) with less than 10% the number of branches of the specimens in Figures 7–12. Lateral terminal branches are drooping rather than erect. Spines are longer, broader, and more golden than in the previous plants.

I saw seemingly native (i.e. uncultivated) plants of *Cyllindropuntia bernardina* close to the Cuyama River and Highway 166 by the town of Cuyama (Figs 13–14). These were much smaller plants, about 1.2 m (4 ft) tall, with dozens, not hundreds, of branches. Internodes, i.e. the vertical distance between successive areoles, were shorter and spines were longer on these plants than on the previous specimens. Their terminal branches were not always erect, but sometimes drooped. In overall morphology, these seemingly native uncultivated plants of *C. bernardina* closely

resembled *C. acanthocarpa* (Engelmann & J.M. Bigelow) F.M. Knuth var. *coloradensis* (L.D. Benson) U. Guzmán, albeit realizing that some authors no longer consider var. *coloradensis* to be consistently distinguishable from the type variety of *C. acanthocarpa* (Baker *et al.* 2018). Both *C. bernardina* and *C. acanthocarpa* can have tubercles that merge into contiguous ribs (Fig. 6). These ribs are sometimes vertical enough that, when shoots are viewed from above, the spines on successive areoles line up (Fig. 15). One of these native uncultivated plants was growing in a



**16.** View of the main channel of the Cuyama River, 20–30 m (65–100 ft) from the plant in Figs 13–14. My feet sank several centimeters deep into wet muddy sand when walking across this main channel, looking for more plants on the other side, which I did not find.



**15.** Cutting of *Cyldropuntia bernardina* with vertically aligned areoles and spines.

side-channel of the Cuyama River, about 20–30 m (65–100 ft) from the main channel. While the main channel had no surface water at this locale, where the river valley was quite wide, water was just below the surface (Fig. 16). When I walked across the main channel, my feet quickly sank into wet muddy sand. In terms of elevation, *C. bernardina* on the side-channel here was growing no more than one meter above the level of the main channel and could possibly have tapped into subsurface water. Therefore the small size and drooping terminal branches may not have had



**17.** View of the side-channel of the river, 15 m (50 ft) from the plant in Figs 13–14. Note the remaining piles of sand that have not been eroded away. This seems like an odd habitat for a cholla. While not visible in this photo, there was lots of *Atriplex canescens* (saltbush) in this side-channel.

much to do with lack of water. That said, it was striking seeing a cactus in a river bed, even if just a side-channel. This probably reflects that the Cuyama River does not flood as much as it did historically because of recent large extractions of groundwater for irrigation and oil extraction. Another indication of the side channel being a relatively dry area were the large number of surrounding saltbush plants, *Atriplex canescens* (Pursh) Nuttall. Yet the carving of the sinuous side channel by water indicated flooding in the not too distant past (Fig. 17).



**18.** View looking north from Highway 166 near the town of New Cuyama, an adjacent town, looking across the Cuyama River Valley. Compare the broad shallow river valley in the foreground of this and the previous figure with the deeper and much narrower parts of the river valley in Figures 20–22.

*Cylindropuntia bernardina* is not just restricted to the wide-open parts of Cuyama River valley near Cuyama and New Cuyama (Figs. 18–20), but also where the Cuyama River valley narrows to a steep canyon, near where the river and Highway 166 enter the Los Padres National Forest from the east. Dave Keil found a downstream specimen of *Cylindropuntia bernardina* [labeled *Cylindropuntia parryi* Engelm.; at least on the digitized online sheet at CCH2.org], also growing in the Cuyama River flood plain. The herbarium label (*David J. Keil 26231*; OBI 102360) reads, “Along Highway 166, 11 road miles north-east of Tepusquet Canyon Road, opposite National Forest trailhead. Flood plain between north bank of Cuyama River and highway.” This probably refers to the Adobe Trailhead. While hiking the Adobe Trail, I never saw chollas, not thinking to walk on the other side of the road, down into the flood plain in order to find cacti. The Adobe Trailhead is as far downstream (west) as Dave Keil has ever found *Cylindropuntia bernardina* (personal communication). I made the same mistake at the Willow Creek Trail, which starts 3.5 km (2.2 miles) southwest of the Adobe Trailhead. I again hiked uphill and did not see *C. bernardina*, when I instead should have hiked down to the river for a chance to see chollas. Note that *C. bernardina*



**19.** Absurdist information sign in ‘downtown’ New Cuyama.

is definitely not a cryptic species, but one that truly stands out when present. The bottom line (pun intended) is that, both upstream and downstream, it is easiest — but still not very easy — to find native plants of *C. bernardina* in the Cuyama River flood plain. Be prepared to get your feet muddy.





**20–22.** Typical look of the Cuyama River in the narrow, deep, downstream regions. Note how Highway 166 is perched right on the river and how there is running surface water.



**23 & 24.** *Opuntia mojavensis* along Highway 166, mile 14.5, just west of Twitchell Reservoir, where the Cuyama and Huasna Rivers converge. These plants are about 1.2 m (4 ft) tall with each erect pad being 20-25 cm tall (8-10 inches). This large patch of prickly pear may be a single clone that is growing on modestly steep crumbling soil. [I only report highway distance markers in miles because that is what the signs along the highway say, despite my preference for metric units and driving a Canadian car that uses kilometers.]

## *Opuntia mojavensis*

Oddly for a write-up on *Opuntia mojavensis*, I need to start with a paragraph on *Opuntia phaeacantha* Engelm., which is still a poorly circumscribed and poorly understood species, followed by an even longer explanation of what the binomial *Opuntia mojavensis* Engelm. & J.M. Bigelow refers to.

*Opuntia phaeacantha* is hexaploid (2N=66) with large pads and juicy fruits. Over its entire range, *O. phaeacantha* is supposed to be a short-statured plant that crawls across the ground, without much lignification, so that shoots tend to lie flat each winter, but without extensive wrinkling and creasing of pads in winter. *Flora of North America* (Pinkava 2003b: 139) succinctly describes *O. phaeacantha* as “shrubs, decumbent to commonly trailing, 0.3–1 m”, although other authors suggest that *O. phaeacantha* is even shorter. Powell and Weedon (2004: 160) wrote, “*O. phaeacantha* is 10–50 cm tall and often in the short end of that range.” According to *Flora of North America*, *O. phaeacantha* is a widespread and fairly common species throughout the southwest United States and northern Mexico, whose range extends as far east as Kansas, Oklahoma, and central Texas, but also contains a disjunct population in southern San Luis Obispo County and adjacent Santa Barbara County, including along the Cuyama River valley. In fact, according to distribution maps in *Flora of North America* (Pinkava 2003b), *O. phaeacantha* is the only species of prickly pear found along the Cuyama River. This prickly pear population in San Luis Obispo and Santa Barbara Counties is truly disjunct. There are no reports of *O. phaeacantha* from Ventura County and almost none from Kern County. Calflora contains a single herbarium record of *O. phaeacantha* in 1 April 1934 from Kern County (*E. Armstrong 1181A*; UC 572503), which was found at La Rose Creek, near Tehachapi Pass, halfway between the towns of Tehachapi and Mojave, along what is now Highway 58 [the spelling of “La Rose Creek” is correct, although in the past may have been “La Rosa Creek”].

The big problem is that the *Opuntia* population in southern San Luis Obispo County and Santa Barbara County does not seem to be *O. phaeacantha*, instead being a much taller plant, usually 1.0–1.5 meters tall, with cladodes stacked 4–6 high vertically, even in winter (Figs. 23–24). Near the Cuyama River, pads of this taxon are about 20–25 cm tall (8–10 inches) and about 15–20 cm across (6–8 inches). This is on the large end of the size range reported in *Flora of North America* for *O. phaeacantha*. Concatenate five such pads

vertically, which frequently occurs along the Cuyama River, it is easy to get a 1.2 m (4 ft) tall plant. The pads here seem to remain erect even after many seasons, assuming that plants only grow one pad taller per year. Plants labeled *O. phaeacantha* from farther south in Santa Barbara County, such as near Cachuma Creek and Vandenberg Air Force Base, also have equally large pads. Plants along the Cuyama River seem no more nor less lignified than those of the “true” *O. phaeacantha* in Arizona and New Mexico, at least based on ease of taking cuttings at the joints between successive pads. However, like the “true” *O. phaeacantha*, the prickly pears along the Cuyama River are hexaploid (2N=66) (Pinkava *et al.* 1977).

Dave Ferguson (personal communication) suggests that this prickly pear in San Luis Obispo and Santa Barbara Counties be called *Opuntia mojavensis*, a species first described for plants on the western edge of the Mojave Desert in California, near the town of Hesperia. The type specimen of *O. mojavensis* is fragmentary, but matches characters of the large bushy prickly pear currently growing on the edge of the Mojave Desert near Hesperia (Green and Ferguson 2012). Opuntia web (<https://www.opuntiads.com/opuntia-mojavensis/>) states, “The only historical drawing of this cactus shows 2 spine clusters and immature or sterile fruit.” I use the binomial *O. mojavensis* for plants along the Cuyama River with trepidation because (1) the Cuyama River is geographically distant from the Mojave Desert and (2) even the author of this binomial showed reservations about its use. Engelm.’s (1856: 293) entire text about *Opuntia mojavensis*, with the original typography, reads:

*O. Mojavensis*, E. & B. in P. R. R.:  
*prostrata; articulis grandibus suborbiculatis; pul-*  
*villis remotis; setis fulvis; aculeis 3–6 validis*  
*infra fuscis.*

*On the Mojave, west of the Colorado. –*  
*The material is too scanty to make out where*  
*it belongs; but perhaps it is only a form of*  
*O. phaeacantha.*

Not only is the supposed type specimen too scanty (see below), but plants near Hesperia and the Cuyama River valley are not prostrate.

What exactly is the original publication of *Opuntia mojavensis*? Index to Plant Names Index (IPNI) and World Flora Online both say the original publication was “Engelm. & J.M. Bigelow, Proc. Amer. Acad. Arts 3: 293 (1856)”. But in *Proceedings of the American Academy of Arts and Sciences* 3: 293, Engelm. (1856) stated, “*O. Mojavensis*, E. & B. in P. R. R.”, in which P.R.R. refers to the *Pacific Railroad Report*.

On page 260 of *Proc. Amer. Acad. Arts Sci.*, Engelmann (1856) explicitly referred to “Reports of the Boundary Commission and those of the Pacific Railroad Surveys”, which he then abbreviated B.C.R. and P.R.R., respectively. Furthermore, the plates at the back of the *Pacific Railroad Report* (Engelmann & Bigelow 1856) all included the header “U.S. PRR & Surveys, 35<sup>th</sup> Parallel”. On page 260 of *Proc. Amer. Acad. Arts Sci.*, Engelmann (1856) also stated that the *Boundary Commission Report* (1859) and *Pacific Railroad Report* (1856) were still in preparation, delayed by production of the plates. On page 40 of Volume IV, Part V of the *Pacific Railroad Report* (1856), subtitled “*Report on the botany of the expedition*”, Engelmann cited this taxon as “Op. Mojavensis, E. & B.”, and not as “Op. Mojavensis (sp. nov.)”. By contrast, in the *Pacific Railroad Report*, Engelmann & Bigelow (1856) seemingly used “sp. nov.” for all other new binomials, including for the very next taxon on page 40, namely “*Opuntia camanchica* sp. nov.” However, Engelmann (1856; *Proc. Amer. Acad. Arts Sci.*) was published prior to Engelmann & Bigelow (1856; *Pacific Railroad Report*), so has priority, even though the description, quoted above, in Engelmann (1856), is incredibly minimal and only describes the location of this plant as being “on the Mojave; west of the Colorado.” Evidence for priority comes from *The botanical works of the late George Engelmann – collected for Henry Shaw, Esq.* (Engelmann 1887), in which the editors, William Trelease and Asa Gray, listed and reprinted Engelmann’s “Papers on Cactæ” in chronological order, with Engelmann’s (1856) *Synopsis* from the *Proceedings* immediately followed by Engelmann and Bigelow’s (1856) report on cacti of the *Pacific Railroad Report*. Trelease, Gray, and especially Shaw were Engelmann’s contemporaries, so would not have erred on the order of publication. Nonetheless, we should look at Engelmann and Bigelow (1856; *Pacific Railroad Report*) for much more detailed information, despite being published after Engelmann (1856; *Synopsis – Proceedings*).

The full text regarding *Opuntia mojavensis* in the *Pacific Railroad Report* (Engelmann and Bigelow 1856: 40), again with typography as in the original, reads:

*Op. Mojavensis, E. & B.: prostrata, articulis grandibus suborbiculatus, pulvillis remotis, setis grandibus fulvois, aculeis 2-6 validis compressis acute angulatis elongatis plus minus curvatis, fuscis versus apicem pallidioribus annulatis, adjectis infra 1-3 minoribus tenuioribus pallidis; bacca pulvillis 20-25 fusco-setosis stipata. (Plate LX, fig. 6-8.)*

*On Mojave creek; at the time it was considered identical with the following species [Op. camanchica], and no further notice taken of it; only a few fragments were brought home, together with a sterile fruit. Spines 1-2½ inches long, stout, bright-brown; fruit 1¾ inch long, oblong; pulvilli crowded towards the upper end. It is possibly a distinct species, but the material too incomplete to permit us more than merely to indicate it.*

“Mojave creek” is now known as West Fork Mojave River, which flows through the southeast outskirts of modern day Hesperia. West Fork Mojave River has its headwaters in the San Bernadino Mountains on the southwest edge of the Mojave Desert. The Mojave River is formed by the confluence of Deep Creek and West Mojave Fork. Confusion with the more easterly *Opuntia camanchica* Engelmann & J.M. Bigelow resulted in Bigelow only collecting and illustrating one pericarpel/fruit and four areoles (four areoles collected; two illustrated) during the Pacific Railroad Survey, from the prickly pear along “Mojave Creek” that three years later was named *O. mojavensis* based on this fragmentary collection.

The lectotype of *Opuntia mojavensis* (<https://plants.jstor.org/stable/10.5555/al.ap.specimen.mo-178687>) is not much help either, including four areoles, one fruit/pericarpel, and two pages of Bigelow’s handwritten field notes. Slightly confounding matters, Lyman Benson’s label on the lectotype that he selected claims that the correct name is *Opuntia mojavensis* Engelmann, when it should be *Opuntia mojavensis* Engelmann & J.M. Bigelow.

I hope this long explanation justifies my trepidation about use of the binomial *Opuntia mojavensis* that both *Flora of North America* (Pinkava 2003b) and the *New Cactus Lexicon* (Hunt et al. 2006) reduced to synonymy with *O. phaeacantha*. But I cannot find a better name than *O. mojavensis* for the Cuyama River plants and have no interest in suggesting a new combination. I therefore tentatively use the combination *Opuntia mojavensis* Engelmann & J.M. Bigelow for the prickly pears along the Cuyama River, as well as for other inland prickly pears in San Luis Obispo and Santa Barbara Counties.

Along the Cuyama River, *Opuntia mojavensis* grows from the southern terminus of Chimineas Ranch Road in the east, although these specimens may be cultivated, all the way to the foothills overlooking Nipomo in the west, i.e. west of Twitchell Reservoir, which marks the confluence of the Cuyama and Huasna Rivers. *O. mojavensis* is most often found along the deep and steep parts of the Cuyama River



**25 & 26.** *Opuntia mojavensis* along Highway 166, mile 32. This is at the start (upstream end) of the deeper of the Cuyama River valley. Note the river bed at the center and *Hesperoyucca whipplei* at the lower left. The patch of *O. mojavensis* may be a single clone. *Opuntia mojavensis* is common along Highway 166, along the deep part of the river valley between miles 25 and 33.



27. Fruit of *Opuntia mojavensis* along Highway 166, mile 14.5, just west of Twitchell Reservoir.

valley (Fig. 25), only extending a little ways into the broader flatter upstream parts of the river valley. At least in the deep and steep parts of the Cuyama River valley, *O. mojavensis* seems to unequivocally be native.

I only saw *Opuntia mojavensis* on south-facing slopes along the Cuyama River or on flat terrains. This meant that most specimens were north of the river, i.e. in San Luis Obispo County. Occasionally there were small individuals, but most were what looked like huge clonal clumps composed of hundreds or thousands of pads (Figs. 24 & 25). And as mentioned earlier, this taxon also appears to be native farther south in Santa Barbara County, such as along Cachuma Creek and Vandenberg Air Force Base, which encompass the disjunct western population shown on the distribution map for *O. phaeacantha* in *Flora of North America* (Pinkava 2003b), as well as on the Calflora map of herbarium specimens for this species ([https://www.calflora.org/cgi-bin/species\\_query.cgi?where-calrecrenum=5946](https://www.calflora.org/cgi-bin/species_query.cgi?where-calrecrenum=5946)).

Fruits of *Opuntia mojavensis* along the Cuyama River seem to ripen in January and February, which is an indication of mild winters. The fruits were fairly large, juicy (Figs 27–28), and tasted good. The fruits are typical for plants in the *O. phaeacantha* complex.

Number and length of spines on *Opuntia mojavensis* varied greatly along the Cuyama River, even on a single plant. The pad with the longest and largest number of spines was growing on top of a pad that



28. Fruit of *Opuntia mojavensis* along Highway 166 at end of Chimineas Ranch Road. I am not sure whether this a native stand of this species, but this shows how appetizing the fruits can look, as well as how long its spines can be.



29. The pads of *Opuntia mojavensis* along the Cuyama River with both the longest spines (10 cm = 4 inches) and shortest spines (basically non-existent) growing from one another! One possible cause for this was that the lower pad was shaded, so grew no spines, while the upper pad finally rose above whatever was shading this plant, therefore finally grew spines and impressive ones at that. Nonetheless, this photo is of poor quality because, at least in winter, both pads still were in fairly deep shade.

had almost no spines (Fig 29). Many of the spines on the top pad of this specimen were 10 cm (4 inches) long, which is longer than the range of 3–8 cm long (1.2–3.1 inches) reported in *Flora of North America* (Pinkava 2003b) for *O. phaeacantha*.



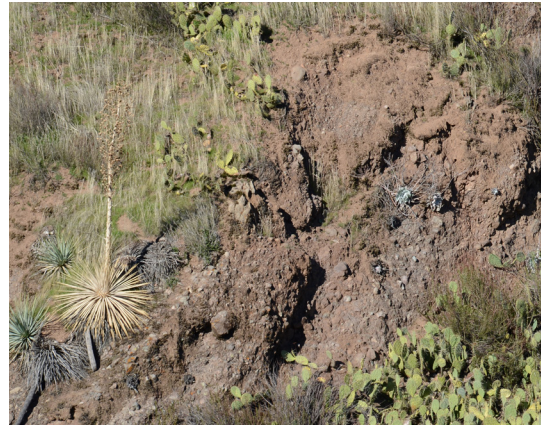
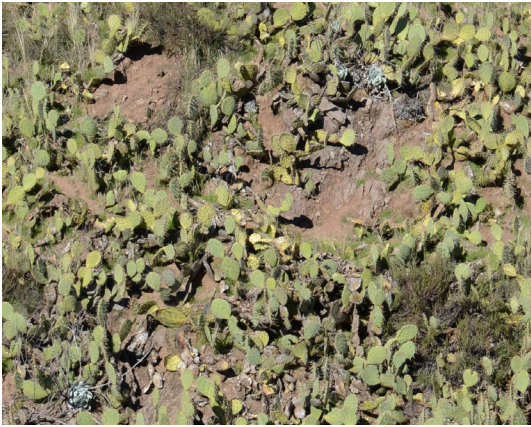
### *Dudleya pulverulenta*

*Dudleya pulverulenta* is one of the most common species of *Dudleya* in southwestern California. With its cabbage-sized rosettes of powdery blue leaves, it is also one of the prettiest. This species always grows on crumbling steep slopes, making it hard to photograph. Supposedly, it is also difficult to grow in cultivation, but I have never tried. In southern California, the easiest place to see it is by walking along ocean beaches bordered by steep cliffs. Near the top of the cliffs, one can often find *D. pulverulenta*, from Avila Beach in the north (Figs 30–31) to San Diego and Baja California in the south. It also grows farther inland, especially in the Transverse Ranges and Peninsular Ranges. I recall seeing beautiful plants of *D. pulverulenta* along Highway 101 between Camarillo and Newbury Park, in Ventura County, although you should not trust the identification of a plant by someone driving 75 miles per hour on a crowded six-lane highway. There are also a few records of this species from the Mojave Desert of San Bernardino County. Note, that the distribution map for *D. pulverulenta* in the online version of *Flora of North America* is currently incorrect, but I am working to get that remedied.

Along the Cuyama River, wherever I saw *Dudleya pulverulenta*, I also saw *Opuntia mojavensis*, but not vice versa (Figs 25–26). The one odd place that I saw



**30 & 31.** *Dudleya pulverulenta* probably at both the northern and western edge of its range, i.e. not along the Cuyama River. This locale is the eastern one-third of Pirate's Cove Beach in Avila Beach, San Luis Obispo County. This is a very easy place to see this species, but a difficult place to photograph it. Not only are the plants reasonably high up, circa 10–25 m (33–82 ft) above the high water mark on nearly vertical cliffs at this beach, but this is one of the few legal public clothing-optional beaches on the coast, therefore photography is rightfully frowned upon, especially with a long-distance lens.



**30 & 31.** *Dudleya pulverulenta* along with *Opuntia mojavensis* and *Hesperoyucca whipplei* along the Cuyama River and Highway 166 at mile 32.

*D. pulverulenta* was just across Highway 166 from the Cal Fire Station at Miranda Pine Creek. There it was growing on a north-facing slope that seemed to get no direct sunlight during the dead of winter (Fig 32). This plant did not look as robust nor as large as many conspecifics, but nonetheless had infructescences and looked reasonably healthy. Right across Highway 166 was a small specimen of *O. mojavensis*, also with fruits, but not looking as large nor robust as this plant usually looks in this region. But, unlike the nearby *Dudleya*, at least this prickly pear got some direct sun around the winter solstice.

The genus *Dudleya* is interesting in that many species appear to have facultative CAM photosynthesis (Park & Zutta 2007). If it is dry out, they can open their stomata at night to let in CO<sub>2</sub>, but build sugars during the sunny daytime hours with stomata closed. They can revert back to ordinary C<sub>3</sub> photosynthesis, with stomata opened during the day, when conditions are wetter.

### *Dudleya caespitosa*

*Dudleya caespitosa* (Fig 5) is almost exclusively a coastal species, including growing on both sides of the Santa Maria River where it flows into the Pacific. Given that Cuyama River changes names to the Santa Maria River where it merges with the Sisquoc River, in a broad sense, one could say that *D. caespitosa* is a succulent of the Cuyama River valley. Note that the Santa Maria River valley is quite wide and shallow, much like the upper Cuyama River valley. But *D. caespitosa* here isn't so much growing along the river as it is growing along the coastal dunes that just happened to be bifurcated by the river.



**32.** *Dudleya pulverulenta* on the south side of Highway 166 at Miranda Pine Creek, across the Highway from the Cal Fire Station and *Opuntia mojavensis* in Figure 30. This plant is on a north-facing slope and gets no direct sunlight near winter solstice, which might explain its more open rosette of smaller leaves than usual.

### *Hesperoyucca whipplei*

The last succulent along the Cuyama River is also the most common, *Hesperoyucca whipplei*. I refer to it as being succulent because, like most species of *Yucca*, *H. whipplei* has most of its biomass below ground in massively fleshy succulent roots. Only a few percent of its biomass is above ground, with barely semi-succulent stems and thin fibrous leaves. This species is common in the California Coastal Ranges from Monterey County and San Benito County in the north all the way into the Peninsular Ranges of San Diego and Baja California in the south. This species is also prevalent in the Sierra Nevada from Kings Canyon south to Kern and Los Angeles Counties. In fact, the first place I ever saw a native stand of this species was just north of the city of Los Angeles, along Interstate 210. *H. whipplei* is ubiquitous in the mountains





**33.** I have no patience nor ability for counting past single digits, but would estimate that this photo contains about 500 rosettes of *Hesperoyucca whipplei*, on a south-facing hillside, i.e. just north of the Cuyama River. This is at mile 32 on Highway 166, at the upper (eastern) portion of the deep downstream part of the Cuyama River valley, where several of the other figures herein were taken, including of *Opuntia Mojavensis* and *Dudleya pulverulenta*, although neither of those species are in this photo.

surrounding the Cuyama River, so while driving Highway 166 can be most easily seen in the western (downstream) stretch of the river. It is as easy finding *H. whipplei* on this stretch of the Cuyama River as it is finding water when jumping off of a boat (Fig 33).

*Hesperoyucca whipplei* is often referred to as monocarpic or semelparous, which is not technically correct insofar as each shoot dies after flowering and fruiting but the individual plant usually lives on by offsetting (Fig 34). This is another standard trick for *Yuccas* — growing new shoots from the succulent roots. Twice I have moved a plant of *Y. filamentosa* L., digging up an enormous root mass, only to have new shoots arise from the remaining soil for up to a decade, with it being impossible to entirely eradicate the plant despite thoroughly digging up every new shoot with its root mass as soon as new leaves appeared above ground. Some of the patches of *H. whipplei* near the Cuyama River seemed to form ‘fairy rings’, where old shoots die but are replaced by new offsets that form a larger and larger circle of shoots (Fig 35). At least along the Cuyama River, *H. whipplei* is often found in association with *Heteromeles arbutifolia* (Lindley) M.J. Roemer (Fig 36).

Leaves of *Hesperoyucca whipplei* are uniformly powdery glaucous blue, much like those of *Dudleya pulverulenta*. This is a leaf color only seen in a few *Yucca* species, such as *Y. glauca* Nuttall, *Y. pallida* McKelvey, and



**34.** Many dead rosettes of *Hesperoyucca whipplei* following flowering and fruiting along Willow Springs Trail, high above the Cuyama River, Santa Barbara County. Willow Springs Trailhead is at Highway 166 mile 28.5. Withered infructescences are 3.5–4.0 m (11–13 ft) tall. Note that not only do roads follow rivers, but so do electrical transmission lines.

*Y. rigida* (Engelmann) Trelease.

On and near the Central Coast of California, *Hesperoyucca whipplei* flowers in June and fruits in July and August (Fig 37).

## Final remarks

While hardly a cactus and succulent paradise, the Cuyama River valley is a great place to see the species described here, all of which have lots of charm.



**35.** Possible fairy ring of *Hesperoyucca whipplei*, in which rosettes die but are replaced by a centrifugal circle of offsets. This figure contains one of my favorite shrubs in this part of the world, *Heteromeles arbutifolia*. See the next figure for a better image of this species.

*Cylindropuntia bernardina* (*C. californica* var. *parkeri*) is a statuesque cholla that deserves to be used much more often as centerpiece in gardens that are not too cold. I have never seen it sold commercially, although Native West Nursery in San Diego lists it in their online catalogue, which is the only place I could find it for sale online. It is a trivial taxon to propagate by cuttings and probably also by seed. What I am tentatively calling *Opuntia mojavensis* has lots of horticultural potential because of its large juicy fruits and large stature, so that it could also serve as a background plant in many gardens. Unfortunately, like *C. bernardina*, *O. mojavensis* does not seem to be commercially offered for sale. *Dudleya pulverulenta* and *Hesperoyucca whipplei* are two gorgeous species with rosettes of powdery blue leaves that are unrelated to one another — one a eudicot and the other a monocot. While *D. pulverulenta* is supposedly difficult to grow in cultivation, it is sold commercially by quite a few vendors, so cannot be too difficult. *Dudleya caespitosa*, which is found along the Pacific coast at the mouth of the Santa Maria River is also readily commercially available and supposedly even easier to grow. *Hesperoyucca whipplei* is rather easy to grow and is commercially widely available for sale.

If perchance you are wine tasting in Santa Barbara County or San Luis Obispo County or simply doing the coastal drive through Monterey County, I

highly encourage you to take a short detour to the Cuyama River valley to see these lovely taxa. Without stops, the drive from Highway 101 in the town of Santa Maria along Highway 166 to the town of Cuyama only takes an hour. Therefore, even if you simply double back the way you came, this is only a two-hour detour that is well worth your while. Or you could take the longer road back via Soda Lake Road (County Road 285), past Soda Lake in Carrizo Plain National Monument, to see more plants of *O. mojavensis*. Regardless of route, you should take a few hours along the way to stop and closely look at these plants.

## Acknowledgments

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**36.** *Heteromeles arbutifolia* — whose common names are toyon, christmas berry, and christmas holly — is a very common plant along the deeper (downstream) parts Cuyama River. It is, in fact, common throughout oak chaparral near the Pacific from British Columbia to Baja California. *H. arbutifolia* is typically covered by thousands of bright red fruits in fall and the first half of winter, against a backdrop of toothed dark evergreen leaves. The red fruits are so striking that previously they were collected as ornamentals around christmas time, a practice that was outlawed a century ago by the state of California. The plant here is about 4 m across and 4 m tall (13 ft), growing near the Cuyama River at Miranda Pine Creek.

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**37.** *Hesperoyucca whipplei* flowering at the summer solstice at Julia Pfeiffer Burns State Park, Monterey County.