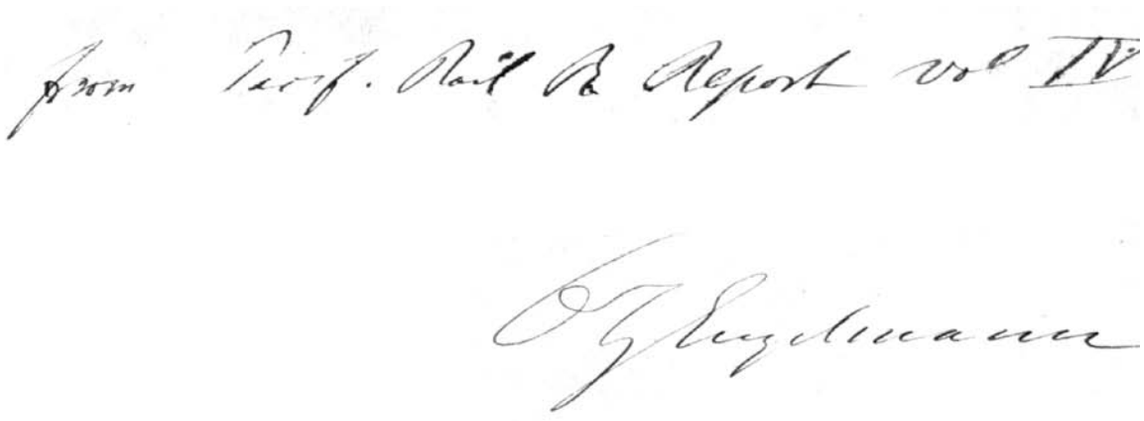


EXPLORATIONS AND SURVEYS FOR A RAILROAD ROUTE FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN.

WAR DEPARTMENT.

ROUTE NEAR THE TWENTY-FIFTH PARALLEL, EXPLORED BY LIEUTENANT A. W. WHIPPLE, TOPOGRAPHICAL ENGINEERS, IN 1853 AND 1854.

REPORT

ON

THE BOTANY OF THE EXPEDITION.

WASHINGTON, D. C.
1856.

No. 3.

DESCRIPTION OF THE CACTACEÆ.

BY GEORGE ENGELMANN, M. D. OF ST. LOUIS, AND JOHN M. BIGELOW, M.D.

MAMILLARIA, Haw.

I. EUMAMILLARIA. Englm. in Synops. Cact.

1. MAM. WRIGHTII, Englm. in Rep. of Bound. Com.: Flowers and fruit were unknown until specimens brought from the Pecos flowered in Washington. From these the following description was drawn:

"Sepalis exterioribus triangularibus obtusiusculis fimbriatis sub-13, interioribus margine petaloideis acutis sub-8, petalis (purpureis) lanceolatis acuminatis aristatis sub-12; bacca succosa majuscula purpurascente floris rudimentis coronata; seminibus obovatis basi acutis scrobiculatis nigris. I am not certain whether the flower is actually lateral and the germen immersed, whether, therefore, this species actually belongs to the true *Mamillariæ*, or to the subgenus *Coryphantha;* I am, on the contrary, inclined to consider at least the germen emersed. I, nevertheless, think it best to leave this species with the *Crinitæ*, to which it seems to be so nearly allied, till more complete observations establish the contrary. The flower is about one inch long, petals and margin of inner sepals bright purple; berry large and purplish; seeds about 0.7 lines long."

High plains near the Gallinas. Hills and rocky places near Anton Chico, on the Pecos, September 25, 1858. Santa Rite del Cobre mountains, near Lake Santa Maria, Chihuahua. Wright and Bigelow, in boundary collections.

2. MAM. GRAHAMI, Englm. in Rep. B. C. Sand and gravelly banks of streams. Williams' river to the Colorado Grande, January 26, 1854.

3. MAM. PHELLOSPERMA, Englm. in Synops. Cact. (M. tetrancistra Englm. in Sillim. Jour., Nov. 1852): Living specimens of this and the preceding species have been brought to Washington, and are now growing in the Congressional garden. Few specimens only show more than one of the 4 central spines hooked. The manifestly improper name previously adopted had therefore to be altered. "I have substituted for it a name derived from the peculiar spongy or corky appendage of the seed, which greatly resembles that of the seed of *Potenttilla paradoxa, Nutt*."—(Engelmann.) Sandy banks of streams, Colorado Grande and Mohave, February 4–23, 1854. The external habit of this plant very much resembles that of *M. Grahami*, and it was collected in nearly the same localities.

4. MAM. MEIACANTHA, Englm. in Rep. B. C.: Distinguished from *M. applanata* by the fewer and stouter spines, central spine often wanting. Cedar plains near the Llaño Estacado to the Pecos, September 23–27, 1853.

II. CORYPHANTHA. Englm. Synops. Cact.

5. MAM. NUTTALLII, Englm.: var. γ. *robustior* aculeis lrevioribus radialibus sub-12, centrali robusto. The northern and Texas plants have pubescent spines.

Plains on the False Washita and Canadian, near Fort Arbuckle, August 22–29, 1853.

6. MAM. VIVIPARA, Haw.

β. NEO-MEXICANA, Englm. in Rep. B. C.: Found in many different forms, from the plains of the Canadian, in longitude 100°, to the Aztec mountains, in longitude 112° west. The forms mostly belong to the var. β. *Neo-Mexicana*. One of the specimens brought to Washington bore abnormal flowers, quite interesting in a morphological point of view. The ovary is 4–5 lines long, covered with 8–12 fimbriate sepals, (or scales,) much like the ovary of an *Echinocactus*, the ovules deformed or wanting; styles irregularly divided to the base, or nearly so, in 8–10 parts, stigmatose at the upper part; other parts of the flower normal. This plant occurs in the greatest variety of altitudes through 12 degrees of longitude. Specimens of it were collected on the top of the Sandia mountains, near Albuquerque, upwards of 13,000 feet above the level of the sea, September 4, 1853, to January 17, 1854.

ECHINOCACTUS, Link.

No specimen of this genus was found till the Colorado Chiquito was reached. From there to the California mountains five species were observed, two only of which, *E. Lecontei* and *E. Emoryi*, had before been seen any where else.

1. E. WHIPPLEI, (sp. nov.): globoso-ovatun, costis 13–15 (sæpe obliquis) interruptis tuberculatis, areolis orbiculatis approximatis; aculeis radialibus 7 compressis albidis, infra brevioribus, supra deficientibus; aculeis centralibus 4 radiales superantihus, summo complanato recto albido ceteris plerumque longiore compresso-quadrangulatis fusco-atris, demum cinereo-rubellis, 2 lateralibus rectis sursum divergentibus, inferiore robustiore deorsum hamato; flore? bacca? seminibus oblique obovatis opacis minutim verrucoso-tuberculatis. (Plate I.)

This species was discovered on Lithodendron creek, near the Colorado Chiquito, about 90 miles west of Zuñi, in sandy plains, December 3–4, 1853. At first only dead specimens were found, afterwards young living ones were collected. It was not seen after leaving the valley of the Little Colorado. We have named this very pretty species in honor of Captain A. W. Whipple, the zealous and talented commander of this expedition.

Our plant is from 3 to 5 inches high, and 2 to 3 or 4 in diameter. The outer spines are straight or slightly recurved 6–9 lines long, the lower ones shorter than the others. The two lowest lateral spines are darker, and almost form a cross with the two upper dark central spines; the 5 other radial spines are white. The upper central spine is the longest and broadest of all, being 12–18 lines long, and $\frac{1}{2}$ to $1\frac{1}{4}$ line broad at base, and mostly straight, and directed upwards almost contiguous with the radial spines, the circle of which it seems to complete. The 3 other central spines are a little shorter, 12–15 lines long, nearly equal among themselves, quadrangular compressed, often somewhat curved, dark brown or black when young, with lighter tips; afterwards reddish, and finally of an ashy color. The lowest one has a sharp recurved hook, which is whitish on the convex side of the curvature.

Among the debris of the dead specimens preserved, a number of seeds were found which no doubt belong to this species. They are large 1.6–1.7 lines long, and 1.2 lines in diameter, very little compressed at the upper part, narrowed down to an acute point below the large orbicular hilum, and sharply carinate on the lower part of the back (opposite the hilum.)

E. Whipplei evidently belongs to the section *Hamati*, found in numerous forms on the middle and lower Rio Grande; with *E. polyancistrus* it is, so far as at present known, the only representative of this section west of the Rocky mountains. It is more nearly allied to *E.*

brevihamatus Englm. from Eagle Pass, the seeds of which are as yet unknown. It is, however, easily distinguished by the arrangement of the spines; the eastern species has 11 terete radial spines all around, and 4 central ones, the uppermost one being smaller and narrower than the lower hooked one.

2. E. POLYANCISTRUS, (sp. nov.): ovatus s. demum subcylindricus, costis 13–17 obtusis tuberculatis interruptis; areolis orbicularis s. cum areola florifera contigua minore ovatis, junioribus fulvo-tomentosis; aculeis radialibus sub-19 compressis albis, summo deficiente, superioribus latioribus longioribus apice adustis, lateralibus brevioribus, inferioribus brevissimis subsetaceis; aculeis centralibus 2–3-formibus, summo singulo (rarius binis) compresso-quadrangulato elongato albo apice adusto sursum curvato, reliquis 5–10 teretiusculis s. subangulatis purpureo-fuscis, 2 superioribus plerumque rectis (rarius uncinatis) ceteris omnibus arcte unciuatis; floribus in axillis summis solitariis; sepalis sub-25 orbiculato-ovatis abrupte acuminata mucronatis ciliatis, petalis acuminatis aristatis, stigmatibus 9–10. (Plate II, fig. 1–2.)

On gravelly hills and sandy plains at the headwaters of the Mojave, on the eastern slope of the California Cordilleras, one day's journey before reaching the Cajon Pass. This elegant and striking species was collected March 15, 1854, with young flower buds. The plant is 4–10 inches high and 3–4 in diameter; areola? 4 lines in diameter and (from center to center) 7–9 lines distant from one another; the younger ones covered with a reddish-yellow wool. The 4 upper radial spines 1–2, lateral ones $\frac{3}{4}$–1 , and lowest $\frac{1}{2}$ inches long. The upper central spine is 3–5 inches long and $\frac{1}{2}$–$\frac{3}{4}$ line wide; sometimes a second similar, but smaller, one is seen above or beside it. All the other central spines are bright purple-brown, the upper ones longer, (2–3 or even $3\frac{1}{2}$ inches long,) the others gradually shorten, the lowest not more than $1\frac{1}{4}$–$1\frac{3}{4}$ inches long; the two uppermost brown spines are often straight, but sometimes, like all the lower ones, sharply hooked, the hooks being turned in different directions; the convexity of the hook is of a paler color. In the young or smallest specimens we find only 5 brown spines, all hooked, one in the centre of the others; in others 5 to 7 or 8 brown hooked spines are counted, one central to the others, or all in a semi-circle, the upper part of the central circle always closed by the broad white spine.

The flower buds were just forming in the axils of the half-grown spines; those glandular organs which divide the floriferous from the spiniferous areolae in *E. Setispinus*, and other species, seem to be very partially only, and incompletely developed in this species.

3. E. LE CONTEI, Engelm. in B. C. Rep.: ingens ovatus s. ovato-cylindricus, costis 20–30 compressis sub-obtusis interruptis, areolis elengato-oblongis approximatis; aculeis radialibus inferioribus superioribusque robustioribus 8–10 angulatis subannulatis plus minusve recurvatis aculeis extimis lateralibus summisque 10–15 tenuioribus setaceis flexuosis; aculeis centralibus 4 compressis carinatis annulatis 3 superioribus sursum inferiore deorsum curvatis; floribus plurimis subcentralibus, ovario squamis 30–40 reniformibus tecto, sepalis tubi oblongis 20–30, petalis 25–30 angustis sulphureis, stylo ad medium in stigmata sub-14 linearia subacute diviso; bacca globosa sicca squamosa floris rudimentis coronata, seminibus oblique obovatis compressis sublucidis minutissime scrobiculatis.—(Plate II, figs. 3–5.)

This gigantic species was first noticed by Dr. John L. Le Conte, on the lower Gila, where also Dr. C. C. Parry saw it. Both took it for the New Mexican *E. Wislizeni*, to which, indeed it bears a great resemblance in habit as well as in botanical characters, but the seed that I received from the first-named gentleman at once satisfied me that I had a distinct species before me. Subsequently Dr Bigelow met with this remarkable plant, abundantly, from the Cactus Pass, at the head waters of Williams' river, down this stream to the Colorado, and west of it till *E. Polycephalus* took its place.—(Engelmann.) It grows on rocky or gravelly plains and ravines, and often in crevices of perpendicular rocks, to the height sometimes of 5 feet by 2 feet diameter. The ribs are somewhat interrupted by a transverse incision between the areolae.

These areolae in the specimen before us are 8 lines long by 4 wide, and only $\frac{1}{4}$ inch distant from one another. In some specimens of *E. Wislizeni* the same closeness is observed, while in others, especially young and vigorously growing ones, they are often over one inch distant. The four principal central spines are 2–2$\frac{1}{2}$ inches long, lateral ones more quadrangular, the upper and lower ones flat and flexible; the former carinate above, the latter below. This lower one is rather the longest and 1$\frac{1}{2}$–1$\frac{3}{4}$ lines broad, almost straight or somewhat curved, but never (in the specimens brought home) hooked. The other spines are 1$\frac{1}{2}$–2 inches, the lowest are only about 1 inch long. Five radial spines are arranged below the four central ones and three to five above, three of which are often pushed into the centre by the flexuous bristly spines which occupy the space between the upper and lower radial ones and the uppermost part of the areola.

At the upper end of the areola, and between it and the floral areola, we meet with the same obtuse cylindric ligneous (when young, fleshy) glands which divide the spiniferous from the floral areola? in several of our species of *Echinocactus*, 3–5 in number in the species before us, about one line long.

We had the good fortune to collect a single specimen of the fruit, (the only one found,) which is globose, $\frac{3}{4}$ inch in diameter, and, together with the persistent remains of the flower, about 2 inches long. Dr. Le Conte has noticed "a crown of yellow fruits on the plant, about 2 or 2$\frac{1}{2}$ inches long." The dissection of the dead flower indicates a structure very similar to that of *E. Wislizeni;* petals apparently fleshy and narrow; stamina numerous, very few from the base, the majority from the middle and the upper thickened end of the short tube; style 10 lines long, divided nearly down to the middle into 14 sub-erect filiform stigmata; seed black, oblique-obovate, compressed, carinate on lower part of back, somewhat shining, and very lightly pitted, (under the glass,) 0.8–0.9 lines long; hilum small, oval; albumen rather small; embryo ovate, straight, with short hooked cotyledons. Mr. Schott has found this species abundantly in Western Sonora and the Gadsden purchase. The flowers are yellow, and similar to those of *E. Wislizeni*, but rather smaller; the stems are generally much higher than thick, and of a clavate shape; lower central spine sometimes almost hooked.

Echinocactus Wislizeni is distinguished by the less flattened, less flexible, stouter spines, the lower central one being channelled above and strongly hooked; by having only three lower radial spines, &c. The distinction indicated by the spines is confirmed by the shape and structure of the seeds; and thus the plants of the Colorado and of the Rio Grande are distinct representatives of the same type on both sides of the Rocky mountains.

4. E. Wislizeni, Englm. in Wisl. Rep., (Pl. III, fig. 1–2.)—This plant is very abundant in the neighborhood of El Paso, where it was first found, many years ago, by Dr. Wislizenus.

The fruit and seed of this plant were collected by Captain Whipple in the neighborhood of the *Cereus giganteus*, while engaged in surveying the Gila, on the boundary commission, in 1852. There possibly may be some doubt about its growing in that region, however, from the fact that Captain Whipple's fruits were labeled "*Cereus giganteus*," and were not collected by a botanist.

In our present expedition, when I first found a giant *Echinocactus—E. Le Contei*—at Cactus Pass, I was sure, in common with Drs. Parry and Le Conte, that it was *E. Wislizeni*, which I had often seen before at Doña Ana. I was most happy, however, in being able to secure even a single specimen of the fruit and seeds of that plant, by means of which, with the spines I collected, it has been identified and confirmed by the acute observations of my friend, Dr. Engelmann. It may be well to observe here, that the figure of this plant, in Major Emory's report, was made from a specimen seen on the headwaters of the Gila, near the mouth of the Azul branch, not far from Santa Rita del Cobre, or Copper Mines, and at least four degrees of longitude east of the place where first met *Ech. Le Contei*.

5. E. EMORYI, Engelm. in Emory's Report, 1848: globosus, costis 13 tubcrculatis, tuberculis prominentibus obtusis distantibus; areolis ovatis; aculeis subæqualibus robustis annulatis subcompressis recurvatis s. rectiusculis fuscis versus apicem corneis, radialibus 7 (lateralibus 6, singulo inferiore breviore) s. addito summo rarius 8; centrali singulo teretiore paulo longiore robustioreque, porrecto s. demum deflexo curvato s. subuncinato. (Plate III, fig. 3.)

Collected west of the Colorado, in the valley of the Mojave, mixed with *E. Polycephalus*, and therefore not further noted. The only specimen preserved is 9 inches in diameter, sub-globose, below contracted, pear-shaped, or almost stiped.

On the lower part of the plant the areolæ are elevated on distinct ovate or sub-cylindric tubercles, which higher up become connected in 8 and on the upper part of the plant in 13 ribs; tubercles on this part of plant $\frac{1}{2}$–$\frac{3}{4}$ inch in height and diameter; areolæ $1\frac{1}{2}$ inch distant, $\frac{1}{2}$ inch long, a little less wide; the floral areolæ smaller, closely connected with the former, separated from it by 1–3 sub-globose glandular bodies, half or mostly hidden in the tomentum. Radial spines $1\frac{1}{2}$–2 inches long; the four upper lateral ones longer and stouter, the two lower ones more slender; the lowest spine the shortest, (1–$1\frac{1}{2}$ inch long,) secured like the others, or rarely hooked, similar to the shape of that spine in *E. Viridescens*.

An eighth upper radial spine, similar to the others, is sometimes observed. The stouter central spine is about 2 inches long, at the point strongly recurved, or often almost hooked. Spines of a reddish-brown color, lighter horn-colored, and somewhat transparent at tip.

This is probably the plant collected and figured by Major William H. Emory, in General Kearny's expedition to California in the fall of 1846, and then named after him. We collected only one young specimen, probably on the Lower Colorado, from which this description is taken. Mr. Schott has found the plant abundantly south of the Gila river, and it is known to extend to the Gulf of California. We procured a large specimen in San Francisco, (said to have been brought from Guaymas,) which is now flourishing in the public garden at Washington. This species has, when full grown, a height of 3 and a diameter of 2 feet, and 18–21 ribs. The large flowers are deep red, similar in form to those of *E. Wislizeni*.

6. E. POLYCEPHALUS (sp. nov.): globosus, demum ovatus cylindricusve multiceps, (e basi ramosus,) vertice dense tomentoso, costis 13–21 acutis; areolis ovato-orbiculatis junioribus tomentosissimis; aculeis 8–12 robustissimis compressis annulatis plus minus recurvatis junioribus puberulis cinereo rubellis apice nudatis rubicundis; aculeis radialibus 4–8 infimo deficiente, superioribus si extant gracilioribus; centralibus 4 robustissimis 4-angulatis compressis, superiore latiore suberecto s. sursum curvato, inferiore longiore decurvo; floribus in vertice congestis; ovario lana nivea ex axillis sepalorum 90–100 linearium demum spinescentium orta densissime vestito, sepalia tubi infundibuliformis 100–120 lineari-lanceolatis aculeato-aristatis purpurascenbus, interioribus margine petaloideis, petalis laciniato-fimbriatis herbaceo-aristatis sub-30 flavis, stigmatibus 8–11 linearibus acutis; bacca globoea sicca flore coronata, lana densa involuta; seminibus magnis irregulariter angulatis minutim (sub lente) verrucosis, opacis. (Pl. III, fig. 4–6.)

Stoney and gravelly hills and dry beds of torrents from 20 miles west of the Rio Colorado to about 150 miles westward up the Mojave; found in fruit in the beginning of March. This distinguished species is simple only when quite young; even the small globose plants show several heads from one base, and older cylindric stems have as many as 20 or 30 heads, all pretty nearly of the same size; the globose ones are 6–9 inches in diameter; the ovate heads are 12–15 inches high by 8–10 in diameter, and the largest cylindric stems seen were 2–$2\frac{1}{2}$ feet high by less than a foot in diameter. The number of ribs varies, in old specimens it is generally 21. Areolae about half au inch in diameter, and $\frac{1}{4}$–½ inch distant from one another; floral areolae smaller, without the ligneous glandular organs noticed in others. The spines in a young 5-ribbed living specimen before us are 7 radial and 1 central one; very soon, however, the 4 upper larger spines become central and 4 new upper spines are arranged radially; even in old

and full grown specimens sometimes not more than these 8 spines are found, the 4 upper ones (which are in this case perhaps rather improperly designated as central) stouter and cruciate, and the 4 lower ones arranged around the lower half of the areola Generally, however, 2 upper radial spines, weaker and less curved than the 4 lower ones, make their appearance; and in a few specimens before us we find 3–4 upper radial spines, the uppermost ones being quite Blender.

In the field we noted as many as 15 spines occasionally, when no doubt 7 occupy the place of upper radial ones. The central spines are always very stout but very different in size; in some specimens we find them $1\frac{1}{4}$ to $1\frac{3}{4}$, while in others they are 2 to $3\frac{1}{2}$ inches long; they are nearly straight or very much curved; the upper one is often $1\frac{1}{2}$ to 2 lines wide, the lower one the longest.

The yellow flowers seem to make their appearance in February as the fruit ripens in March; the ovary and the fruit are enveloped in dense pure white cottony wool, which originates from the axillæ of the lower sepals and through which only the dark reddish-brown spinescent points of the sepals are visible. The incomplete description of the flowers was made from withered specimens adhering to the fruit. Tube of flower funnel-shaped, short and rapidly widening towards the upper end, naked (without free stamina) at the lower part. Petals about 1 inch long and 2 lines wide. Style 1–$1\frac{1}{2}$ inch long, stigmata 4 lines long. Fruit dry 8–10 lines in diameter, together with the remnants of the flower about 2 inches long, open at base when falling off like the fruit of many if not most of our *Echinocacti*, seeds 2 lines long, $1\frac{1}{2}$ line broad, irregularly shrivelled, appearing rugose and angular, much like those of the nearly allied *E. horizonthalonius Lem.*; hilum transversely oval; embryo curved, the cotyledons buried in the large albumen, accumbent, sometimes oblique.

This species is very nearly allied to *E. Parryi*, Englm. Synops. Cact. of the neighborhood of El Paso, but this latter species is depressed globose, much smaller, simple, with only 13 ribs, whiter, less flattened spines; fruit and seed are said to be the same, but unfortunately have been lost and cannot be compared; no doubt satisfactory diagnostic characters will be discovered in the seeds; the fruit of *E. horizonthalonius* and *E. Texensis* are also similar, the latter, however, though woolly, is not dry.

Very different in flower and fruit but very similar in shape, in the many heads, numerous ribs, and stout curved annulated spines, is *E. cylindraceus*, discovered by Dr. Parry a few degrees further south on the eastern slope of the Sierra. We shall repeatedly have occasion, especially among the *Opuntiæ*, to indicate the remarkable analogies in the external form or in the more essential character of *Cactaceæ* in different geographical divisions of the southwest.

CEREUS, Haw.

Subgen. ECHINOCEREUS.

1. CEREUS VIRIDIFLORUS, Englm. in Wisl. Rep. Subnom. *Echinocereus*.

On the plains east of New Mexico, near the 100th degree of longitude, to the mountains of the Rio Grande, September 12, 1853.

2. C. CAESPITOSUS, Englm. in Plant. Lindh. 1. c. The most eastern of all our *Cerei!* and only found in the plains. It was first seen about 170 miles west of Fort Smith, near the 96th degree, about the same longitude where Mr. Lindheimer first discovered it on the Brazos, four degrees further south. Its western limit seems to be near the 100th degree, where the range of *C. viridiflorus* commences.

It may not be uninteresting to observe that this is the first time that this interesting genus has been recognized within the boundaries of the United States under the acquisition of Louisiana.

3. C. FENDLERI, Englm. in Pl. Fendl.: Seen first on the high plains 50 miles east of the Pecos, about 11 to 105th degree, and extending from there over the mountains of New Mexico westward to the Aztec mountains, near the 113th degree. Southward it has been seen as far as El Paso.

The ovate or mostly elongated cylindric heads are simple or few together, and of a dark green color; they are characterized by the dark central spine, which is very bulbous at base and curved upwards, and by the lower radial spines being by far the stoutest, the lowest being 4-angular. Flower and fruit have been described elsewhere.

Var. β. PAUPERCULUS, with only about 6 spines, the central one assuming the place of an upper radial spine, was also found near the Pecos. It hardly deserves the designation of a distinct variety, as occasionally complete bunches of spines occur on the same plants with the depauperate ones.

4. C. MOIAVENSIS (sp. nov.): ovatus, dense cmspitosus, 10–11-costatus, glaucescens; areolis orbiculatis junioribus dense albo-tomentosis distantibus; aculeis basi bulbosis teretiusculis s. subangulatis robustis elongatis curvatis, radialibus 7–8, infimo superioribusque debilioribus, lateralibus longioribus, centrali singulo angulato sursum incurvato. (Plate IV, fig. 8.)

Var. β? ZUNIENSIS: dense cæspitosus 10-costatus, areolis paulo minoribus, aculeis tenuioribus basi bulbosis quadrangulatis rectis s. paulo curvatis flexuosisve, radialibus 8 infimo graciliore, summo robustiore longioreque, centrali singulo robustiore longiore recto s. sursum incurvo. (Pl. IV, fig. 9.)

Found between the Rio Colorado and Mojave creek, with *Echinocactus polycephalus* and *Opuntia erinacea*, etc., a region rich in rare *Cactaceæ*. The oval heads, 2–3 inches high, and $1\frac{1}{2}$–2 inches in diameter, form dense cespitose masses much like *C. phaniceus*. The areolæ are 3 lines in diameter, 6 lines or more distant from one another. The long and very bulbous spines are curved and interlocked so as almost to hide the body of the plant. Upper and lower radial spines 9–15 lines, the uppermost one wanting or weaker than the rest; lateral spines 15–25 lines long, ashy-red when young; central spine more angled $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, dusky; all spines ashy-gray when old.

C. Zuniensis seems to form an intermediate link between this and the next species, but resembles most the former, to which for the present—not knowing flower and fruit—we doubtfully draw it as a variety. It was found near Cañon Diablo, on the Colorado Chiquito, about 120 miles west of Zuñi. Its manner of growth and whole appearance is very much like that of the Mojave species, the spines are weaker, straighter, and more angular; the principal difference consists in the stout upper radial spine, which is similar to the central spine. Young areolæ nearly 3 lines in diameter, 4–6 lines distant; lowest radial spine 6–9 lines, lateral ones 9–15, and upper one 12–18 lines long; central spine $1\frac{1}{2}$–2 inches long, very bulbous at base. Young spines straw colored, old ones ashy.

C. Mojavensis seems to be nearly allied to *C. Fendleri*, (in both the spines are very bulbous at base, the central one single, angular, and curved upwards,) but the cespitose growth, glaucous color, longer radial spines, the lowest one of which is weakest, seem to distinguish it. The examination of numerous specimens *in loco*, and the flower and fruit only can decide here whether they are distinct, or forms of a single species, and this indeed is the case with all those *Cactaceæ* the flower and fruit of which are unknown to us. *C. Zuniensis* was collected December 18, 1852, and the Mojave plant March 4, 1854.

5. C. GONACANTHUS (sp. nov.): ovatus simplex s. e basi parce ramosus costis 7 interruptis, areolis magnis orbiculatis distantibus, aculeis robustis angulatis rectis s. varie curvatis flexuosisve, radialibus 8, inferioribus lateralibusque quadrangulatis flavidis basi et sæpe apice obscuris,

infimo breviore, summo elongato robusto multangulo obscuro erecto aculeum centralem similem multangulatum erecto-patentem subrequante, rarius excedente. (Plate V, fig. 2–3.)

On high sand-bluffs, covered with scattering cedars, near the natural well, about 40 miles west of Zuñi, near the 109th degree. Only seen in that locality. This species resembles, in its growth and the character of its spines, *C. triglochidiatus;* it is simple or has 2 or 3 heads, 3–5 inches high; the young areolæ are very tomentose, 3–4 lines in diameter, and 6–10 lines distant from one another; the lower radial spine is 8–12, the others 10–15 lines long, pale or dirty yellow when young; the upper radial spine is much stouter and longer than the others, and resembles the central spine in shape, size, and color; in the few specimens at our disposal, we find it from $1\frac{1}{4}$ to $2\frac{1}{2}$ inches long; sometimes it assumes a more central place in the areolæ, the two upper lateral spines almost closing above it, very rarely a small tenth spine appears above it. The central spine is $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, 1 line in diameter, deeply furrowed, and 6 or 7 angled; it is longer, equal to or rarely shorter, than the upper radial spine. Both those spines are almost black or mottled yellowish and black when young, and become, with all the others, gray when old. Collected November 29, 1853.

6. C. TRIGLOCHIDIATUS, Englm. in Wisl. Report, sub Echinocereo: In rocky cañons at the Rio Gallinas, east of the Pecos, and from there to the Sierra Madre, near Mount Taylor; not noticed farther west; always with few branches, or nearly simple. Major Brooks, the commandant of the fort at Santa Fe, informed me that the fruit of this species is edible, like many other allied species. Collected September 28, 1853. (Pl. IV, figs. 6–7.)

7. C. HEXAËDRUS, (sp. nov.): ovatus, simplex seu e basi parce ramosus; costis 6 obtusiusculis subinterruptis, sulcis latis superficialibus, areolis orbiculatis distantibus; aeuleis tenuioribus rectis rigidis subangulatis basi bulbosis, radialibus 5–7 e flavido rubellis, inferiore breviore, summo sæpe robustiore, centrali robustiore longiore acute-angulato juniore fuscato, sæpe deficiente. (Plate V, fig. 1.)

On sandy hills, under cedars, about fifteen miles west of Zuñi. Few heads 4–6 inches high, 2–$2\frac{1}{2}$ in diameter, with six obtusish ribs, separated by wide and shallow grooves. Areolæ tomentose when young, only $1\frac{1}{2}$ line in diameter, 6 or 8 lines distant. Spines slender, but stiff; quite bulbous at base; lower ones 5–10, upper ones 8–15 lines long; mostly 6 radial spines, without a central one, the uppermost being the stoutest, longest, and darkest one, but smaller where a central spine is present. In a single instance, we found 7 radials, and in another one 2 compressed central spines; central spine usually 12–15 lines long. From the nearly allied, more southern *Cereus paucispinus*, Engl. this northwestern form is principally distinguished by the slender and angular spines. But as of neither of them we know the flower and fruit, we cannot form definite conclusions as to their specific distinction. These forms and *C. triglochidiatus* have a smaller number of ribs than any other species of this section. Collected November 28, 1853.

8. C. PHOENICEUS, Englm. in Synop. Cact., *E. coccineus;* Englm. in Wisl. Rep. non De C. nec Salm. (Pl. IV, figs. 1–3.) Found from the Upper Pecos to Albuquerque and Santa Fé, also five degrees further west, on the San Francisco mountains. The specimens perfectly agree with the description given in Wislizenus's report. The numerous heads, 2–3 inches high, about 2 inches in diameter, form dense cespitose masses, often one foot or more across. Areolæ 3–4 lines distant, large; spines slender, almost setaceous, with very slightly bulbous base, 8–12 radial ones, 3–6, 1–3 central ones 5–10 lines long; upper radial spines much shorter than lower ones.

The following form seems very distinct, especially in its manner of growth; but we have seen intermediate forms which seem to indicate the necessity of uniting both. Such questions, however, can only be solved satisfactorily by careful examination of flower and fruit, which are as yet unknown, and by extensive observation of these plants in their native wilds.

9. SUB-SPECIES C. CONOIDEUS: ovatus versus apicem conoideo-acutatus parce e basi ramosus, costis 9–11 tuberculatis, areolis orbiculatis s. subovatis junioribus albo-tomentosis, aculeis basi bulbosis, radialibus 10–12 tenuibus rigidis rectiusculis, summis brevibus, lateralibus inferioribusque longioribus, centralibus 4, (rare 3–5,) superioribus radiales vix superantibus infimo multo longoire 4-angulato sæpe complanato porrecto s. deflexo. (Plate 4, fig. 4–5.)

On rocky and mountainous localities on the Pecos, *Cer. Roemeri*, Muhlenpf., not Englm., from the San Saba, in Texas, seems to agree well with our plant, but the description is not full enough to decide about their identity.

Heads 3–4 inches high, single or few, of unequal height together; remarkable on account of their conical or acutish shape uniformly observed. Areolæ 4–6 lines distant; spines white or straw colored, larger central one often dusky when young; radial spines slightly bulbous at base; upper ones 2–5 lines, lateral ones 6–15 lines long, and lower ones hardly a little shorter; central spines very bulbous; upper ones cot much longer than the lower radial ones; lower central spine sharply quadrangular, mostly compressed, often deflexed and curved, 1–3 inches long

On the San Francisco mountains, a specimen was collected with 11 ribs, 8–9 radial spines, (4–12 lines long,) the uppermost shortest, and 3–4 reddish-gray central spines, very bulbous at base, the lowest longest (12–20 lines long) and angular. In superficial appearance, this plant resembles *C. Mojavensis*, but it must be referred here, and seems to indicate a range of this form through seven degrees of longitude.

A specimen from Anton Chico, on the Pecos, seems to unite *C. conoideus* with *C. phœniceus*. Areolæ more distant than the latter; spines longer; 3 central spines, lower one somewhat curved and angular. Collected September 28 and December 18, 1853.

10. C. ENGELMANNI, Parry, var. α VARIEGATUS: ovato-cylindricus simplex s. parce e basi ramosus 12-costatus, areolis orbiculatis approximatis, aculeis exterioribus sub-13 gracilibus rigidis albis apice sphacelatis adpressis lateralibus longioribus, summis deficientibus; aculeis centralibus 4 cruciatis (raro 5) plus minus curvatis infimo elongate angulato albo decurvato, ceteris brevioribus teretiusculis nigris corneisque variegatis; floribus ex axillis areolarum vetustiorum inferiorum; bacca ovata sicca pulvillis numerosis setas tenues albidas plurimas gerentibus stipata; seminibus obovato-subglobosis compressis rugoso-tuberculatis opacis. (Plate V, fig. 4–7.)

Var. β? CITRTSOCEXTRUS, cylindricus parce e basi ramosus 10–12-costatus, areolis magnis; aculeis radialibus 12–14 albis superioribus setaceis brevibus, inferioribus longioribus robustioribus angulatis compressis rectis s. paulo incurvis, centralibus 4, superioribus rigidis robustis basi bulbosis angulatis rectiusculis elongatis, erectis vitellinis, inferiore angulato compresso albo recto paulo breviore deflexo; floribus ex inferiore plantæ parte; bacca ovata pulvillis paucis aculeos setosos longiores albos gerentibus stipata. (Plate V, fig. 8–10.)

On the Cactus mountains and at the head of Williams river, degrees 113½ longitude. Heads 4–9 inches high, single or few, not more than 4–6 together; areolæ 2–4 lines distant; radial spines 3–5 lines long, upper central spines 3 or sometimes 4, black on the upper, and horn-colored on the lower side and towards the point, 1–1½ inches long, lower central white, 1½–2 inches long. Position of fruit on lower half of plant much like that of *C. chloranthus*, R.B.C., fruit only 6–8 lines long, crowned with the remains of the (red?) flower. Seed 0.6–0.7 line long compressed, tubercles sometimes irregularly confluent and leaving pits between the ridges, lower part of the back with a smooth carina, hilum oval.

Var. β CITRISOCENTRUS, named after its deep golden-yellow spines, is, probably, not specifically distinct, though the straighter, stouter, and less divergent spines give it a very peculiar appearance. It was found where *C. variegatus* disappears on the lower part of Williams' river, and was seen from there to the Mojave creek, and up that stream to the Sierra Nevada. Stems 5–10 inches high, areolæ 6–7 lines distant, young ones 2½–3 lines in diameter. Upper radial spines 3–5, lateral 5–7, and lower ones 7–12 lines long; the latter flattened and often curved up.

Upper central spines 3 or sometimes 4, 2–3 inches long, bulbous and angular at base, terete above; lower central spine $1\frac{1}{2}$–$2\frac{1}{2}$ inches long, flattened. Spines on fruit 3–8 lines long, fewer and stouter than in the other form.

Cereus Engelmanni, Parry, has been found abundantly by Mr. A. Schott on the lower Gila; a specimen brought home evidently seems to unite them, and consequently *C. variegatus* and *C. chrysocentrus* are to be considered forms of it.

I am acquainted with the *habitus* of about 15 or 16 species of the subgenus ECHINOCEREUS. All of them are of low growth, (I write of those only with which I am acquainted,) never more than 12, seldom more than 8, and often less than 5 inches in height. All, also, are more or less cespitose, or branching from the root; some of them slightly, others very much so. *Cereus viridiflorus, chloranthus, dasyacanthus, ctenoides, cæspitosus, longisetus, Fendleri, gonacanthus, hexædrus, paucispinus*, and *Engelmanni*, grow in small irregular tufts, or masses, some of the joints or stems being much taller than others. Some of them, such as *C. viridiflorus, dasyacanthus, ctenoides, cæspitosus*, and *Fendleri*, are often nearly simple, or having but few branches; while others, such as *C. chloranthus, longisetus, gonacanthus, hexædrus, paucispinus*, and *Engelmanni*, have usually 8–20 joints. *C. polyacanthus, phœniceus*, and *enneacanthus* are much branched, and grow in somewhat flattened masses, sometimes with a circular outline, but not always, all the joints being of nearly an equal height. *C. stramineus* always forms a dense hemispherical mass, of a perfectly regular contour—the central joints being the oldest and longest—9–12 inches high, gradually subsiding towards the circumference of the mass until the extreme outer stems are not more than 2 inches high. *C. Mojavensis* often grows similarly, but I have also seen it in much broader masses, containing 500–800 heads or joints; in such cases it is always flattened on the top. Where this state occurs, the central joints are as high as in the hemispherical masses, but the hemispheric contour is destroyed by the longitudinal extension of the joints, forming masses sometimes 4 or 5 feet in diameter. *C. phœniceus* and *C. conoideus*, two forms which Dr. Engelmann has united are quite different in their manner of growth. *C. phœniceus*, as stated above, grows in irregular flattened masses, while *C. conoideus* has the more elevated and somewhat hemispherical shape of *C. stramineus*. On account of the unfavorable season of the year (October—March) during our journey through regions of these cacti, we were unable to procure the flower or fruit of any of these plants In our friendly correspondence with Dr. Engelmann, I insist that *C. phœniceus* and *C. conoideus* are distinct species, and (from analogy only) I assume that when the flower of *C. conoideus* is obtained, it will be found to be a *purple*, while that of *C. phœniceus* is *crimson*. Time and observation, however, are the only decisive arbiters of such controversies.

Subgen. EUCEREUS.

Of *Cereus* proper only one species was seen, viz:

11. CEREUS GIGANTEUS, Englm.: Williams' river to the Colorado of the west, February 4 to February 22, 1854. This is the most northern true *Cereus* that we have, being found as high as latitude 34°, while *Cer. Greggii* and *Emoryi* are found only a little above latitude 32°. This plant has a considerable range, extending south, from this place to near latitude 28° in the vicinity of Guaymas Sonora. The fruit under the Mexican name of *Pitajaya*, pronounced Pit-a-zi-ah or Pit-ai-yah, is a great source of sustenance to the Mexicans and Indians of the regions where it grows. Conserves and molasses, or syrup, are made from them which are preserved during the winter season for future use. They are very pleasant to the taste in a fresh state. As the fruit grows near the top of the tree at an altitude of 25 to 50 feet and being very large and pulpy, if permitted to ripen and drop to the ground, they burst and are almost rendered unfit for use. The Indian mode of collecting them is to take a long light pole, make a fork at the top by tying a short piece to it, by which they contrive to firing them within reach. Birds and every- kind of animal and insect that can reach them are so fond of them that many

of them are thus destroyed. My friend, Mr. Schott, of the Mexican boundary, who has lately returned from that desolate but rather interesting region, informs me that still further south this interesting plant is replaced by another not so large—but still a great cactus. This is very probably the one collected by Mr. Thurber, described and named by Dr. Engelmann, in Silliman's Journal, *Cer. Thurberi*. The pitajaya of this species, according to Mr. Schott, is the principal support of the Papige Indians. It is much larger, sweeter, more juicy than that of the *Cer. giganteus*. The color of the pulp is also of a much brighter red.

In consequence of the remote and unhospitable region of this curious and interesting cactus, our acquaintance with it became very gradual. Dr. Engelmann thinks that Baron Von Humboldt, in his work on New Spain, must have had reference to this plant, but this is quite uncertain because no characteristics are given of his cacti (organos del Lunal) except size and edible fruit, and many other large species of both cerei and opuntiæ are long and well known to yield them. In 1846, Major Emory first collected seeds and made figures of it which, on being presented to Dr. Engelmann, he was enabled to pronounce it a true *Cereus* and at that time very appropriately named it. Subsequently, (winter and spring of 1852,) Dr. Parry, under Major Emory, visited that region, collecting spines, wood, &c, and making copious notes on the ground, enabled Dr. Engelmann to give a good diagnosis of it. Still Dr. Parry was unable to procure the flower or fruit on account of the lateness of the season. It was reserved for Mr. Thurber, who repassed this region in the summer of 1852, to collect complete specimens, and Dr. Engelmann, in a subsequent number of Silliman's Journal, has given a complete description of it. (Vide Amer. Jour., Vol. XVII, 2d series, March, 1854.) To the several excellent accounts given of this tree by Dr. Engelmann, little of interest can be added. As noticed by Drs. Parry and Engelmann, the number of ribs at tho base is about 12, and they "increase upward, by bifurcation and addition," to the largest circumference of the tree, which is about 15–18 feet from the ground, and where also usually the few branches are given off. Here the ribs sometimes number 30, and from this point upward they decrease in number to 18–20. The wood at the base of old specimens becomes a perfect hollow cylinder, and from thence upward to the first branches, instead of being solid it becomes a reticulated net-work of bundles of wood continuing the hollow cylinder as is seen on a smaller scale in the wood of *Opuntia arborescens*. These trees in abundance give the landscape a very peculiar appearance, and from their novelty and entire dissimilarity to any others, at first is not only curious but pleasing, but as the eye becomes accustomed to it, a gradual transition takes place in ones feelings and from being pleasing they at last become monotonous and repulsive. This feeling, however, may be somewhat accounted for by the surrounding sterility of the land. As far as the eye can reach in the vallies or on the mountains, little else but rocky boulders and the stately yet awfully sombre aspect of the cereus giganteus can be seen.

OPUNTIA, Tourn.

Subgenus 1. PLATYOPUNTIA, Englm.

1. OPUNTIA ENGELMANII, Salm. At Delaware, about 170 miles west of Fort Smith, a specimen of this plant was observed about four feet high. This seems to be the northern limit of a species which is widely spread from lower New-Mexico to the mouth of the Rio Grande, and on both sides of that river, northward and southward. In the southern regions it grows much taller than in the north.

2. OP. ENGELMANII, β? CYCLODES: erecta; articulis orbiculatis, pulvillis remotis tomento griseo setisque stramineis rigidis inæqualibus instructis; aculeis subsingulis rectis validis compressis stramineis basi fuscis deflexis, adjectis sæpe 1–2 inferioribus brevioribus pallidioribus; bacca globosa late umbilicata, seminibus late undulato-marginatis. (Plate VIII, fig. 1 & XXII. figs. 8–9.)

About the mouth of the Gallinas into the Pecos, near Anton Chico, New Mexico; collected in fruit in September. Plant 4 feet high; joints orbicular, or even transversely oval, about 7 inches in diameter; pulvilli 1 inch apart, large, with a semi-circle of large, coarse bristles, 3–4 lines long at the upper edge, and a single .stout spine, $1\frac{1}{4}$–$1\frac{3}{4}$ inch long, on the upper pulvilli, often with 1 or 2 additional ones, 4–9 lines length. Flower not seen. Fruit globose, 1–$1\frac{1}{4}$ inch in diameter, of a purple color. Seed 2.0–2.3 lines in diameter, with a broad and thick acutish undulate rim. The circular joints with fewer spines, and the small globose fruit with large seeds, distinguish this form from *O. Engelmanni*, as it usually appears further south.

3. Op. occidentalis, (sp. nov.): erecta patulo—ramosissima, caule demum lignoso terete corticato; articulis grandibus obovatis rhomboideisve, pulvillis remotis griseo-tomentosis, setis flavis s. flavo-fuscis gracilibus confertis, aculeis 1–3 validis compressis angulatis rectis deflexis divergentibusve, uno alterove ad articuli marginem superiorem erecto, albidis corneisve subannulatis basi flavo-fuscis cum adventitiis 1–2 gracilioribus pallidioribus deflexis; flore flavo intus aurantiaco, ovario obovoto pulvillis fusco-villosis vix fulvo-setosis sub-25 notato subinde parce aculeolato, sepalis (extus rubellis) 10–12 dilatato-obovatis cuspidatis, petalis (8?) obovatis obtusis subintegris; bacca obovata late umbilicata succosa, seminibus majoribus irregularibus undulato-marginatis, crenulatis. (Plate VII, figs. 1–2. & XXII, fig. 10)

On the western slope of the California mountains, from Quiqual Gungo, east of Los Angeles, to San Pasquale and San Isabel, northeast of San Diego, (A. Schott,) at an elevation of 1,000 to 2,000 feet, in immense patches, often as large as half an acre. Flowers in June. Stout ligneous stems, with innumerable branches, sometimes over one hundred joints, spreading far, and then often bent to the ground; joints 9–12 inches long, 6–8 inches wide; pulvilli $1\frac{1}{2}$–2 inches distant, with slender and closely set (much more so than in *O. Engelmanni*) bristles, only 2–3 lines long on the upper part of the pulvillis; spines 1–$1\frac{1}{4}$, smaller ones $\frac{1}{2}$–$\frac{3}{4}$ inch long. Flower yellowish and orange, deeper colored inside at the base, 3–$3\frac{1}{2}$ inches in diameter; ovary $1\frac{1}{2}$ inch long, not one inch in diameter; pulvilli pretty equally distributed over it, (not as much congregated toward the top as in *O. Engelmanni;*) sepals short and unusually broad; petals only 9 or 10 lines wide by 15 lines in length, rounded, and not emarginate in my specimen, nor mucronate. Fruit 2 inches long, $1\frac{1}{4}$–$1\frac{1}{2}$ inches in diameter, "very juicy, but of a sour and disagreeable taste." Seeds $2\frac{1}{2}$–$2\frac{3}{4}$ lines in diameter. The young plants, raised from the seeds which we brought home, fail to exhibit the very hairy pulvilli which all the young of *O. Engelmanni* show; they bear only the numerous bristly spines seen in moat young *Opuntiæ*, at least of this section.

To Mr. A. Schott, who has considerably enriched our knowledge of the vegetation of the countries along the boundary line and in the Gadsden purchase, is due the credit of having discovered the flower of this plant, heretofore unknown, and of many valuable notes about its general habits.

The plant mentioned in Silliman's Journal, November, 1852, (Dr. Parry's collections,) as being common "on the hill-sides and plains near San Diego," and which Mr. Schott seems to have also found "on the sea-beach near San Diego," may be a form of *O. Engelmanni*, as suggested in the above publication; or it may be a naturalized wild state of *O. Indica* which is cultivated about the missions there. Enough material has not been obtained to decide about it. At all events, it seems to be distinct from the plant of the western mountain slopes.

4. Op. chlorotica, (sp. nov.): erecta grandis, caule demum-lignoso terete, cortice cinereo-fulvo; aculeis flavis numerosissimis fasciculatis armato; articulis orbiculato-obovatis magnis pallide flavo-virescentibus s. subglaucis; pulvillis subremotis griseo-tomentosis, setis stramineis difformibus exterioribus brevioribus tenuioribus subsequalibus confertis, interioribus uniseriatis robustioribus longioribus; aculeis in pulvillis inferioribus 1–3, in superioribus 3–6 inæqualibus stramineis plus minus compressis (nec acute angulatis) plerisque deflexis, interiore breviore

subinde erecto; flore flavo, ovario tubercula pulvilli-gera conferta sub-50 gerente; sepalis tubi sub-20 oblanceolatis cuspidatis, petalis sub-10 obovato spathulatis, obtusis mucronatis, stigmatibus 8 patulis; bacca obovata tuberculosa profunde umbilicata. (Plate VI, figs. 1–3.)

On both sides of the Colorado, from the San Francisco mountains to the headwaters Williams' river, sometimes called "Bill Williams' fork," and to the Mojave creek. The only erect, flat-jointed *Opuntia* in this section of country, 4–5 and sometimes even 7 feet high, forming large bushes, on one of which upwards of one hundred joints were counted. The large trunks have a scaly, grayish, or light-red brown bark; the pulvilli are not obliterated on it, as they are on *O. Engelmanni*, but are largely developed, 4–6 lines in diameter, pulvinate, densely covered with a thick brown tomentum, surrounded by numberless straw-colored bristles, 4 lines in length, and bearing 20–30 or more yellow, compressed spines, often 1–2 inches in length, stellately radiating in every direction, and covering and shielding the whole surface of the stem. The only *Opuntia* which I find described as having a similarly armed stem is *O. Karwinskiana*, Salm., which is said to have 18–20 gray spines on the oldest pulvilli.

Joints 8–10 inches long by 6–8 wide, always of a very pale glaucous, or rather more yellowish green color, which is strikingly characteristic, even at a distance, and which has procured our name for the plant; pulvilli about 1 inch apart, strongly pulvinate; bristles two-fold and distinct, the upper and outer, and by far the most numerous ones are shorter and thinner, and cover the upper semi-lunar area of the areola; inside of them is a semi-circular row of stouter and longer bristles, 4–6 lines long, which unite with the outer and shorter spines of the outer and lower margin of the areola. This arrangement is most distinct on the upper and more fully developed pulvilli; among our *Opuntiæ* it is only seen again, as far as known, in the obscure *O. dulcis* from Presidio del Norte. Spines proper 1–1½ inches long, pale straw color, with faint transverse markings, hardly darker at base; shorter spines 4–9 lines long.

The description of the flower was drawn from an old withered specimen gathered in winter; it seems pale yellow, between 2 and 3 inches in diameter; sepals and petals remarkably narrow, the latter about 1 inch long, and not half as wide. The ovary and fruit (all the specimens found were sterile) are quite tuberculous; pulvilli crowded, bearing brown wool and short, yellow bristles. Specimens of sterile fruit seen 1¼–1½ inches long.

5. Op. procumbens, (sp. nov.): prostrata, articulis orbiculato-obovatis grandibus pallide viridibus, pulvillis remotissimis griseo-tomentosis, setis flavis robustis valde inæqualibus, aculeis validis 2–4 subinde (in articulis vetustioribus ?) 7–9 compressis angulatis inæqualibus, stramineis s. pallidioribus versus basin obscurioribus, sæpe rufis fuscisve, deflexis. (Plate VI, figs. 4–5.)

From the San Francisco mountains to the Cactus Pass, at the head of Williams' river, in rocky localities. Joints 9–13 inches long, 7–9 broad, prostrate, always on edge; pulvilli 1½–2 inches apart; bristles 2–4 lines long, comparatively stout; spines 1–2 inches long; no flower or fruit seen. Very similar to *O. Engelmanni;* but prostrate, with even more distant pulvilli, and stouter and often more numerous spines.

6. Op. angustata, E. & B.: prostrata s. adscendens, articulis elongato-obovatis versus basin sensim angustatis suberectis; pulvillis remotis griseo-tomentosis, setis fulvis gracilibus; aculeis paucis (2–3) validis compressis albidis s. stramineis, versus basin rufis s. fulvis, adjectis sæpe infra 1–2 debilioribus, omnibus deflexis; bacca obovata, tuberculata rubella, late profundeque umbilicata pulvillis 24 stipata; seminibus magnis subregularibus late marginatis. (Plate VII, figs. 3–4. & XXII, fig. 11.)

From the foot of the Inscription rock, near Zuñi, to Williams' river, and westward as far as the Cajon Pass of the California mountains. Prostrate in the first and last-mentioned localities but sub-erect in the bottoms of Williams' river. Joints 6–10 inches long, and at the upper third 3–4 inches wide, gradually narrowed downwards, rounded above; pulvilli over 1 inch

apart, oblong, quite strongly pulvinate, 3 lines long, bearing slender brown bristles; spines in the specimens collected cast of the Colorado sharply angular, pale straw colored or whitish, brownish only at the very base, 1–1½ inch long; sterile fruit obovate-subglobose, 1–1¼ inch long, with large pulvilli crowded toward the upper end of the fruit, covered with grayish-brown wool and bright brown bristles. The specimen from Cajon Pass has brighter colored spines, with the lower half red brown, not so angular; some erect spines, at the upper end of the joint, almost terete. On this specimen a ripe fruit was collected, from which the above description has been taken; it is 1½ inch long, nearly one inch in diameter, with the wide and flat umbilicus immersed about half an inch; pulvilli on tubercular elevations about 14 on the upper part of the fruit, and 10 along the rim; seeds 3 lines or more in diameter, much compressed, with the broad rim almost curled. Some of the seeds have germinated, and the young plants grow vigorously.

This plant cannot be confounded with any others of our species; some southern *Opuntiæ* have similar, or even more elongated joints, but are erect and almost unarmed, such as *O. stricta*, *O. tuberculata, O. lanceolata*, etc. *O. polyantha* from South America, seems to be similar, but has smaller and more spiny joints, etc.

7. Op. phæacantiia, var. major E. in Pl. Fendl. Mem. of American Acad. IV, page 52.

Near Zuñi.—As both Mr. Fendler and ourselves failed to collect the fruits of this form, it remains doubtful whether it has been justly referred here, or whether it is more closely allied to *O. Camanchica*.

Op. mojavensis, E. & B.: prostrata, articulis grandibus suborbiculatus, pulvillis remotis, setis grandibus fulvis, 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 IX, figs. 6–8.)

On Mojave creek; at the time it was considered identical with the following species, 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.

8. Op. camanchica (sp. nov.): articulis adscendentibus majusculis obovato-orbiculatis pulvillis remotis orbiculato-ovatis tomentum griseum setasque paucas stramineas fulvasve (in pulvillis terminalibus demum elongatis rigidiores) gerentibus plerisque armatis; aculeis 1–3 s. ad marginem pluribus compressis fuscis s. atro-fuscis versus apicem pallidioribus superioribus elongatis suberectis ceteris deflexis gracilioribus; flore ? bacca ovata late umbilicata atro-rubente succosa, pulvillis remotis obsoletis; seminibus majusculis irregularibus angulatis late marginatis (Plate IX, figs. 1–5 & XXII, figs. 12–15.)

On the Llaño Estacado, at the base of the hills, in rather fertile soil, from the eastern slope of that elevated plain to the Tucumcari hills, near the upper course of the Canadian river. A large plant, spreading extensively, with large rounded joints 6–7 inches long by 5½–7 wide; pulvilli about 1¼ inch remote; bristles dirty-yellowish, greenish or brown, inconspicuous, except at the upper edge, where they often become elongated and stouter; only the lowest pulvilli are spineless, the others bear 2–3 and the marginal ones 3–6 spines; larger ones 1½–2 and in some specimens almost 3 inches long. Flower unknown; fruit very characteristic, distinguishing this species from the nearly allied *O. phœacantha*. It is oval, not narrowed or constricted at base; 1½–2 inches long, 1–1¼ inch in diameter, with a large fiat umbilicus ¾–1 inch in diameter, considerably resembling the fruit of *O. Engelmanni*; of a deep-red color and a very sweet juicy pulp. Seeds 2¼–3 lines in diameter, very irregular, angular and often twisted, with sides impressed, mostly with a broad and thick acute or obtuse rim deeply notched at the hilum.

9. Op. tortispina (sp. nov.): prostrata; articulis majusculis adscendentibus obovato-orbiculatis; pulvillis subremotis stramineo s. fulvo-setosis; aculeis 3–5 majoribus compressis angulatis subinde canaliculatis sæpe spiraliter tortis, albis basi apiceque sæpe corneis, adjectis infra aculeolis 2–3 gracilibus albis; flore ———; bacca obovata areolis sub-20 parvulis notata, late umbilicata, seminibus majusculis regularibus crassis. (Plate VIII, fig 2–3 & XXIII, figs. 1–5.)

On the Camanche plains, near the Canadian river, east of the plateau of the Llaño Estacado. Similar in growth to the more western *O. Camanchica*. Joints rounded, 6–8 inches long; pulvilli 1–1½ inches apart; bristles short, except on the edges, where they are 2–3 lines long, but rather slender; spines more numerous than in any other of our species, with juicy fruit, often 6–8, lower smaller ones ⅓–1 inch, larger ones 1½–2½ inches long, entirely white or yellowish horn-colored at base and tip; on the upper areolæ one erect spine, the others spreading in different directions, lower ones deflexed. Fruit similar to that of last species, large, oval, not contracted at base, perhaps less juicy and with a somewhat smaller and deeper umbilicus, 1¾–2 inches long, 1–1¼ in diameter. Seeds 2–3 lines across, thick and quite regular, with a very slight indentation at the hilum.

I had observed that sometimes 2 plants are produced from the same seed; this I found to be the case occasionally with *Opuntia occidentalis*, *Engelmanni* and *dulcis*, one of the young plants always much larger and more vigorous than the other. In examining different seeds of this species, I succeeded in finding one with two embryos (see figure), one spirally coiled around the other, both together appearing like one large one. (Plate XXIII, figs. 4–5.)

10. Op. Rafinesquii, Engelm.: diffusa; radice fibrosa, articulis mediis s. majusculis obovatis s. suborbiculatis per-viridibus; foliis subulatis elongatis patulis; pulvillis sub-remotis albido-s. griseo-villosis setas graciles rufas demum elongatas gerentibus plerisque inermibus; aculeis paucis plerumque solum marginalibus validis teretibus rectis albidis sæpe basi apiceque rufescentibus erectis s. patulis, singulis s. uno alterove graciliore deflexo adjecto; floris alabastro conico acuto, ovario clavato pulvillis 20–25 griseo-villosis rufo-setosis instructo; sepalis tubi sub-13 oblanceolatis acuminatis, interioribus late petaloideo-marginatis cuspidatis; petalis 10–13 late obovatis eroso-denticulatis emarginatis sulphureis basi intus miniatis, stigmatibus 7–8 erectis adpressis flavo-albidis; bacca ovata basi angustata clavata subnuda pulposa purpurascente, umbilico infundibuliformi immerso; seminibus subregularibus compressis, margine plerumque lato compresso sub-acuto. Var. *microsperma*: subinermis; seminibus minoribus regularibus angustius marginatis. (Plate X, figs. 3–5 & XXIII, figs. 7–8.)

In sterile, sandy, or rocky (consisting as well of sandstone as of limestone) localities in the Mississippi valley, Illinois, Missouri, Arkansas, and north to Wisconsin, east to Kentucky, and south, probably, to Louisiana and Texas; westward it has not been found west of the western boundary of Missouri and Arkansas. Flowers in May and June; fruit ripens in the same season, but remains on the plant till the following spring. Joints rather large, orbicular 3–4 inches in diameter, or obovate, 4–5 inches long by 3 in width; (a small variety with orbicular joints only 2 inches in diameter occurs on sandstone rock in southern Missouri. The color of the plant is dark or fresh-green. Leaves 2½–4 lines long, diameter about one-fourth of the length: pulvilli 9–12 lines apart with short whitish or grayish wool, and bright red-brown bristles conspicuous even in the youngest joints. Spines rarely none, generally few in var. *microsperma*, sometimes disappearing entirely in fertile soil in gardens, etc.; mostly only on the upper part or the edge of the joint, single or rarely 2–3, 9–12 lines long, rather stout, white with a darker tip and sometimes also darker base. Flowers 2½–3½ inches in diameter, sulphur-yellow, mostly with a red centre. Fruit 1½–2 inches long, less than half that in diameter, narrowed at base, the seminiferous cavity not extending to the base; umbilicus funnel-shaped, but with shallow bottom, much wrinkled and scarred; naked by the disappearance of the bristles of the pulvilli, and edible, somewhat acid or sweetish. Seeds 2½ lines in diameter,

Opuntia vulgaris is figured Pl. X. f. 1–2 & Pl. XXIII f. 13
to compare with O. Rafinesquii

hardly more than one line in thickness; rim rather narrow, thick, but acutish. Var. *Microsperma* has seeds only 0.8 or 0.9 line in diameter, more compressed, with quite a narrow rim.

This species has, by western botanists, generally been considered identical with the eastern *O. vulgaris*. Riddell mentions it as occurring in Kentucky and Illinois, Torrey & Gray in their Flora do not give any locality in the Mississippi valley; but Rafinesque had already observed it in Kentucky, and, in his usual careless manner, had indicated 3 species: *Cactus humifusus*, (which growing, "from New York to Kentucky and Missouri," probably comprised both *O. vulgaris* and our species,) *O. cæspitosa*, from Kentucky and Tennessee, and *O. Mesacantha*, from Kentucky to Louisiana. As it seems impossible from his incomplete descriptions to make out what he meant by three different names, and as we know only one species in those States of the Mississippi valley, I take the liberty of discarding those names and of substituting the name of the author for the western species. It is not improper to state here that Rafinesque's vague and partly erroneous descriptions have found their way into Seringe's Bulletin, 1831, page 216, into the Linnæa, vol. VIII, into Pfeiffer's Enumeratio Cactearum, page 146, and into other works, but with the substitution of Nuttall's for Rafinesque's name as authority; the "rounded joints" have, in these works, been taken for "globose" or "cylindric" joints, and our plant has been classed with the *Opuntiæ glomeratæ* from Chili and Mendoza.

A large form of *O. Rafinesquii* was collected near Fort Smith, on the western border of Arkansas; further west, where no true *O. Rafinesquii* has been found, several forms were met with, which, though they exhibit some distinctive characteristics, are, perhaps, not sufficiently different to constitute distinct species. The flowers of most of them are unknown as well as the leaves, but fruit and seeds were carefully preserved, which not only furnish important characters, but also the means to propagate, cultivate, and further to study them. We append them as sub-species.

1. RADICE FIBROSA.

α. O. CYMOCHILA: diffusa; articulis orbiculatis; pulvillis subremotis griseo-tomentosis stramineo s. fulvo-setosis, plerisque armatis; aculeis 1–3 robustioribus elongatis teretibus s. subcompressis tortisque albidis basi sæpe rufescentibus, patulis deflexisve, additis sæpe 2–3 gracilioribus radiatim deflexis; flore? stigmatibus 8; bacca obovata umbilico plano s. parum depresso pulvillis 20–21 griseo-tomentosis parce setulosis, demum nudatis; seminibus irregularibus angulosis; margine undulato acuto. (Plate XII, figs. 1–3 & XXIII figs. 10–12.)

On the Camanche plains east of the Llaño Estacado, near the 100th degree of longitude, and from there to Tucumcari hill, 80 miles east of the Pecos. Joints $2\frac{1}{2}$–3 inches in diameter, orbicular or very slightly obovate; pulvilli 6–8 lines apart; the very light yellowish-brown bristles numerous, and conspicuous only on the older joints; only the lowest pulvilli of a joint unarmed, upper ones with 2–5 spines, 2 or 3 larger ones, often reddish-brown at lower half, 1–2 inches long, lower, smaller, paler ones 3–9 lines long. Fruit oval, 1–$1\frac{1}{4}$ inches long, about 10 lines in diameter, purplish, pulpy, sweet, and edible, less contracted at base than *O. Rafinesquii*; seed remarkably irregular and twisted, $2\frac{1}{2}$ lines in diameter, with a wavy or twisted very sharp rim, whence the name which indicates the undulated border.

The orbicular joints, the numerous spines, the oval not clavate fruit, and curiously twisted seed, seem to distinguish this form sufficiently from *O. Rafinesqui*, but these characters may not be sufficiently constant or important to constitute specific difference. The characters of *Opuntiæ* are not yet sufficiently studied to permit us to form satisfactory conclusions about their diagnostic importance; so we find a form collected on the Sandia mountains, near Albuquerque, which, in habit and appearance, does not differ from the common form of *O. Rafinesquii*, but which has the seeds of *O. cymochila:*

O. CYMOCHILA, *β*. MONTANA: articulis orbiculatis majoribus inermibus s. margine superiore solum aculeatis; pulvillis remotis stramineo-setosis; aculeis singulis binisve validis albidis

infra fuscis; bacca obovata subclavata seminibus irregularibus acute undulateque marginatis. Joints 3–4½ inches in diameter, pulvilli 9–12 lines apart, spines 12–18, smaller ones 4–6 lines long, on some plants entirely wanting. Fruit 1½ inches long, much contracted at base, with a much depressed, almost funnel-shaped, umbilicus. Seeds cannot be distinguished from those of the plant of the plains.

b. O. STENOCHILA: prostrata articulis obovatis, pulvillis remotis stramineo-setosis superioribus solum armatis; aculeis singulis albidis patulis, 1–2 minoribus deflexis sæpe adjectis; bacca obovata clavata pulposa, umbilico lato parum immerso, seminibus regularibus crassis anguste obtuseque marginatis. (Plate XII, figs. 4–6 & XXIII, fig. 9.)

At the cañon of Zuñi. Joints 4 inches long and 3 wide, flaccid or often lying flat on the ground, (in November;) pulvilli 12 lines apart, small, with yellowish or greenish bristles; larger spines 1–1¼ inches long, smaller ones less than half as long; fruit green or pale red, very juicy; 1½ inches long, but sometimes much enlarged, even more juicy, and 2–2½, inches long and 1 inch in diameter above, long clavate towards the base. Seeds quite characteristic, about 2½ lines in diameter, 1½ line thick, regular, with a very narrow and somewhat obtuse rim, whence the name.

In the same neighborhood another plant was found with similar smaller, more rounded, and somewhat more spinous joints, fruit less clavate, smaller, seeds similar, but a little smaller.

2. RADICE TUBEROSA.

c. O. FUSIFORMIS: diffusa s. adscendens, radicibus fusiformibus elongatis, irregulariter incrassatis; articulis suborbiculatis majusculis, foliis elongatis subulatis patulis pulvillis subremotis griseo villosis, setas elongatas virescente-fuscas gerentibus, plerisque s. solum superioribus armatis; aculeis 2–3 gracilibus inæqualibus deflexis s. patulis, albidis; floris minoris flavi (basi rubelli?) ovario pulvillis 23 stipato, stigmatibus 8, bacca ovata basi vix clavata demum nudata, pulposa rubella, umbilico immerso subinfundibuliformi; seminibus subregularibus crassis majusculis acute marginatis. (Plate XII, figs. 7–8 & XXIII, fig. 6.)

Cross-timbers longitude 97°–99°; west of the region inhabited by *O. Rafinesquii*, and east of that of *O. cymochila*; also collected by Dr. Wislizenus in the same longitude, but farther north on Cow creek and the Little Arkansas, (on the road from Independence to Santa Fé;) and by Dr. Hayden, of the United States army, on the Missouri, below the Big Bend. Fl. in May. Roots form elongated tubers, attenuated at one or both ends ½–1 inch in diameter; joints 4 or even 5 inches in length; leaves 2 ½–3½ lines long, pulvilli 9–12 lines apart, with numerous stout yellowish-brown bristles, often 2 lines long, spines 1 or 2, 1–1½ inches long, with a smaller one of half the length, more slender than in most other allied forms. Flowers 2–2½ inches in diameter, yellow apparently with red base, smaller and with fewer sepals than *O. Rafinesquii*, but the same number of stigmata. Fruit 1½ inches long, umbilicus ½ inch wide; seed rather larger and thicker than in *O. Rafinesquii*, 2¾ lines in diameter and 1½ thick. The description of the flower is from the specimens collected by Dr. Wislizenus.

O. MACRORHIZA, Engl., of Texas, also belongs here as another tuberous rooted form in the wide circle of *O. Rafinesquii*.

11. O. BASILARIS (sp. nov.): humilis, articulis obovatis s. subtriangularibus glaucescentibus pubescentibus adscendentibus e basi proliferis, fere rosulatis; foliis subulatis minutis erectis rubellis tomentum axillare vix superantibus; pulvillis subconfertis fulvo-tomentosis setas gracillimas demum numerosissimas breves fulvidas et subinde aculeolos setiformes caducos gerentibus; floris purpurei ovario obovato pubescente pulvillis plurimis (40–60) confertis fulvo-tomentosis instructo, sepalis 20–25 exterioribus oblanceolatis acuminatis, interioribus late obovatis cuspidatis, petalis sub-10 obovato-orbiculatis retusis s. obcordatis sæpe tenuiter mucronatis,

stigmatibus 8 brevibus in capitulum conicum congestis; bacca (sicca?) breviter obovata late umbilicata, seminibus magnis crassis subregularibus. (Plate XIII, fig. 1–5 & XXIII, fig. 14.)

On hills and in ravines from the Cactus Pass down the valley of Williams river to the Colorado, and to Mojave creek; Mr. Schott met with it on the lower Gila; and both he and Mr. Albert H. Campbell obtained the beautiful purple flowers of this plant in April and May, 1855. The habit of this plant is very different from any other of our *Opuntiæ*, as the stout obovate or often fan-shaped or sometimes almost obcordate joints originating from a common base form a kind of rosette, resembling somewhat an open cabbage head. Among thousands of specimens observed, none deviated from this peculiar manner of growth, none was proliferous in the shape of the other elliptic *Opuntiæ*. Joints 5–8 inches long, ½ inch in thickness, minutely pubescent; leaves only 1 line in length, slenderly subulate, smaller than any other of our species; next in size are the leaves of *O. Missouriensis, O. fragilis*, and *O. filipendula;* the largest leaves are produced by the cylindric *Opuntiæ*, some of which have them 10 lines long.

Pulvilli somewhat immersed, 4–6 lines apart. Flower of a beautiful and rich purple color, about 2½ inches in diameter, ovary nearly 1 inch long, crowded with 40–60 elevated areolæ, with light brown wool and brighter brown bristles; filaments not very numerous, leaving the inner base of the tube naked; stigmata about 2 lines long, or less, apparently green. Fruit seems to be perfectly dry, short and thick; seeds 3 lines in diameter, nearly 2 lines thick, with a rather narrow but very thick rim, regular or sometimes quite irregular.

12. O. HYSTRICINA, (sp. nov.): diffusa, articulis obovato-orbiculatis, compressis, pulvillis subconfertis magnis griseo-tomentosis setas pallidas rutilasve gerentibus, omnibus armatis; aculeis 5–7 inferioribus gracilioribus brevioribus albidis deorsum radiantibus, superioribus 5–8 elongatis validioribus angulatis sæpe tortis flexuosisve, 3–4 deflexis albidis, uno alterove longissimo, ceteris 2–4 superioribus patulis suberectisve sæpe basi s. ad medium fuscatis; flore ——, bacca obovata subclavata, umbilico parum immerso planiusculo, pulvillis 25–30, inferioribus inermibus, superioribus confertis aculeolos paucos gerentibus: seminibus maximis irregularibus late crasseque marginatis. (Plate XV, fig. 5–7 & XXIII, fig. 15)

This beautiful species was found abundant from the Rio Grande westward to the San Francisco mountains, mixed with *O. Missouriensis*, to which it is nearly allied. The specimens before us were obtained at the Colorado Chiquito and on the San Francisco mountains. Joints 3–4 inches long and nearly as broad. Pulvilli 5–6 lines apart, unusually large; lower radiating spines 4–9 lines, the others 1½–3 and even 4 inches long, irregularly arranged as we generally find it in this species. We notice many specimens where 3 or 4 larger spines are placed above the lower short radiating ones, the uppermost one of them is usually the longest; somewhat above these are 2–4 other spines, the lower one of which is the darkest and often not much shorter than the one just mentioned, the others are shorter and whitish or dark only at the base. The bristles are yellowish in some and brown in other specimens; sometimes we find short pale and longer darker bristles together. The fruit is 1 inch long and half as thick, with a very shallow umbilicus; only the upper larger pulvilli bear 4–6 spines (2–5 lines long,) the lower ones on the contracted part of the fruit are very small, distant, and unarmed. Seed among the largest in this genus 3½ lines in diameter, the thick and broad rim acutish. The name indicates the porcupine-like armature of this species.

13. *O. Missouriensis*, D. C.: prostrata; radice fibrosa; articulis obovatis suborbiculatisve tuberculatis compressis laete viridibus adscendentibus, foliis subulatis minutis patulis, pulvillis subconfertis albo s. griseo-tomentosis stramineo—setosis omnibus armatis; aculeis in pulvillis inferioribus gracilioribus paucioribus, in superioribus 5–10 exterioribus minoribus radiantibus albidis, 1–5 interioribus robustis teretiusculis longioribus patulis, rarius suberectis, albidis s. rufescentibus; floribus sulphureis basi intus sæpe aurantiacis, ovario obovato subgloboso, pulvillis 25–35 albo tomentosis aculeolatis instructo; sepalis tubi sub-13 exterioribus oblanceolatis,

interioribus obovatis cuspidatis petaloideo-marginatis, petalis sub-13 obovato-orbiculatis emarginatis s. obcordatis crenulatis sæpe mucronulatis; stigmatibus sub-8 viridibus in capitulum globosum s. conicum confertis; bacca ovata s. subglobosa, umbilico parum depresso, pulvillis 25–35 albo tomentosis setas albidas stramineas s. rufescentes aculeolosque numerosos breves s. elongatos gerentibus; seminibus magnis plerumque irregularibus late subacuteque marginatis. (Plates XlV, figs. 1–10, XV figs. 1–4, XXIII, figs 16–19 & XXIV figs. 1–2.)

This variable species extends from the country north of the Upper Missouri river to the regions south of the Canadian and of Santa Fé, latitude 48° 35′; and from longitude 99° cast of Fort Pierre, on the Missouri, to 112° on the San Francisco mountains. It has not been found south of Albuquerque, along the Rio Grande, nor in the Salt Lake valley, Utah, as far as at present known. Flowering in May, fr. same fall. Nuttall discovered this common western species on the Upper Missouri in 1811, and described it under the name of *Cactus ferox;* he noticed "8–10 greenish stigmata" and the "dry spiny fruit." The deep purple fruit, as large as a hen's egg," attributed to our species on the authority of Dr. James, by Torrey and Gray, in their Flora, perhaps belongs to our *O. Camanchica*; it certainly cannot belong to *O. Missouriensis*.

It forms large spreading masses, much dreaded by travellers and their animals. Joints mostly suborbicular, 2–4 inches long, and 2–3½ wide, light green, somewhat tuberculated from hemispherical elevations which bear the leaves and pulvilli, 4–6 lines apart; leaves 1½–2 lines long, hardly more than ½ line in diameter at the base, nearly twice as long as the wool in their axills; numerous small white spines radiating downwards and laterally, sometimes a few rather longer ones obliquely upwards, mostly 3–6 lines long, rarely more elongated; central spines in the Missouri specimens mostly 1, rarely 2; in the southern ones, often 2–4, 1–1½, or even 2 inches long, terete or somewhat angular, white, or mostly with a reddish base when young, or entirely brown red, with lighter tips. On the lower pulvilli the stouter spines are mostly wanting; in some Missouri specimens, I find few and weak spines on the upper, and none at all on the lower part of the joints; in other plants, from the same region, all the pulvilli are nearly equally armed with 5 weaker (2–3 lines long) lower deflexed, and 5 inner stouter (4–6 lines long) spreading spines. Flowers 2–3 inches in diameter, ovary, with subulate sepals, similar to the leaves, spines already present, but not as long and stiff as in the fruit. Petals yellow towards the base, or sometimes almost entirely rose-colored, orange, or brick-colored, sometimes only the margin remaining yellow. Exterior filaments much the longest, deep red; interior ones paler, shorter; pistil pale yellowish, thickened below the middle, as in almost all the species of this genus; stigmata united into a small subconic head.

Fruit ovate, or sometimes globose, umbilicus shallow, spines on the pulvilli numerous, 6–12, usually short, 1–4, sometimes 6 lines long. Seeds about 3 lines in diameter, sometimes larger, in one form much smaller, mostly irregular, twisted, angular, much compressed, with a broad and thick but rather acutish rim. Embryo of different shapes, conform to the shape of a seed, always with a small albumen.

The following forms, we think, must be included under this species, though the whole history of most of them is not known; some of them may not even be constant varieties.

α. RUFISPINA: articulis orbiculatis s. transversis; setis parcis rufescentibus, aculeis radialibus 6–8 albidis rufo-variegatis, interioribus validis fuscis apice pallidioribus, 2–4 deflexis, singulo patulo s. suberecto robustissimo; bacca ovata.—(Plate XIV, figs. 1–3.& XXIII fig. 16.)

This is the stoutest form of our species, and greatly deserves Nuttall's original name ferox; It was collected on rocky places on the Pecos; Dr. Hayden has also sent it from the Yellowstone, and it no doubt is met with in all the intervening territory. Joints 2–3 inches in diameter, pulvilli 4–5 lines apart; bristles fewer, but longer and darker than in other forms; central spines 1¼–2 inches long; fruit 1 inch long, half as thick, with shallow umbilicus, about 30 pulvilli, spines on the upper ones 4–6 lines long. Seeds 2½–3 lines in diameter.

β. PLATYCARPA: articulis obovato-orbiculatis, setis parcis stramineis, aculeis exterioribus

5–10, inferioribus albidis, superioribus robustioribus rufescentibus, centrali subsingulo robusto fusco patulo s. deflexo; bacca depresso-globosa, umbilico lato plano, pulvillis sub-25 aculeolos 5–10 breves gerentibus.—(Plate XIV, fig. 4 & XXIII fig. 17.)

Sent from the Yellowstone by Dr. Hay den. A stout form; joints 3 inches long, $2\frac{1}{2}$–$2\frac{3}{4}$ wide; pulvilli 4–6 lines apart, the dirty yellowish bristles visible only on the older joints. Central spine single, or only on vigorous specimens on the upper pulvilli 2, mostly brownish, deeper colored on the margin. Fruit 8–9 lines long, umbilicus, of the same diameter, spines only 1–3 lines long, deflexed. Seed 3 lines in diameter, rim rather narrower than in the first-mentioned form.

γ MICROSPERMA: articulis ut in præcedente; stigmatibus 5; bacca ovata, umbilico parum depresso, pulvillis, 20–30 setosis et breviter aculeolatis, seminibus anguste acuteque marginatis. (Plate XIV, figs. 5–7 & XXIV, fig. 2.)

On the Missouri, about Fort Pierre; brought down 10 years ago by the fur traders. Very similar to the last form in the general appearance; also with only 1, or at most 2, central dark spines; flowers only with 5 stigmata, otherwise same as the one described above; fruit short, oval, with 10–20 very short spines on the numerous pulvilli; seed only 2 lines in diameter, more regular, thicker in proportion, with a narrow and acute rim. It might be supposed that these characters were important and constant enough for a specific difference, if we did not know the great variability in this genus, and if we did not find among Dr. Hayden's plants seeds of intermediate shape and size. (Plate XXXIV, fig. 1.)

δ SUBINERMIS: articulis elongato-obovatis, pulvillis subremotis, inferioribus inermibus, superioribus aculeos paucos breves gerentibus.

Brought from the Upper Missouri by Dr. Hayden; remains constant in three years cultivation. Joints $3\frac{1}{2}$–5 inches long, half as wide, gradually narrowed down at base; leaves entirely similar to those of the common form; pulvilli 6–9 lines apart; spines entirely wanting, or on the upper pulvilli 2 or 3 short and slender ones, rarely one or the others more robust, $\frac{1}{2}$–$\frac{1}{4}$ inch long; flowers not seen.

ε ALBISPINA: articulis late obovatis, setis stramineis, aculeis omnibus albis gracilioribus, exterioribus 6–10 setaceis, interioribus in pulvillis superioribus 1–3 robustioribus elongatis deflexis s; patulis, bacca ovata, seminibus magnis. (Plate XIV, figs. 8–10 & XXIII, fig. 18.)

Sandy bottoms and dry beds of streamlets on the Upper Canadian, 250 miles east of the Pecos; on the Sandia mountains, near Albuquerque; also, on the Upper Missouri. This was the first form of this species met with in travelling up the Canadian; the stouter and more compact forms were found further west, in higher elevations. Joints 3–4 inches long, $2\frac{1}{2}$–3 wide; pulvilli 4–6 lines apart; spines all ivory white, rarely with a yellowish tinge, larger ones $1\frac{1}{4}$ inch ong; fruit with very shallow umbilicus, and very slender and short spines; seed 3–$3\frac{1}{2}$ lines in diameter, irregular, rim broad, acutish. A form from the Sandia mountains with pulvilli more remote; spines longer, more slender, some of them flexuous; seems to unite this with the next variety.

ζ TRICHOPHORA: articulis ovatis, pulvillis confertis parce albo-tomentosis setas stramineas demum albidas breves gerentibus, omnibus armatis; aculeis 10–18 setiformibus albis, exterioribus 8–12 brevioribus radiantibus, interioribus longioribus deflexis, rarius singulo suberecto; pulvillis in articulis vetustioribus lignosis confertissimis setas numerosas aculeosque 15–25, nonnullos capillaceos elongatos flexuosos gerentibus; bacca ovata, umbilico parum immerso; pulvillis 35–40 albo-tomentosis stramineo-setosis fasciculum aculeolorum 12–18 plerumque denexorum gerentibus; seminibus maximis valde compressis irregularibus latissime acuteque marginatis. (Plate XV, figs. l–4 & XXIII, fig. 19.)

Only on the volcanic rocks about Santa Fé, and on the Sandia mountains. The hoary appearance of the older joints is very characteristic, and reminds one strongly of *Pilocereus senilis*. These hairs are from a few lines to 2 or $2\frac{1}{2}$ inches in length, and of the appearance and about as

fine as an old man's beard. The older joints become thick and of a solid ligneous substance; younger joints 4½ inches long, 2½ inches wide, or larger; pulvilli 4–5 lines apart; exterior spines 3–6 lines, interior ones 9–18 lines long. Fruit ovate, 10 lines long, 1 in diameter; very slender and numerous spines, 3–6 lines long. Seeds, with those of *O. hystricina*, the largest known to us, 3½ lines in diameter, sometimes larger; rim large, almost of the thickness of the seed itself. This is, perhaps, a distinct species, and must be further studied.

14. O. SPHÆROCARPA, (sp. nov.): diffusa articulis orbiculatis transversisve tuberculatis; pulvillis confertis albo-tomentosis, setas stramineas breves gerentibus, plerisque inermibus, summis solum et marginalibus aculeos 1–2 reflexos s. patulos, adjectis subinde 1–3 brevioribus gerentibus; bacca globosa, umbilico minore plano, pulvillis sub-25 tomentosis setosis vix aculeolatis, seminibus mediis acute marginatis. (Plate XIII, figs. 6–7 & XXIV, fig. 3.)

On the eastern declivity of the Sandia mountains, near Albuquerque. Joints in the specimen before us 3 inches wide, less in length, strongly tuberculated; pulvilli 4–5 lines apart; spines on the upper lateral pulvilli mostly single, deflexed, ½ inch long; on the middle or lower ones none; on the uppermost and marginal ones mostly 2, rarely 3 lines long, reddish brown, with darker tip; 1–3 smaller additional spines, 2–4 lines long also reddish. Fruit perfectly globose, 9 lines in diameter; umbilicus 5–6 lines wide; pulvilli bristly, but only the upper ones with one or a few small spines. Seeds 2½ lines in diameter, very irregular, with a rather narrow, but sharp rim.

The arrangement of the spines is so different from any form of *O. Missouriensis*, which always shows the numerous slender radiating spines, and always has spiney fruits, that we feel obliged to separate this plant as a distinct species. The seeds brought home by the expedition have germinated, and are growing vigorously.

15. O. ERINACEA, (sp. nov.): diffusa adscendens; articulis tumidis ovatis s. teretiusculis, pulvillis confertissimis ovato-orbiculatis albo-tomentosis demum stramineo-setosis omnibus armatis; aculeis 3–5 gracilibus elongatis e cinereo-rubellis 1–3 superioribus brevioribus sursum porrectis, centrali longior patulo vel declinato, ceteris deflexis, additis 2–4 minoribus inferioribus; bacca ovata umbilico infumlibuliformi pulvillis 30–40 setas stramineas et aculeolos 12–20 gerentibus; seminibus magnis subregularibus late acuteque marginatis. (Plate XIII, figs. 8–11 & XXIV, fig. 4.)

West of the great Colorado near the Mojave creek; joints 2–2½ inches long, 1–1½ incites wide, and about ½–¾ inch thick, sometimes elongated, almost cylindric, densely covered with the large white pulvilli, which are only 2–3 lines apart, and numerous reddish-gray spines with red points bristling hedgehog-like (whence the specific name) in every direction. Spines 6–14 or in old joints even 20 lines long, with smaller ones; very slender, flexible, but stiff. Young plants cylindric, covered with bunches of 15 or 20, or more, white hair-like spines. Bristles dirty-yellow even in young joints present, in old ones densely crowded, and 2–3 lines long; in a dead flower a 6-parted stigma was noticed. Fruit 1–1¼ inches long, about ½ an inch in diameter, with a deep funnel-shaped umbilicus; pulvilli crowded, prominent, white-tomentose with yellowish bristles and numerous, mostly deflexed, spines, 3–6 lines long. Seed nearly 3 lines in diameter, much compressed, more-regular than in the three foregoing species.

15. O. BRACHYARTHRA, (sp. nov.): prostrata s. adscendens, articulis ovatis s. orbiculatis tumidis saepe subglobosis, tuberculatis; pulvillis confertis magnis albo-tomentosis parce setulosis plerisque armatis; aculeis 3–5 albidis s. fuscatis patulis; 1–2 validioribus sursum versis, caeteris minoribus minimisqe subdeflexis; floris parvi ovario subgloboso, pulvillos 12–15 tomentosos setosos superiores aculeolatos gerante, sepalis tubi exterioribus obovatis cuspidatis stigmatibus 5. (Plate XII, fig. 9.)

At the foot of the inscription rock near Zuñi under pine trees, only seen in that single locality. A singular looking plant with short tumid joints (10–15 lines long, 10–12 wide and

nearly the same in thickness) one growing on the top of the other 60 as to resemble, somewhat, a jointed finger. In the absence of ripe fruit we are unable, with certainty, to class this species; the shape of the joints and the somewhat spinulose fruit seem to bring it very near to *O. fragilis*, and it may possibly be a small and compact form of this species, though the appearance is very different; on the other hand the subglobose joints seem to refer it to the section *Glomeratæ*, Salm.

Pulvilli 2–4 lines apart, large, white or when old grayish tomentose with very few short yellowish bristles, even in the old joints; spines 9–12 lines long, rather stout, terete, often with 1 or 2 short ones not more than 1–2 lines long. No ripe fruit was found (Novr.) which is also often the case with *O. fragilis*, but many remains of flowers with globose-ovate fleshy sterile red ovaries, 3–4 lines long, some of them becoming larger and probably proliferous, generally only some of the upper pulvilli bear a few short spines. The flower seems to have been about 1 inch in diameter, with about 5 sepals, 8 or 9 petals, and style with 5 stigmata.

O. FRAGILIS, Haw., the seed of which we give a figure of, (pl. XXIV, fig. 5,) grows on the upper Missouri and Yellowstone and probably down to Santa Fé. The joints are small, ovate, compressed or tumid, or even terete, 4 larger spines on the upper fully developed pulvilli cruciate, the upper one suberect, stouter and longer than the others, mostly yellowish-brown; on the lower margin 4–6 small white radiating spines; bristles few. Fruit apparently somewhat fleshy, getting dry much later with 20–28 pulvilli, almost naked, only the upper ones with a few short spines; seeds few, large, regular.

Subgen. 2. CYLINDROPUNTIA, Engelm.

§1. *Clavatæ.*

17. O. CLAVATA, E. in Wisl. Rep. (Plate XXII, fig. 1–3 & XXIV, fig. 6.) Found from Santa Fé to Albuquerque, where Wislizenus and Fendler had already collected it, and no where else. A remarkable and well characterized species, the type of this section. We add to the characters previously published, (Wislizenus' Report note 12, and Plantæ Fendlerianæ in Mem. Ame. Acad. vol. IV, page 49,) that the leaves are long and subulate, 2–2½ lines long; the broadest spines were 1½ lines wide; fruit 1½–1¾ inch long, lemon-yellow, almost covered with 30–50 hemispherical pulvilli, which bear innumerable white slender bristles, spreading ray-like in every direction. Seeds large for this section, and, as in all the allied species, transverse or broader than high; 2¼–3 lines in the longest diameters, rostrate, somewhat angular; commissure (which in the cylindric and clavate opuntiæ replaces the rim of the flat-jointed ones), impressed, linear or a little wider; cotyledons in several seeds examined by me oblique.

18. O. PARRYI, E. in Sillim. Journ., Nov., 1852: Articulis ovatis basi clavatis, tuberculis oblongo-elongatis, pulvillis albo-tomentosis setas paucas rigidas gerentibus; aculeis angulatis scabris rubello-cinereis, interioribus validioribus sub-4 triangulato-compressis, exterioribus 5–8 angulatis supra infraque divergentibus, extimis 6–10 gracilibus rigidis radiantibus; bacca ovata basi clavata pulvillis sub-40 setosissimis stipata; seminibus regularibus latius commissuratis. (Plate XXII, figs. 4–7 & XXIV, fig. 7.)

On the gravelly plains 30 miles west of the Colorado, near the Mojave river; southward to the eastern slope of the California mountains near San Felipe, Dr. Parry. Joints 2½–3 or 4 inches long, 1¼ inch in diameter, attenuated not only below but also somewhat above in the specimen before us. Tubercles about 9 lines long, pulvilli small, bristles few, coarse and long. Spines very numerous in 3 series; the 4 inner ones 12–16 lines long, ½–¾ lines broad, the lower one somewhat flattened, the others triangular; the next series consists usually of 2–3 upper ones and 3–5 lower ones, angular, more slender and shorter than the first, 4–8 lines long; the third or external circle consists of 6–10 bristly slender spines, 3–4 lines long, some above, but

most of them lateral or inferior. Young spines reddish-grey with paler margins, older ones ashy. Fruit $1\frac{1}{2}$ inch long; seed rather regular, $2–2\frac{1}{2}$ lines in the transverse diameter, less than 2 lines high, not beaked, commissure broader and more distinct than in any other of this section examined by us. Cotyledons in all the seeds examined oblique.

This description refers to the plant brought by the expedition from the Mojave river. Several years before Dr. Parry had described a plant discovered by him "on the hills and plains about San Felipe on the eastern slope of the California mountains," which had been named after the discoverer. We presume that both plants were identical, but have to remark that Dr. Parry's plant is much larger, having joints of 4–8 inches in length, with tubercles 6–12 lines long, spines whitish, half an inch long; he describes the flowers as $1\frac{1}{2}$ inch in diameter, greenish-yellow with green stigmata. Fruit not mentioned. Further investigation will be necessary to clear up those doubts.

From *O. clavata* (which grows 8 or 9 degrees east and on much greater elevation) the Mojave species is distinguished by the shape of the joints, the color, much narrower, more numerous spines and the smaller more regular seeds, with the broad commissure.

§ 2. *Cylindricæ.*

19. OPUNTIA DAVISII, (sp. nov.): caule dense lignoso ramosissimo divaricato adscendente, articulis junioribus erectis elongatis, basi attenuatis; tuberculis oblongo-linearibus prominulis, setis stramineis tenerrimis; aculeis interioribus 4–7 subtriangularibus rufis apice pallidioribus, vagina straminea laxa fulgida indusiatis divergentibus s. deflexis, aculeis gracilioribus inferioribus 5–6; bacca ovata pulvillis sub-25 setas stramineas aculeolosque paucos gerentibus; umbilico lato. (Plate XVI, figs. 1–4.)

Common on the upper Canadian, eastward and westward of Tucumcari hills, near the Llaño Estacado. A very much branched shrubby, somewhat procumbent, plant, with erect joints, about 18 inches high; wood dense and hard; joints 4–6 inches in length, and half an inch or more in thickness; tubercles not very prominent, 7–8 lines long; very slender bristles, forming a thick brush at upper end of pulvillus; interior spines $1–1\frac{1}{4}$ inches long, covered with a very loose glistening membranaceous sheath, which makes the plant an object of remark for a long distance; lower spines 3–6 lines long. All the fruits seen on the route were sterile, and most of them elongated, $1–1\frac{1}{4}$ inch long; on many pulvilli 1–4 sheathed spines were observed, which possibly are peculiar only to the sterile and proliferous fruits.

We have named this well-marked and pretty species after our enlightened Secretary of War, Colonel Jefferson Davis, under whose auspices the expeditions for the exploration of a proper route for the Pacific railroad were organized, and were enabled to accomplish so much, not only for this specific object, but also for the elucidation of the natural history of this hitherto almost unknown country.

20. O. ECHINOCARPA, (sp. nov.): caule reticulato-lignoso, erectiusculo, ramis numerosis patentissimis subinde pene decumbentibus, articulis ovatis basi clavatis, tuberculis ovatis prominentibus confertis; setis paucis stramineis; aculeis albidis stramineo s. albido-vaginatis, majoribus sub-4 cruciatis, cæteris minoribus 8–16 undique radiantibus; floris flavi (?) ovario pulvillis 30–40 villosis subaculeolatisque confertis stipato, sepalis sub-13, exterioribus ovatis acutis; interioribus obovatis mucronatis, petalis sub-8 obovatis obtusis s. subemarginatis denticulatis, stigmatibus 6; bacca globoso-depressa s. hemispherica, late profundeque umbilicata pulvillis sub-40 aculeolos vaginatos elongates 8–12 gerentibus dense stipata, floris rudimento subpersistente coronata; seminibus subregularibus s. angulatis, crassis, late commissuratis, cotyledonibus parallelis. (Plate XVIII, figs. 5–10 & XXIV, fig. 8.)

In the Colorado valley, near the mouth of Williams' river. Mr. Schott found a stouter form further south. The more northern plant forms a low shrub 6–18 inches high, spreading, and

often partially prostrate; the cylindric tubular wood is reticulated with short meshes. Joints 1–2½ inches long, less than 1 inch thick, tubercles not more than 4 or 5 lines long; bristles few and rather coarse; spines 12–20; the 4 larger ones are somewhat central, 9–12 lines long; the others radiating from 4–9 lines long; the smaller ones, as in all these *Opuntiæ*, hardly vaginate. Flower described from a withered specimen found attached to a fruit, to which it somewhat adhered, but perhaps held more by the long intricate spines than by an organic attachment. Flower 1½–1¾ inches in diameter, apparently yellow, which is uncommon among the *Cylindric Opuntiæ;* petals about 9 lines long and three broad, stigmata about 2 lines long. The fruit is very peculiar, and with the seed, characterizes this species well. The wide umbilicus on the shallow fruit gives it the appearance of a saucer, and the seeds find their place more around the edge of the umbilicus than in the body of the fruit. Spines on fruit from 4–10 lines long. Seed 2 lines or more in diameter, with a broader commissure than any of the allied species, cotyledons always in all the specimens examined regularly accumbent or parallel; the only species, so far, where this regularly is the case; albumen unusually large.

O. Serpentina, from San Diego, is very nearly allied to our species, but seems sufficiently distinct by its elongated cylindric joints and different growth.

21. O. Bigelovii, *Englm.*: caule arborescente erecto crasso reticulato-lignoso, ramis erectis adscendentibusve numerosis congestis, inferioribus demum refractis, articulis ovatis s. ovato-cylindricis tumidis læte s. pallide viridibus fragilibus; tuberculis subhemisphericis depressis confertis; pulvillis immersis ovatis setas pallidas penicillatas et aculeos 6–10 robustiores pallidos stramineo-vaginatos, 3 deflexos, ceteros divergentes et 6–10 graciliores inferiores radiantes gerentibus; ovario tuberculis plurimis stipato parce aculeolato; bacca ovata profunda umbilicata tuberculata pulvillos immersos 60–70 setigeros inermes s. aculeolis 3–4 vaginatis armatos gerente; seminibus parvis.—(Plate XIX, figs. 1–7.)

On Williams' river, a branch of the Colorado; 10–12 feet high, stem 3–4 inch in diameter; skeleton forming a large hollow tube, much reticulated with numerous small roundish or somewhat rhombic meshes in 13 or 21 spiral rows. Branches forming a dense head; younger joints erect, adpressed very fragile, often shaken off by the wind and covering the soil around, taking root everywhere, or sticking to the clothes of the passers-by like burrs. The joints on the older part of the stem are often persistent and reflexed, becoming withered and brown. Joints 2–6 inches long, 1–2 inches in diameter, light fresh green, covered with the small almost hemispherical, and not very prominent, tubercles, which are 3–4 lines long, and arranged mostly in 13 spirals; the areola is immersed at the apex of the tubercle, and surrounded by an elevated paler or almost whitish ridge, having the appearance of 2 lateral glands. Larger spines about 1 inch long. Flower or complete fruit not seen; an ovary or young fruit before me is clavate, 1 inch long, and has a few spines on the pulvilli; some empty (sterile ?) fruits brought home are oval 1½–1¾ inches long, 1 inch in diameter, strongly tuberculated, and spineless; others again are even larger, with more numerous tubercles, and the pulvilli beset with 3–6 sheathed spines 4–7 lines long. These are evidently undergoing a change into proliferous joints; seeds, said to be small, but most unfortunately the specimens were lost, so that we were unable to compare them with those allied species found further south, (*O. fulgida*,) and on the Pacific coast, (*O. prolifera*.) Our plant is distinguished from these forms by its short tubercles, immersed pulvilli, and large tuberculated and somewhat spiny fruit.

[I have thought proper to consecrate this remarkable species, so conspicuous in its desert wilds, to my colaborer Dr. J. M. Bigelow, through whose intelligent exertions and indefatigable assiduity so many new Cactaceæ, described in this report, have been discovered and brought home —Gr. E.]

O. Whiplei, (sp. nov.): caule erecto s. rarius patulo s. subprocumbente, reticulato-lignoso, divaricate ramoso; articulis cylindricis; tuberculis ovatis confertis, pulvillis pulvinatis

parce tomentosis vix setosis; aculeis brevibus cinereo s. stramineo vaginatis, 1–4 majoribus divaricatis, inferiore longiore deflexo, minoribus 2–8 solum ad inferiorem pulvilli marginem deflexis s. undique radiantibus; flore rubro, ovario ovato tuberculato pulvillis 20–30 tomentosis setas stramineas et aculeolos paucos mox deciduos gerentibus stipato; sepalis tubi sub-8 orbiculatis cuspidatis, petalis 8–10 spathulatis cuspidatis; bacca subglobosa leviter tuberculata subcarnosa flava inermi; umbilico infundibuliformi; seminum subregularium commissura lineari. (Plate XVII, figs. 1–4 & XXIV, figs. 9–10.)

α. LÆVIOR humilior, aculeis brevioribus paucioribus, seminibus minoribus.

β. spinosior elatior aculeis plurimis longioribus seminibus majoribus. (Plate XVII, fig. 2)

From the elevated country about Zuñi to the bead of Williams's river, at first seen only 8–15 inches high, subprostrate, afterwards 20–30 inches, and sometimes even 5–6 feet high. Var. β. was found by Mr. A. Schott south of the Gila river, and he also discovered the flower of this plant, which, like the flowers of all the other new species, remained unknown to us, unless winter remains were picked up here and there. Ligneous skeleton tubular, with small meshes, dense at base of stem; joints elongated, 2–4 inches to a foot long, $\frac{1}{2}$ or $\frac{3}{4}$ of an inch in diameter; tubercles ovate or sometimes almost rhombic, about 5 lines long; spines very variable in number, sometimes only with 1 larger and 2 or 3 smaller ones; in other instances, especially in Var. β., with 12 or 14; spines 3–9 lines long, bristles few, generally only on older joints; flowers $1\frac{1}{4}$–$1\frac{1}{2}$ inches in diameter; ovary 6–9 lines long with 20 or 25 pulvilli; fruit about 1 inch long, a little less in diameter, somewhat fleshy and sweet, with 25–35 not very prominent tubercles; seeds with linear or almost linear commissure, $1\frac{1}{2}$–$1\frac{3}{4}$ lines in diameter; cotyledons regularly incumbent or sometimes oblique. The seeds of β. are 2 lines in diameter.

This is easily distinguished from all the allied species of the slender elongated branches, the short, crowded tubercles, and the short spines. We have dedicated this *Opuntia*, characteristic of the desert mountains under the 35th degree, between the Rio Grande and the Colorado, to Captain A. W. Whipple, the commander of the expedition who, by his zealous and liberal cooperation, afforded every facility in his power in the various collections of natural history-

23. O. ARBORESCENS, Englm. found first 200 miles east of the Pecos, and from there abundantly as far west as Zuñi, where other cylindric *Opuntiæ* take its place. In this region it does not grow higher than 5–8 feet, and can scarcely be called arborescent; it is always well characterized by the verticillate often somewhat pendulous branches, the cristate-tuberculate spineless fruit, and the smooth seeds with a distinct and broadly linear commissure. Seeds of specimens collected at Zuñi smaller than others, only $1\frac{1}{2}$ line in diameter. (Plate XVII, figs. 5–6, Plate XVIII, fig. 4, Plate XXIV, fig. 12.)

24. O. ACANTHOCARPA, (sp. nov.): caule arborescente erecto reticulato-lignoso, ramis adscendentibus divaricatis; articulis cylindricis tuberculatis pallide virescentibus; tuberculis oblongo-linearibus pulvillis ovato-orbiculatis breviter tomentosis vix setosis, aculeis numerosis s. plurimis (8–25) stramineo-vaginatis undique porrectis, stellatis; bacca subglobosa late umbilicata tuberculata; pulvillis 12–15 tomentosis parce setosis aculeolis validis 8–10 munitis; seminibus magnis multangulis late commissuratis. (Plate XVIII, figs. 1–3 & XXIV, fig. 11.)

On the mountains of Cactus Pass, about 500 miles west of Santa Fé. Stout, stem 5–6 feet high, wood forming a hollow reticulated tube, solid at base; branches few, never verticillate, separating at acute angles; joints 4–6 inches long, 1 inch in diameter, tubercles 9–10 lines long; pulvilli in some with one central and 6 or 8 exterior spines, in others with 3–7 interior and 10–20 exterior stellately radiating spines. Central spines 1–$1\frac{1}{4}$ inch, exterior 4–10 lines long, with a yellowish or brownish sheath. Fruit 1 inch long with a large but not deep umbilicus, and 12–15 rather shallow tubercles; spines of fruit stout, 3–6 lines long, stouter and more crowded toward the top of the fruit. Seeds unlike any other of our *Opuntiæ*, $2\frac{1}{2}$–3 lines in diameter, with rather broad commissure, often spongy on the margin, and on the sides with many even or concave faces separated by sharp ridges.

This peculiar species cannot be confounded with any other, but comes, in the arrangement of spines, nearest to *O. arborescens*, from which it is easily distinguished by its manner of growth, its elongated tubercles, and especially the much less tuberculated spiny fruit, and the peculiar seed.

25. O. TESSELATA, Englm.: caule frutescente erecto s. diffuso, dense lignoso, ramosissimo, ramis divaricatis, articulis gracilibus teretibus, plano-tuberculatis cæsiis, tuberculis 5–6-angulatis confertissimis depressis, planiusculis; pulvillo lineari tomentoso vix setis paucis deciduis instructo, inermi s. medio s. versus basin aculeo elongato porrecto s. subdeflcxo albido flavido s. fulvo vagiua laxa basi constricta flava s. e ilavo fulva indusiato, singulo s. rarissime binis; aculeis paucis brevibus setaceis infra sæpe adjectis; floris purpurei ovario obovato s. clavato pulvillis 30–50 villoso-tomentosis inermibus s. parce aculeolatis dense stipato; sepalis tubi sub-8 obovato-orbicnlatis cuspidatis; petalis 5 late obovato-orbiculatis emarginatis; filamentis exterioribus latioribus persistentibus, stigmatibus 5 brevibus ovatis adpressis; bacca ovata basi apiceque contracta sicca pulvillis villosis aculeolatissimis confertissimis stipata, floris rudimentis coronata; seminibus subregularibus margine spongioso crasso parum prominente cinctis. *O. ramosissima*, E. in Sill. Journ., November, 1852. (Plate XXI, figs. l–7 & XXIV fig. 20.)

Valley of the Lower Colorado, and from thence to the California mountains; first discovered by Dr. Parry in the Colorado desert, afterwards found by Dr. Bigelow from the valley of Williams' river to 70 miles east of Cajon Pass, in the California mountains. The flower was first noticed by Mr. A. Schott, in western Sonora, towards the Lower Colorado. Fl. May to September. Stems 2–6 feet high, mostly branching from the base; below 1–3 inches in diameter, covered with a dark-gray scaly bark; wood of young branches reticulate, very soon becoming solid, but even then the reticulated structure remains visible in the different layers of wood. Annual layers not as distinct as the medullary rays, but more so than in *O. frutescens*; in a stem of near 2 inches diameter we counted 35 annual layers, 8 or 9 of which belong to the alburnum; branches numerous and slender, of an ashy or grayish green color, younger ones 3 or $3\frac{1}{2}$ lines in diameter, well characterized by the remarkable flattened tubercles, which, by closely crowding together, become 5 or 6 angular, diamond-shaped; the areola is linear, extending down to the middle of the tubercle; its short tomentum usually extends upwards between the next adjoining tubercles. Tubercles $2\frac{1}{2}$–3 lines long, and a little less in diameter. Spines $1\frac{1}{2}$–2 inches long, usually from the middle or at least above the base of the pulvillus, generally only on the upper tubercles of each year's growth, which gives the whole plant a singular appearance, showing the fasciculate spines at some, and having no spines at all on other parts of the apparently homogeneous branches. Sheath contracted at base, and firmly adhering to the spine, loose and saccate above. Small bristly spines at the base of the pulvillus, 2–3, sometimes even 5 in number, 1–4 lines long. Flower purple, about 6 lines in diameter, lowest part of the tube naked. Fruit 9–10 lines long, resembling much the fruit of the *Clavate Opuntiæ* in shape, being contracted above, with a narrow and deep umbilicus, and retaining the dead remains of the flower, of which the broad, scale-like exterior filaments are most conspicuous; pulvilli large and woolly, almost entirely covering the fruit, and beset with 30 to 50 reddish-brown, bristly, flexuous spines, 2–3 lines long. Seeds few, regular, nearly or quite 2 lines in diameter; cotyledons often nearly accumbent.

26. O. VAGINATA, Englm.: caule frutescente erecto dense lignoso, ramis virgatis demum teretibus junioribus tubercula oblongo-elongata subprominentia gerentibus laste viridibus; foliis subulatis pulvillis orbiculatis magnis breviter albo-tomentosis, setarum straminearum penicillo parvo brevi, aculeis ex imo pulvillo singulis elongatis corneis s. fuscis laxe stramineo s. aurantiaco-vaginatis, adjectis subinde supra aculeis minoribus 1–2; bacca ovata tuberculata pulposa flava s. aurantia pulvillos 15–20 majusculos albo-tomentosos setoaos gerente, umbilico angusto immerso, seminibus subregularibus marginatis. (Plate XX, fig. 1 & XXIV, figs. 13–15.)

About Albuquerque, where Dr. Wislizenus had already collected it in 1846; apparently extending into Mexico, as Dr. Gregg collected what seems to be the same species about San Luis Potosi. Shrub 3–5 feet high; lower part of stem 1–1½ inch thick, covered with scaly, light-yellowish-brown bark; older branches smooth terete, younger ones 3–4 lines in diameter, strongly tuberculated; tubercles 6–9 lines long; leaves slender, about 3 lines long, and apparently somewhat persistent, as they are sometimes found adhering, though withered, even to fruit-bearing branches, which, of course, are over a year old. The same, though to a less extent, is sometimes seen in *O. frutescens*. Pulvilli unusually large; bristles in the young ones forming a small but distinct bunch at the upper edge of the areola, but disappearing on the older joints, contrary to the usual occurrence, when the bristles become stouter and more numerous in older joints. Spines 1–2½ inches long, dark, with very loose and glistening sheaths; second or smaller spine sometimes lateral, but usually above-the principal one, not below it, as in most others. Flower unknown. Fruit ovate, 8 or 9 lines long, the pulvilli often bear 2–5 obtuse bodies, almost hidden in the tomentum, apparently glandular, but of a fibrous structure. Seeds, 12–15 in each fruit, about 2 lines or a little more in diameter, commissure broad, prominent, forming a distinct, somewhat spongy, rim. (See plate XX, fig. 1, and plate XXIV, figs. 13–15.) In Dr. Wislizenus' report, the long-spined form of *O. frutescens* was confounded with this species. It is possible, however, that *O. vaginata*, as described here, may be a stouter, tuberculated form of *O. frutescens*, with lighter colored, tuberculated fruit, and larger seed.

27. O. FRUTESCENS, Engelm. This well known species was observed from Laguna Colorado, 60 miles east of the Pecos, to Williams' river, a branch of the great Colorado, always with the same characters. The bark is scaly, almost papery, with a silvery reflection; the wood shows the medullary rays very distinctly, especially 5 of them; much less the annual layers. Fruit deep scarlet, smooth, with small, sometimes almost obliterated pulvilli, 5–9 lines long; seeds 5–10, about 1½ lines in diameter, with a narrow and often acute margin. The forms collected on the expedition belong to var. α. *longispina*; the var. β. *brevispina* has been observed only in Texas and northeastern Mexico. (See Plate XX, fig. 2–5, and Plate XXIV, figs. 16–19.)

EXPLANATIONS OF THE PLATES OF CACTACEÆ.

PL. I. ECHINOCACTUS WHIPPLEI, E. & B.: fig. 1, whole plant; fig. 2, bunch of spines of the usual size; fig. 3, same, uncommonly large and broad; fig. 4, same, lateral view; fig. 5, same, very young; fig. 6, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the tuberculated appearance.

PL. II, Fig. 1–2. ECHINOCACTUS POLYANCISTRUS, E. & B.: 1, upper part of a rib with older and younger bunches of spines, the youngest one with a flower bud in the axil; 2, one of the largest and most fully developed bunches of spines.

FIG. 3–5. ECHINOCACTUS LE CONTEI, E.: 3, part of a rib, with 2 bunches of spines; 4, a single bunch of spines from another specimen; 5, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the oval pits.

PL. III, Fig. 1–2. ECHINOCACTUS WISLIZENI, E.: 1, side view of a bunch of spines; 2, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the reticulation. This species, collected by Captain Whipple on the Gila, and common about El Paso, on the Rio Grande, has been introduced here to show those characteristics which distinguish it from the nearly allied *E. Le Contei*, on the foregoing plate.

FIG. 3. ECHINOCACTUS EMORYI, E.: two bunches of spines on part of a rib.

FIG. 4–6. ECHINOCACTUS POLYCEPHALUS, E. & B.: 4, part of a rib, with 3 bunches of short, stout, and straightish spines; 5, a young bunch of spines of unusual dimensions and much curved, with a woolly fruit in the axil; 6, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface more magnified to show the warty appearance, *d* seed after the removal of the outer integument, embryo, together with a considerable quantity of albumen in the endopleura, *e* embryo curved with accumbent cotyledons.

PL. IV, Fig. 1–3. CEREUS PHŒNICEUS, E.: 1, upper part of a head bearing a flower; 2, a bunch of spines of the usual size; 3, part of a rib, with 3 bunches of spines from an uncommonly large form.

FIG. 4–5. CEREUS PHŒNICEUS, subsp. CONOIDEUS, E. & B.: 4, upper part of a head ; 5, part of a rib, with 2 bunches of spines.

FIG. 6–7. CEREUS TRIGLOCHIDIATUS, E.: 6, upper part of a large head, with a flower; 7, part of a rib of another specimen, with smaller curved spines.

FIG. 8. CEREUS MOJAVENSIS, E. & B.: part of a rib, with 3 bunches of spines.

FIG. 9. CEREUS MOJAVENSIS, E. & B., var. ZUNIENSIS: part of a rib, with 2 bunches of spines.

PL. V, Fig. 1. CEREUS HEXAEDRUS, E. & B.: upper part of a head.

FIG. 2–3. CEREUS GONACANTHUS, E. & B.: 2, part of a rib, with two bunches of spines; 3, another fascicle of spines; the 3 bunches of spines show all a different proportion of the central and the upper radial spines.

FIG. 4–7. CEREUS ENGELMANNI, var. VARIEGATUS, E. & B.: 4 and 5, two bunches of spines, showing a different arrangement of central spines; 6, fruit; 7, seed—*a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to show the irregular tuberculation.

FIG. 8–10. CEREUS ENGELMANNI, var. CHRYSOCENTRUS, E. & B.: 8, part of two ribs, with numerous spines; 9, a single bunch of spines; 10, fruit, sterile and perhaps not fully developed.

PL. VI, Fig. 1–3. OPUNTIA CHLOROTICA, E. & B.: 1, joint with a flower. The flower reconstructed from a withered specimen collected in January; 2, sterile and probably unde

veloped fruit; 3, fragment of the bark of the lower part of the plant, with several large bunches of spines.

Fig. 4–5. Opuntia procumbens, E. & B.: 4, part of a joint; 5, larger bunch of spines from another specimen.

Pl. VII, Fig. 1–2. Opuntia occidentalis, E. & B.: 1, joint of the usual shape and size; 2, fruit.

Fig. 3–4. Opuntia angustata, E. & B.: 3, a large and less spinous joint with a sterile degenerate spinous fruit; 4, a smaller, more spinous joint with a full grown ripe fruit.

Pl. VIII, Fig. 1. Opuntia Engelmanni, var. cyclodes, E. & B.: with ripe fruit.

Fig. 2–3. Opuntia tortispina, E. & B.: 2, fragment of a joint with fewer spines and ripe fruit; 3, part of a more spiny joint.

Pl. IX, Fig. 1–5. Opuntia camanchica, E. & B.: 1, a joint with shorter and lighter colored spines: 2, a joint with larger and darker spines; 3, fragment of a joint with more numerous and crowded spines; 4 and 5, ripe fruit of the smaller and largest size.

Fig. 6–8, Opuntia mojavensis, E. & B.: 6, a younger bunch of spines; 7, another from the oldest part of the plant; 8, a sterile and degenerate fruit.

Pl. X. Fig. 1–2. Opuntia vulgaris, Mill.: 1, a young joint with leaves, the older one has a single spine and bears a flower bud; 2, a single leaf magnified 4 diameters. The figures of this species have been introduced to exhibit the diagnostic characters and its difference from the next species.

Fig. 3–5. Opuntia Rafinesquii, E.; 3, an older joint with a flower and a bud, and a younger half-grown joint with leaves. This represents the spinous form common in Illinois, Missouri, and Arkansas. 4, an older joint of the variety with few spines, bearing numerous fruits of different shapes, as they often occur in the same plant; 5, two leaves of different sizes magnified 4 diameters.

Pl. XI, Fig. 1, Opuntia Rafinesquii, var. minor, E.: the larger joint spineless, the upper one spiny on the margin.

Fig. 2–3. Opuntia Rafinesquii, var. grandiflora, E.: 2; a joint with flower; 3, fruit.

Fig. 4. Opuntia fuscoatra, E.: a joint with a young fruit just after flowering, fragment of an older, very bristly, joint visible.

Pl. XII. Fig. 1–3. Opuntia cymochila, E. & B.: 1, a joint; 2, a single bunch of spines; 3, ripe fruit.

Fig. 4–6. Opuntia stenochila, E. & B.: 4, a joint; 5 and 6, a smaller and large fruit.

Fig. 7–8. Opuntia fusiformis, E. & B.: 7, a joint; 8, a fruit.

Fig. 9. Opuntia brachyarthra, E. & B.: a whole plant with two withered flowers.

Pl. XIII. Fig. 1–5. Opuntia basilaris, E. & B.: 1, a joint somewhat shrivelled as it appears in winter; a late young joint near its base appears more plump and fresh; 2, flower; 3, style; 4, undeveloped sterile fruit; 5, a whole plant reduced in size to show the singular manner of growth.

Fig. 6–7. Opuntia sphærocarpa, E. & B.: joint and fruit.

Fig. 8–11. Opuntia erinacea, E. & B.: 8, joint of the usual shape, (only partly finished;) 9 and 10, bunches of spines; 11, fruit.

Pl. XIV. Fig. 1–3. Opuntia Missouriensis, var. rupispina E. & B.: 1, a joint, (only partly completed ;) 2, a very full bunch of spines; 3, fruit.

Fig. 4. Opuntia Missouriensis, var. platycarpa, E.: fruit.

Fig. 5–7. Opuntia Missouriensis, var. microsperma, E.: 5, joint (unfinished) with flower; 6, bunch of spines; 7, fruit.

Fig. 8–10. Opuntia Missouriensis, var. albispina, E. & B.: 8, joint (unfinished); 9, bunch of spines; 10, fruit.

Pl. XV, Fig. 1–4. Opuntia Missouriensis, var. trichophora, E. & B.: 1, part of an old stem

showing the thickness and hairy spines, upper younger joint unfinished; 2, bunch of spines from a younger joint; 3, same from an older part of the plant; 4, fruit.

FIG. 5–7. OPUNTIA HYSTRICINA, E. & B.: 5, a joint (unfinished); 6, a large bunch of spines; 7, fruit.

PL. XVI. OPUNTIA DAVISII, E. & B.: 1, a branch showing the structure of the older parts, an older and young joints with two fruits; 2, a tubercle with its bunch of spines, the membranaceous sheaths partly torn, showing the spine itself; 3, a degenerate sterile spiny fruit in its transition to a branch, as it is often seen in this species and others, especially cylindric Opuntiae; 4, the whole plant reduced.

PL. XVII, Fig. 1–4. OPUNTIA WHIPPLEI, E. & B.: 1, a branch of the more common form of the plant covered with ripe fruit. At (*a*) the fruit is undeveloped, probably not different from the ovary of the flower, only more shrivelled; 2, branch of a larger specimen, spines more numerous, fruit larger; 3, a single bunch of spines of this specimen; 4, whole plant reduced.

FIG. 5–6. OPUNTIA ARBORESCENS, E.: 5, a stout branch with numerous spines and large fruit; 6, a bunch of spines of same.

PL. XVIII, Fig. 1–3. OPUNTIA ACANTHOCARPA, E. & B.: 1, an older branch with fruit; 2, a young branch; 3, whole plant reduced.

FIG. 4. OPUNTIA ARBORESCENS, E.: whole plant reduced.

FIG. 5–10. OPUNTIA ECHINOCARPA, E. & B.: 5, a branch of the plant densely covered with the sheathed spines; 6, 7, and 8, bunches of spines; 9, fruit, side view; 10, same, top view.

PL. XIX. OPUNTIA BIGELOVII, E.: 1, a single joint; 2 and 3, tubercles, with bunches of spines; 4, young undeveloped fruit; 5, an apparently full-grown fruit, sterile, and perhaps degenerating into a branch; 6, part of the ligneous skeleton, forming a wide tube, and showing in the reticulated structure the traces of the tubercles and branches; 7, an entire plant reduced; on the right of the main stem is a younger shoot, with vigorous erect joints.

PL. XX, OPUNTIA VAGINATA, E.: 1, an older joint bearing two fruits, and a young vigorous shoot.

FIG. 2–3. OPUNTIA FRUTESCENS, E., var. LONGISPINA: from Williams' river of the Colorado; 2, a branch with fruit; 3, lower part of the trunk, with some roots; the sections show the structure of the dense wood.

FIG. 4–5. OPUNTIA FRUTESCENS, E., var. BREVISPINA: 4, a branch with fruits, most of them sterile, one producing young branches from its upper areolæ; 5, a flower.

PL. XXI. OPUNTIA TESSELATA, E.: 1, a branch with fruit *a, a,* and a withered flower *b*; 2 and 3, flowers as they probably are, reconstructed from withered specimens; 4, a small joint magnified so as to show distinctly the appearance of the tubercles and areolæ; 5, part of the stem with a section of the wood above and a fracture below, so as plainly to show the ligneous structure; the bark of the younger branches exhibits the tesselated surface, while in the older trunk it is lost in the irregular scales; 6, ligneous skeleton of a young branch; 7, a whole plant reduced.

PL. XXII, Fig. 1–3. OPUNTIA CLAVATA, E.: 1, joint with a ripe fruit; 2, one of the upper bunches of spines; 3, part of the central spine magnified 4 diameters.

FIG. 4–7. OPUNTIA PARRYI, E.: 4, joint with ripe fruit; 5, bunch of spines, side view; 6, another one, front view; 7, part of the central spine magnified 4 diameters.

The remaining figures of this, and all of the two following plates represent seeds and their details of almost all the *Opuntiæ* described in this report. Fig. *a* represents a side view of the seed, natural size; *b*, same, four times magnified, as are all the following figure; *c*, posterior view; *d*, anterior view; *e*, vertical section of seed, exhibiting the position and proportion of the embryo and the albumen; *f*, embryo and albumen coated by the endopleura, after the removal of the testa; *g*, lateral view of embryo. The other letters *h, i, k*, etc., will be explained wherever they occur.

FIG. 8–9. Seeds of OP. ENGELMANNI, var. CYCLODES.

FIG. 10. Seed of OP. OCCIDENTALS: One of the embryos, *g*, shows the cotyledons in an oblique almost incumbent position.

FIG. 11. Seed of OP. ANGUSTATA.

FIG. 12–15. Seeds of OP. CAMANCHICA, of different sizes and shapes.

PL. XXIII, Fig. 1–5. Seeds of OP. TORTISPINA: 1–3, seeds of different sizes and shapes; 4, two embryos in one seed; *g-h*, different views of both embryos together as they lay in the seed; *i*, interior layer, and *k*, exterior smaller embryo; 5, germination of a double embryo; two young plants from one seed, the larger one still bearing the shell of the seed.

FIG. 6. Seed of OP. FUSIFORMIS.

FIG. 7–12. Seeds of OP. RAFINESQUII, and some of its varieties and sub-species; 7, usual form from Missouri, (see pl. X, fig. 3;) *h, i, k*, germination in different stages of development; *l*, seedling with three cotyledons.

FIG. 8. Small seed from the fruits represented on pl. X, fig. 4.

FIG. 9. OP. STENOCHILA.

FIG. 10–12. OP. CYMOCHILA: 10 and 11, different forms of the usual variety; 12, seed of the variety *montana*.

FIG. 13. Seed of OP. VULGARIS.

FIG. 14. Seeds of OP. BASILARIS: An irregular and a very regular one from the same fruit.

FIG. 15. Seed of OP. HYSTRICINA.

FIG. 16–19. Seeds of different forms of OP. MISSOURIENSIS: 16, var. RUFISPINA 17, var. PLATYCARPA; *h*, seedling of same; 18, var. ALBISPINA; 19, var. TRICOPHORA.

PL. XXIV, Fig. 1–2. OP. MISSOURIENSIS: 1, var. with smaller fruit and seeds from the Upper Missouri; 2, var. MICROSPERMA. (See pl. XIV, Fig. 5–7.)

FIG. 3. Seed of OP. SPHÆROCARPA.

FIG. 4. Seed of OP. ERINACEA: The embryo, *g*, shows considerable obliquity of the cotyledons.

FIG. 5. Seed of OP. FRAGILIS: From the Yellowstone river.

FIG. 6. Seed of OP. CLAVATA: The embryo, *g*, oblique.

FIG. 7. Seed of OP. PARRYI: Embryo, *g*, nearly accumbent.

FIG. 8. Seed of OP. ECHINOCARPA: One of the seeds quite regular, the other irregular; embryo, *g, g*, always regularly accumbent; *h*, and *i*, seedlings with the very narrow and thick cotyledons crossing each other, one of them bearing the shell of the seed.

FIG. 9–10. Seeds of OP. WHIPPLEI: 9, seed of the plant represented Pl. XVII, fig. 2, seed larger, commissure perfectly linear, cotyledons oblique; 10, seeds of the other specimen, Pl. XVII, fig. 1, seeds smaller, of different shapes, commissure a little wider, cotyledons oblique, in *i* somewhat separated; in *k* three cotyledons, of which *l* is a transverse section, *h*, seedling with very narrow and long cotyledons.

FIG. 11. Seeds of OP. ACANTHOCARPA, of different shapes all from one fruit.

FIG. 12. Seeds of OP. ARBORESCENS, of different shapes belonging to the plant, figured Pl. XVII, fig. 5, smaller than those sent by other collectors, embryo *g*, regularly incumbent.

FIG. 13–15. Seeds of OP. VAGINATA: 13–14, seeds of different sizes from the plant, Pl. XX, fig. 1., the smaller one is empty and perhaps not fully formed; 15, seed of the same species collected in Mexico by Dr. Gregg. Cotyledons regularly incumbent.

FIG. 16–19. Seeds of OP. FRUTESCENS: 16, var. LONGISPINA from the Llaño Estacado (Pl. XX, fig. 2); 17, same from Mexico, Dr. Gregg; 18, same from Williams River branch of the great Colorado; 19, var. BREVISPINA, from Texas, Lindheimer. In all these the cotyledons of the embryo are regularly incumbent.

FIG. 20. Seeds of OP. TESSELATA: embryo oblique or almost accumbent.

All the figures are of natural size unless the contrary is expressly stated. They were drawn with the greatest accuracy, partly from living and in part from dried specimens, by Mr. Paulus

Roetter of St. Louis, under the personal superintendence of Dr. Engelmann. The drawings made on the spot by Mr. H. B. Möllhausen, the artist of the expedition, greatly aided the work and were made use of, and even partly copied, especially in the plates exhibiting the habit of the Cylindric Opuntiæ.

Corrections.

The render will please correct the disagreably large number of typographical errors, only the more important of which are enumerated in the subjoined list; the balance and especially the numerous and annoying errors of punctuation he will not fail himself to discover. Many citations of figures, omitted in their proper places, will be found in the „Explanations“.

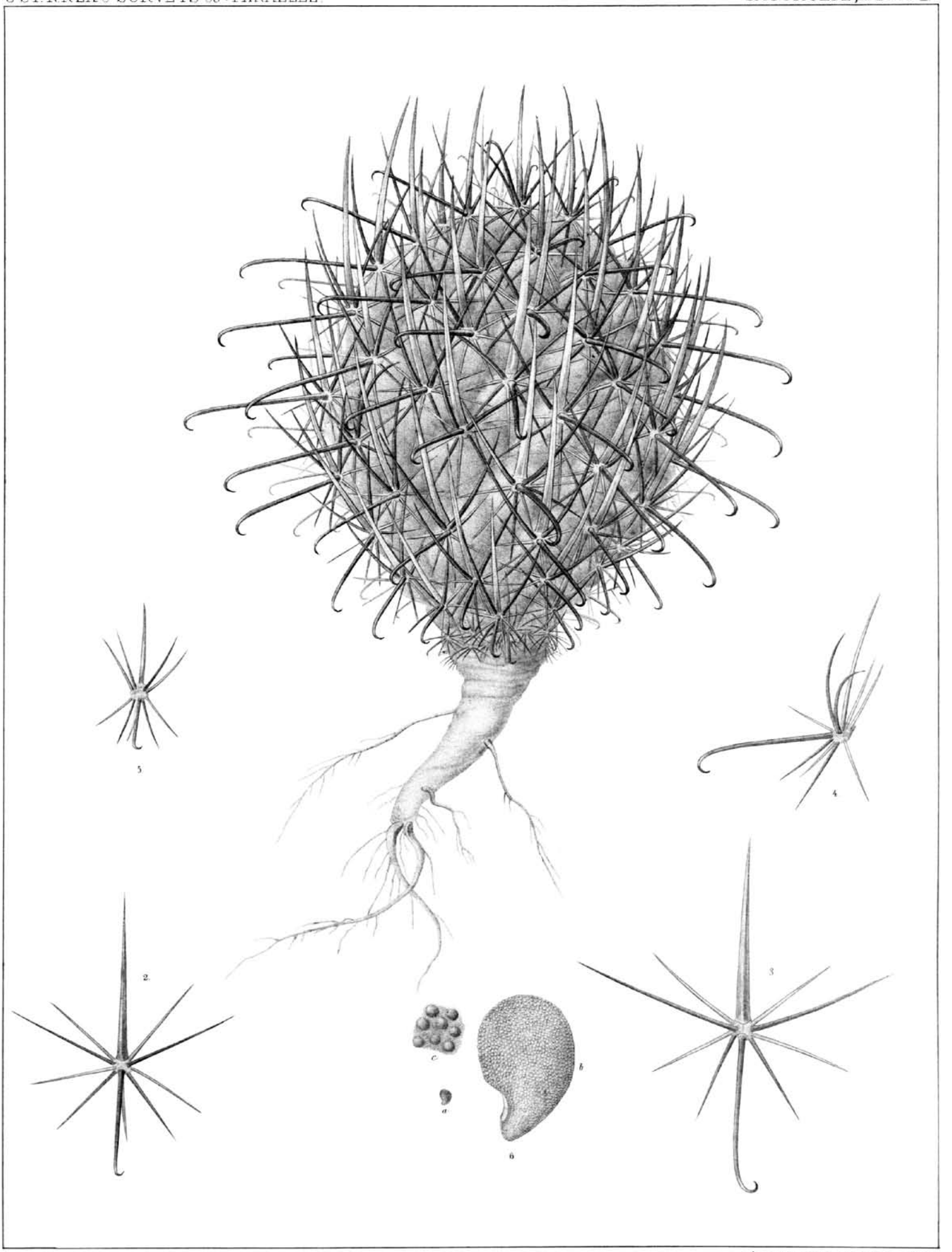
Page	27	line	12	omit *(Pl. I)*
–	–	–	15	for *immersed* read *emersed*
–	28	–	20	– *globosa-* r. *globoso-*
–	–	–	21	– *orbiculatus* r. *orbiculatis*
–	–	–	–	after *radialibus* add 7
–	29	–	11	for *arcete* r. *arcte*
–	–	–	13	– *Plate I* r. *Plate II*
–	–	–	32	– *ovato*, r. *ovato-*
–	–	–	33	for *interutptus* r. *interruptis*
–	–	–	–	– *radalibus* r. *radialibus*
–	–	–	40	– *Plate I* r. *Plate II*
–	30	–	27	– *higher and* r. *higher than*
–	31	–	28	– *cylindricusque* r. *cylindricusve*
–	–	–	45	after 2–2½ add *feet*
–	32	–	14	for *axis* r. *axillæ*
–	–	–	–	– *spinulose* r. *spinescent*
–	–	–	20	omit after *off* the *;*
–	–	–	22	– *laticostatus*
–	33	–	6	after *bulbous* add *at base*
–	34	–	5	for *species* r. *spines*
–	35	–	41	– *ined.* r. *in R.B.C.-Fruit*
–	36	–	26	omit *into subspecies*
–	37	–	14	for *unable* r. *enabled*
–	–	–	41	– *Mexico* r. *New-Mexico*

Page	39	line	32	for *VII* r. *VI*
–	–	–	37	– *distinct* r. *distant*
–	–	–	43	after *stipata* put *;*
–	40	–	13	for *one* r. *our*
–	–	–	14	– *structa* r. *stricta*
–	–	–	15	– *tuberculatus* r. *tuberculata*
–	–	–	34	after *gracilioribus* put *;*
–	41	–	5	for *Pl. V* r. *Pl. VIII*
–	–	–	28	– *marginatis* r. *emarginatis*
–	–	–	32	add *Pl. X fig.* 3–5. *Pl. XXIII fig.* 7–8.
–	43	–	16	omit *similar seed, but*
–	–	–	45	for *purpureis* r. *purpurei*
–	44	–	7	– *originate* r. *originating*
–	–	–	21	after *armatis* put *;*
–	–	–	23	– *flexuosisve* put ,
–	–	–	46	– 5–10 omit .
–	45	–	1	for *petaloide-* r. *petaloideo-*
–	–	–	13	– *spring* r. *spiny*
–	–	–	23	after *young* add *or*
–	–	–	36	– *smaller* add *;*
–	–	–	41	– *transversis* add *;*
–	–	–	44	for *shortest* r. *stoutest*
–	46	–	20	add *Pl. XXIV fig. 1*
–	–	–	35	for 1–¼ r. 1¼

Page 46 line 40 for *stramineis r. stramineas*
– – – 43 after 25 add *nonnullos*
– – – 44 – *immerso* add *;*
– 47 – 34 – *ones* add *;*
– – – 44 – *parvi* omit ;
– 48 – 16 for *turned* r. *tumid*
– 49 – 40 – *ceteri* r. *cæteris*
– – – 44 – *stipata floris*. r. *stipata, floris*
– 50 – 13 – *all* r. *in all*
– – – 23 – *aculeolos… vaginatos* r. *aculeolis… vaginatis armatos*
– – – 25 – ¾ *inch* r. 3–4 *inches*
– – – 39 – *joints; proliferous seeds,* r. *proliferous joints; seeds*
– 51 – 4 – *deciduous* r. *deciduos*
– – – – after *stipato* add *;*
– – – 6 – *infundibuliformi* add *;*
– – – – add *Pl. XVII fig*. 1–4, *XXIV fig*. 9–10.
– – – 8 for 1–4 r. 2
– – – 27 this whole reference belongs to the next species.
– – – 35 after *divaricatis* add *;*
– – – 39 for *muetangulis* r. *multangulis*
– 52 – 3 omit *and* after *tuberculated*

Page 52 line 6 for 5–6 *angu-* r. 5–6-*angu-*
– – – 9 – *laxi* r. *laxa*
– – – 12 after *cuspidatis* put *;*
– – – 14 for *aculeo-latissimus* r. *aculeolatissimis*
– – – 21 – *base below,* 1–3 r. *base; below* 1–3
– – – 42 add *cotyledons often accumbent.*
– – – 45 for *penicilla parvo* r. *penicillo parvo*
– – – 48 – *gerentibus* r. *gerente*
– 53 – 24 after *smooth*, put *with*
– 54 – 27 for *sub, sp*. r. *subsp*.
– – – 42 omit *to be*
– 55 – 11 for *an, docwded* r. *and crowded*
– 56 – 1 – *joints (unfinished)* r. *joint unfinished*
– – – 25 – *left* r. *right*
– – – 32 – *areola* r. *areolæ*
– – – 34 after *are* put ,
– 57 – 14 for *fruit* r. *form*
– – – 35 – *XXII* r. *XVII*

Plate IV for *Bigelovii* r. *Mojavensis*, twice.
– XXIII fig. 2–4 for *tortisperma* r. *tortispina*
– – fig. 10 omit *Op. vulgaris*.

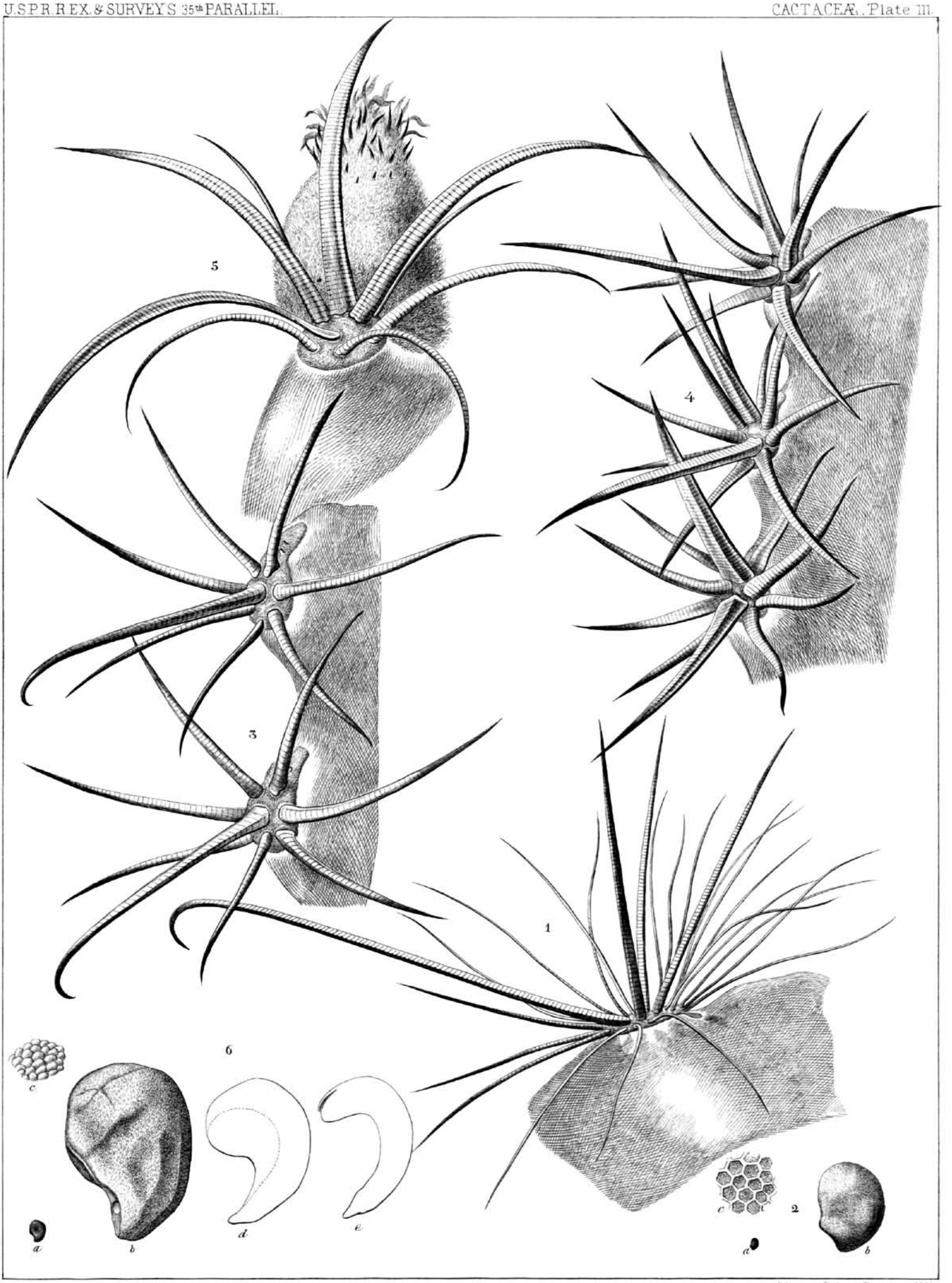


Ackerman Lith. 379 Broadway N.Y.

ECHINOCACTUS WHIPPLEI E. & B.

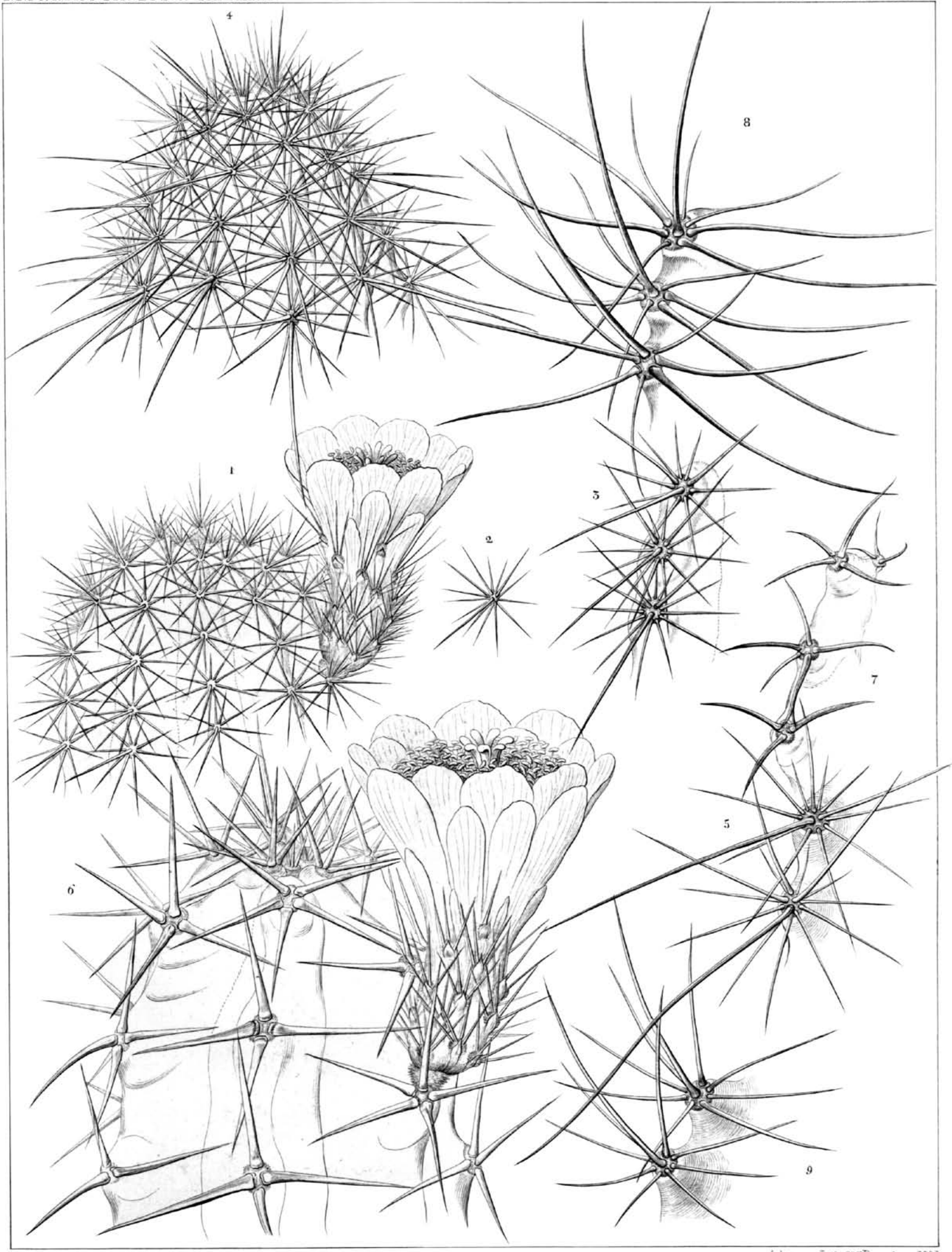
Ackermann Lith. & Pbg. Broadway, N.Y.

1~2. ECHINOCACTUS POLYANCISTRUS, E&B 3~5 ECHINOCACTUS LECONTEI. E.



Ackerman Lith. 59 Broadway N.Y.

1-2 ECHINOCACTUS WISLIZENI, E. 3 E. EMORYI, E. 4-6 E. POLYCEPHALUS, E. & B.

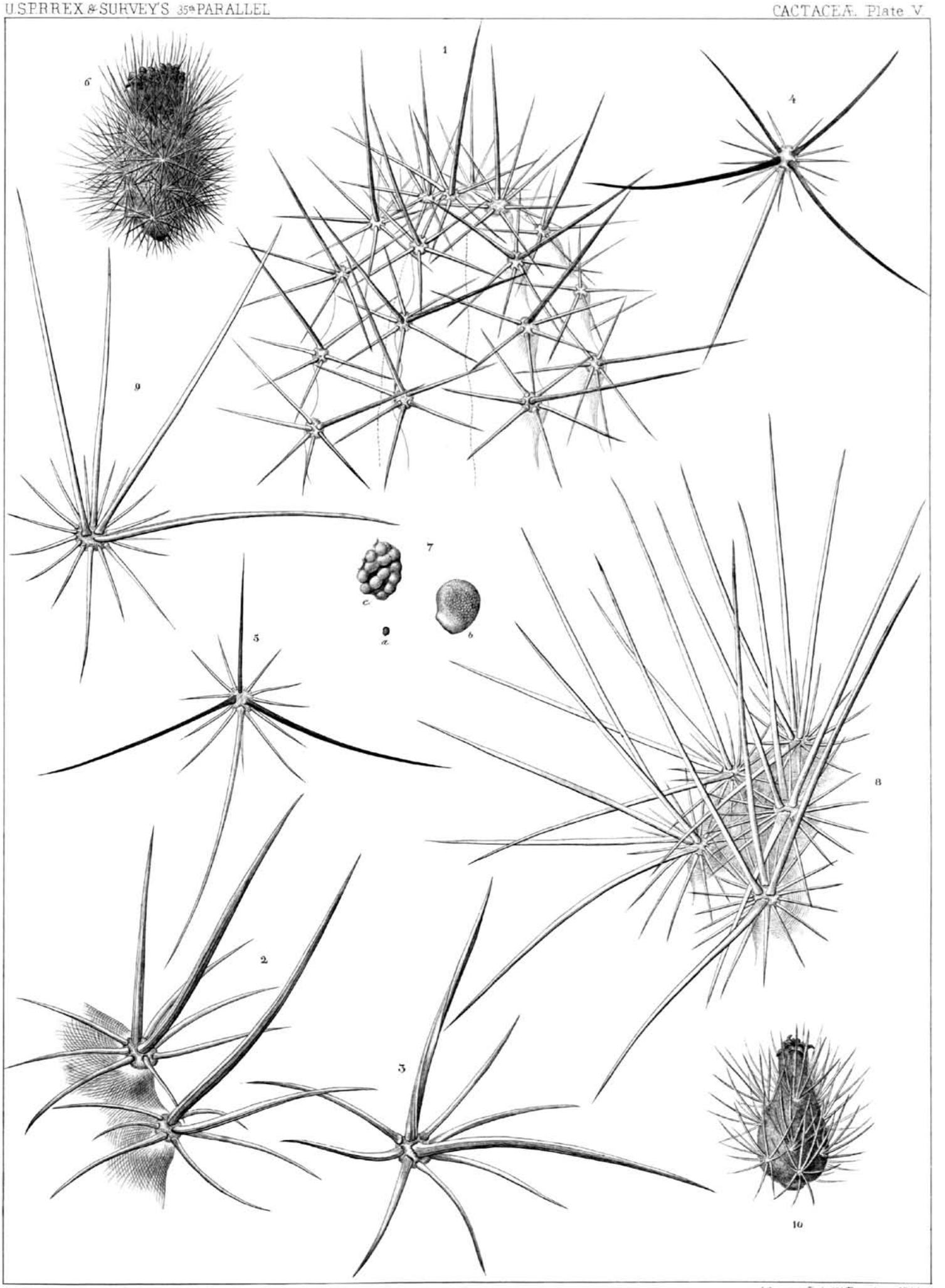


Ackerman Lith. 379 Broadway N.Y.

1-3. CEREUS PHŒNICEUS, E. 4-5. CEREUS CONOIDEUS E. & B. 6-7. CEREUS TRIGLOCHIDIATUS, E.

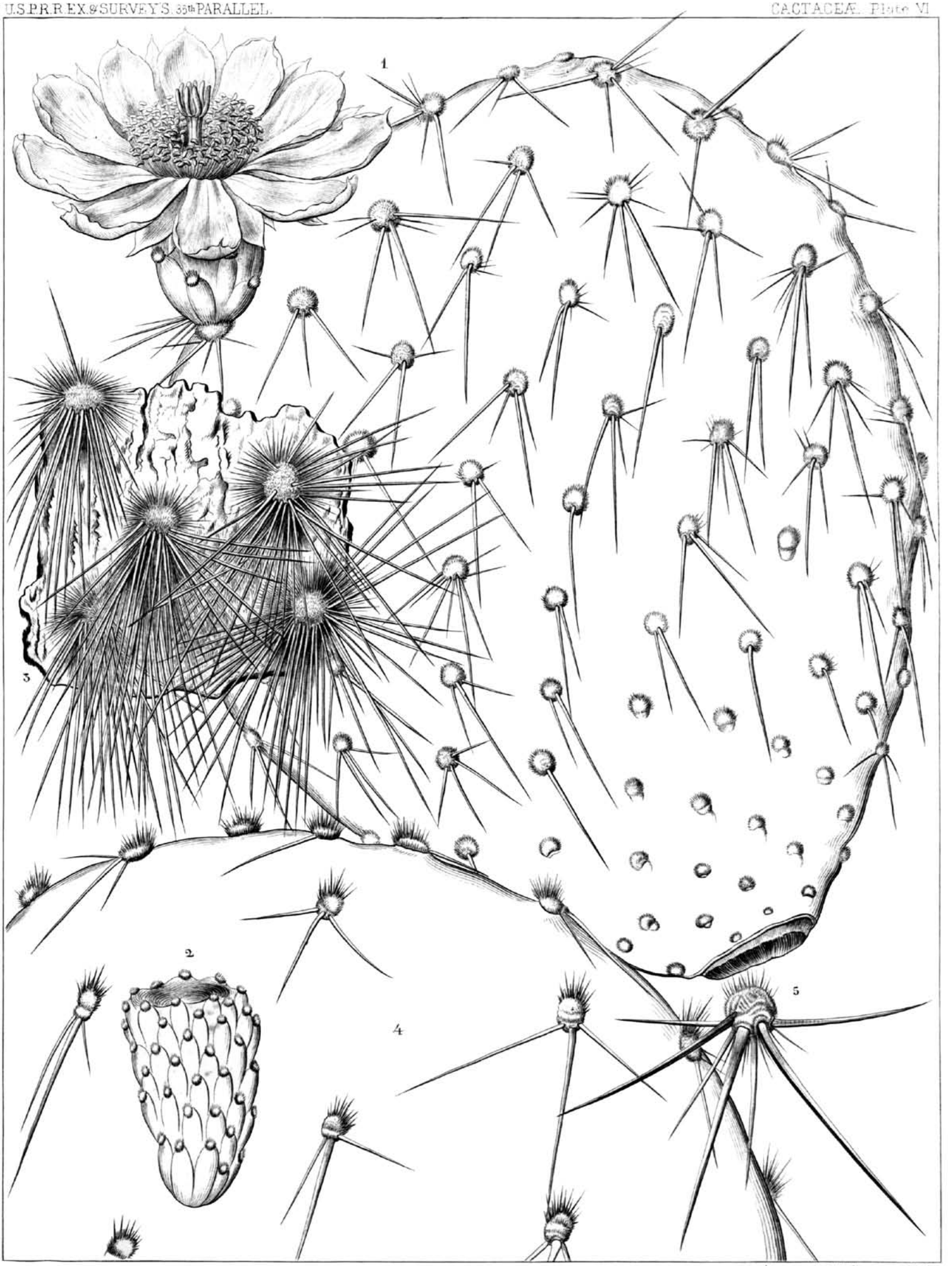
8. C. ~~BIGELOVII~~ 9. C. ~~BIGELOVII~~ β. ZUNIENSIS

Mojavensis Mojavensis



Ackerman Lith. 379 Broadway N.Y.

1. CEREUS HEXAEDRUS E&B. 2–3 C. GONACANTHUS E&B 4–7. C ENGELMANNI, var VARIEGATUS.
8–10. var CHRYSOCENTRUS



Ackerman Lith. 879 Broadway N.Y.

1–3 OPUNTIA CHLOROTICA, E&B. 4–5 O. PROCUMBENS, E&B.

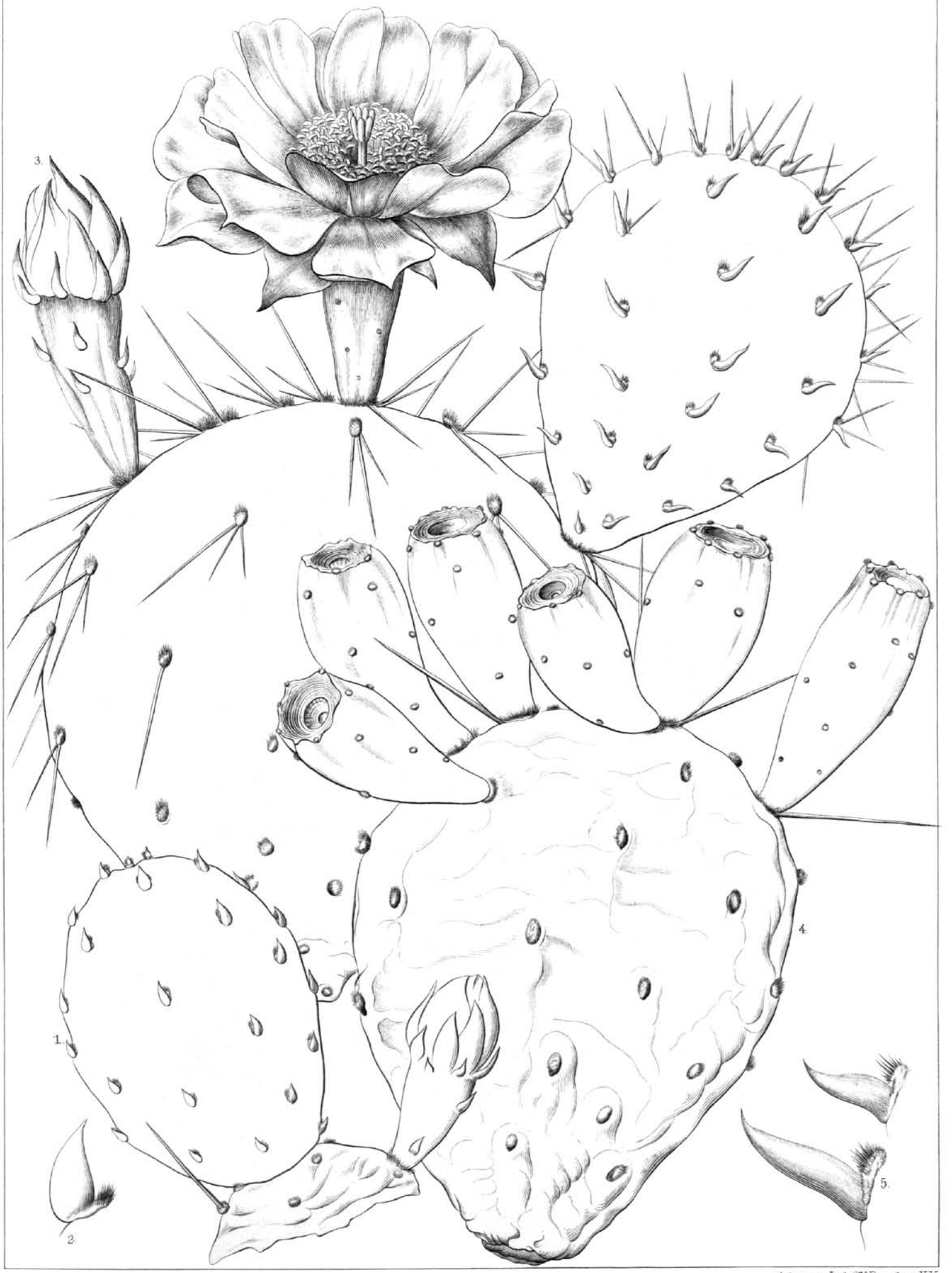
1-2. OPUNTIA OCCIDENTALIS, E & B. 3-4. O. ANGUSTATA, E & B.

Ackerman Lith. 376 Broadway N.Y.

1. OPUNTIA ENGELMANNI *var* CYCLODES. E.&B. 2–3 OPUNTIA TORTISPINA E.&B.

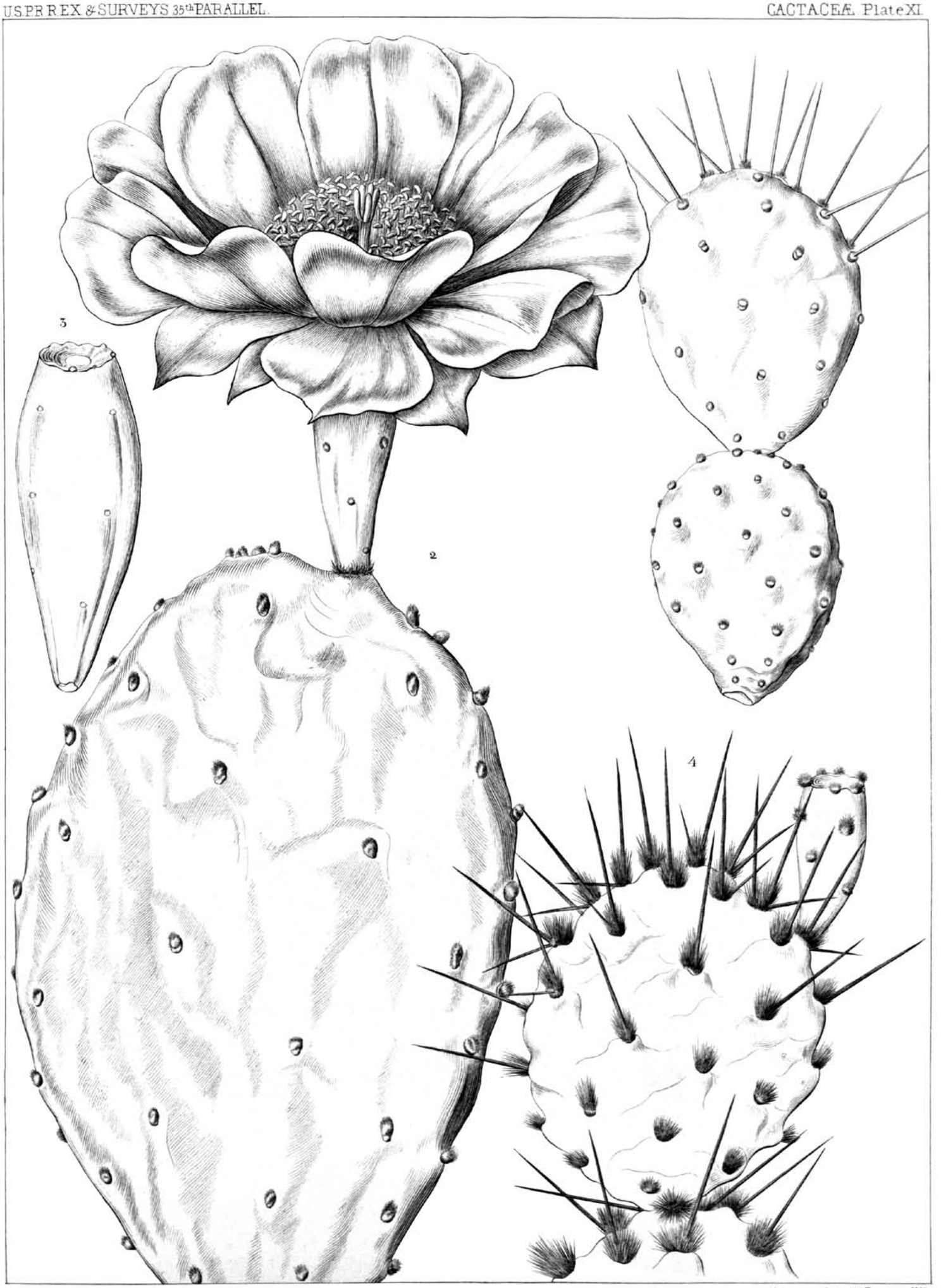
Ackerman Lith. 379 Broadway NY

1-5, OPUNTIA CAMANCHICA, E & B. 6-8, OPUNTIA MOHAVENSIS, E & B.



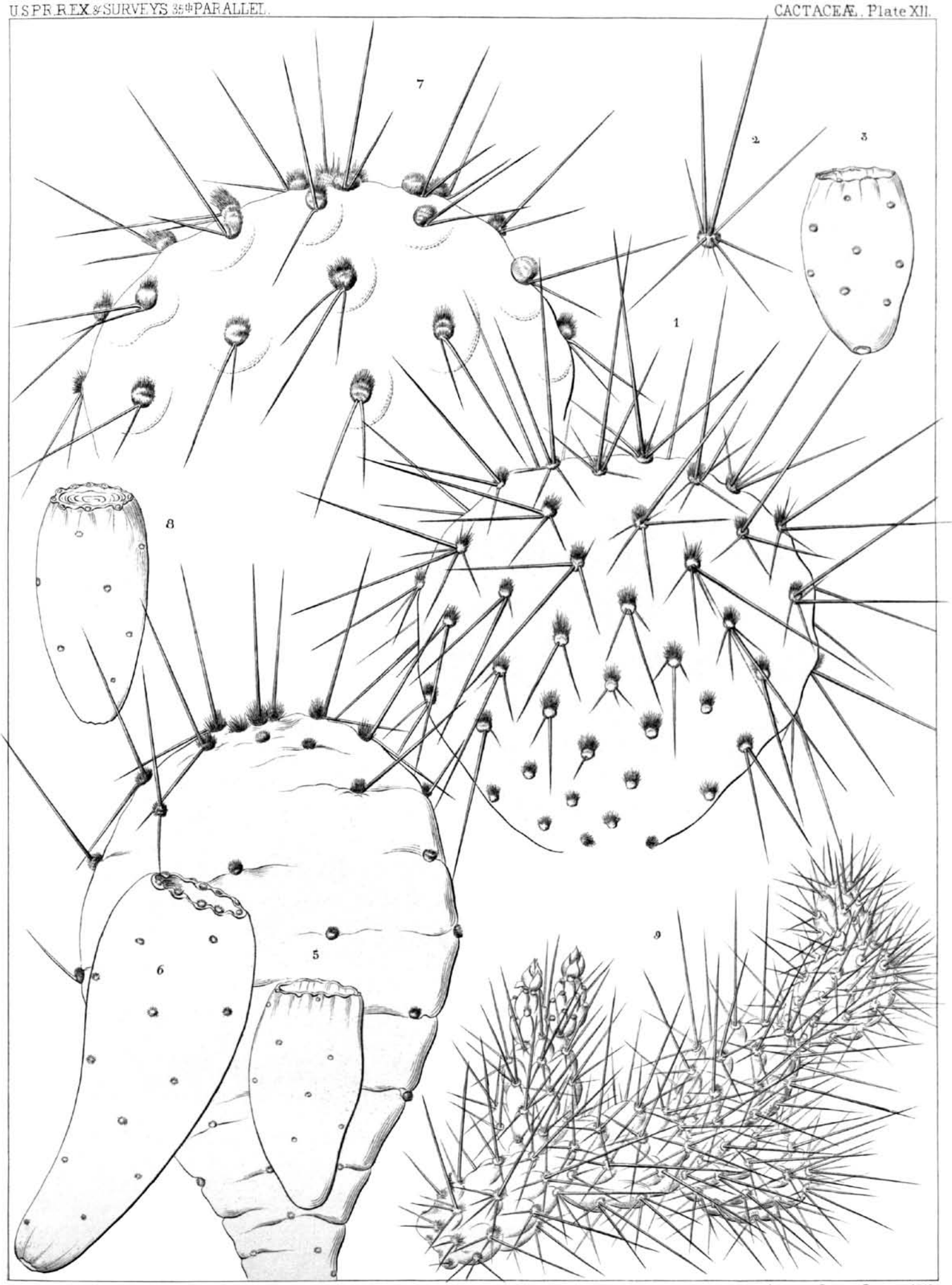
Ackerman Lith. 379 Broadway N.Y.

1-2 OPUNTIA VULGARIS., *Mill.* 3-5 OP. RAFINESQUII, E.



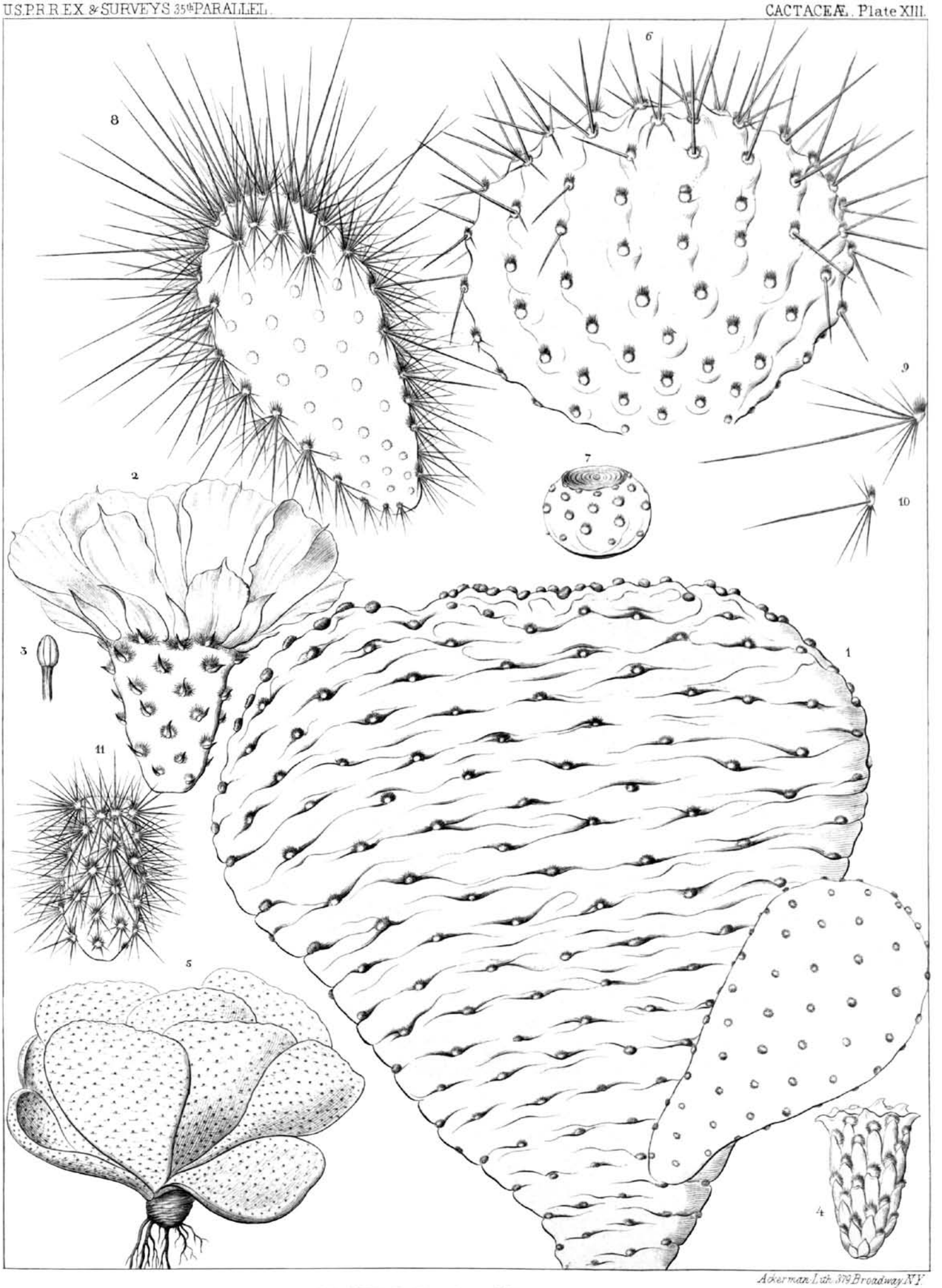
Ackerman Lith. 379 Broadway N.Y.

1, OPUNTIA RAFINESQUII, *minor*, E. 2-3. OP. RAFINESQUII, *grandiflora* E.
4, OPUNTIA FUSCO-ATRA, E.



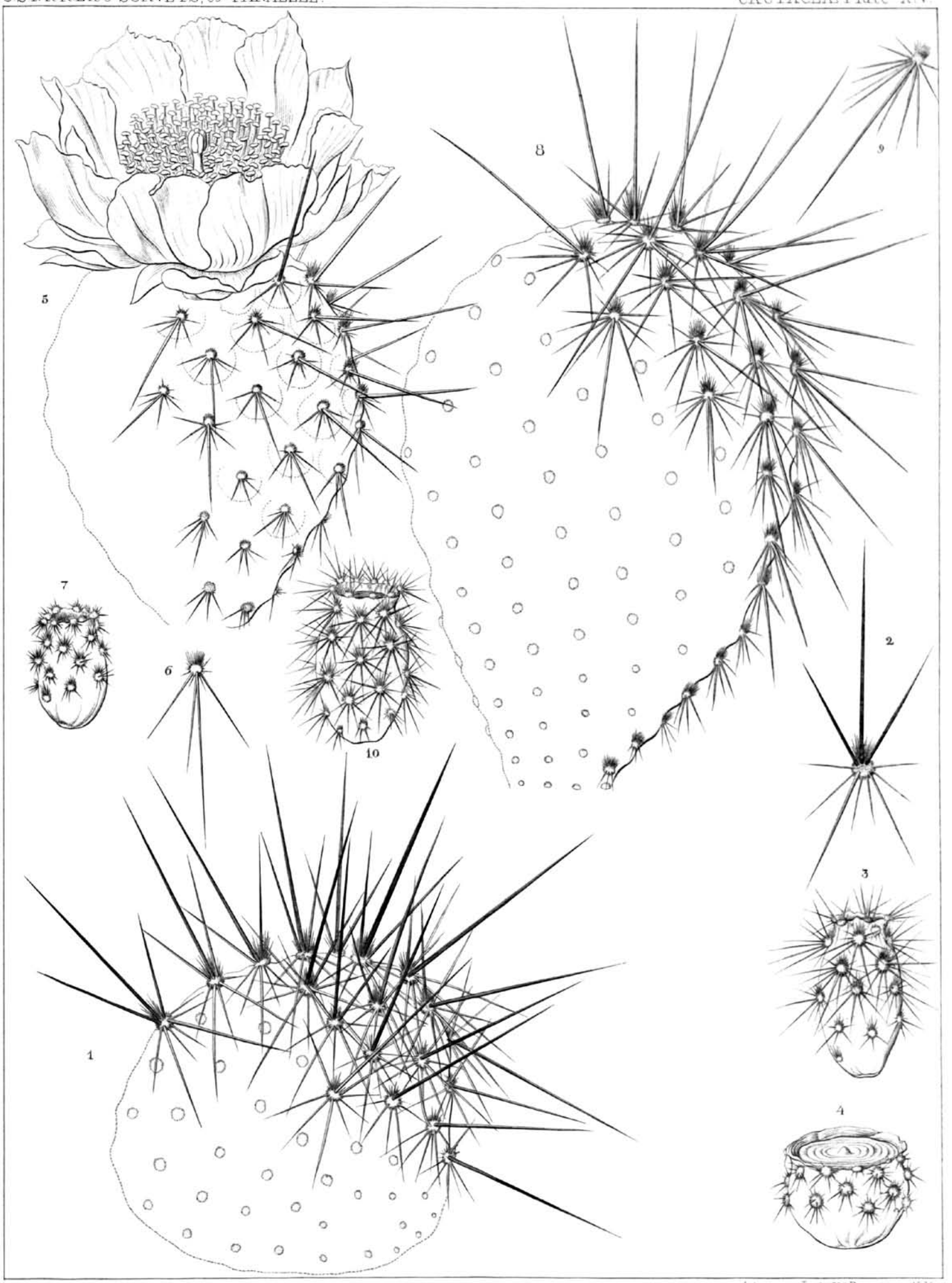
Ackerman Lith. 379 Broadway N.Y.

1-3, OPUNTIA CYMOCHILA, E & B. 4-6. OPUNTIA STENOCHILA, E & B. 7-8, OPUNTIA FUSIFORMIS, E & B.
9, OPUNTIA BRACHYARTHRA, E & B.



Ackerman Lith. 379 Broadway NY

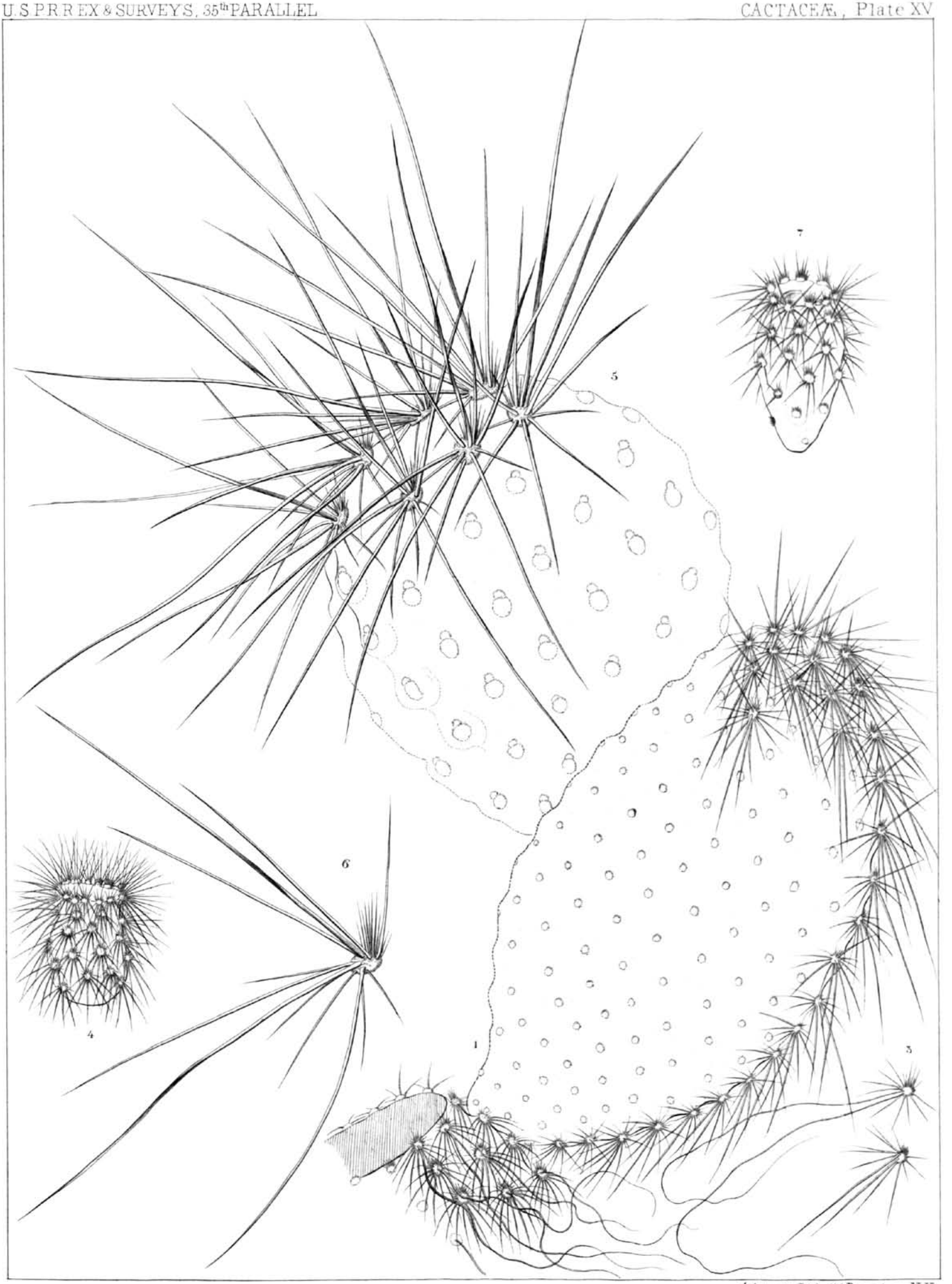
1–5 OPUNTIA BASILARIS, E&B. 6–7. OPUNTIA SPHÆROCARPA, E&B
8–11. OPUNTIA ERINACEA, E&B



Ackerman Lith. 39 Broadway, N.Y.

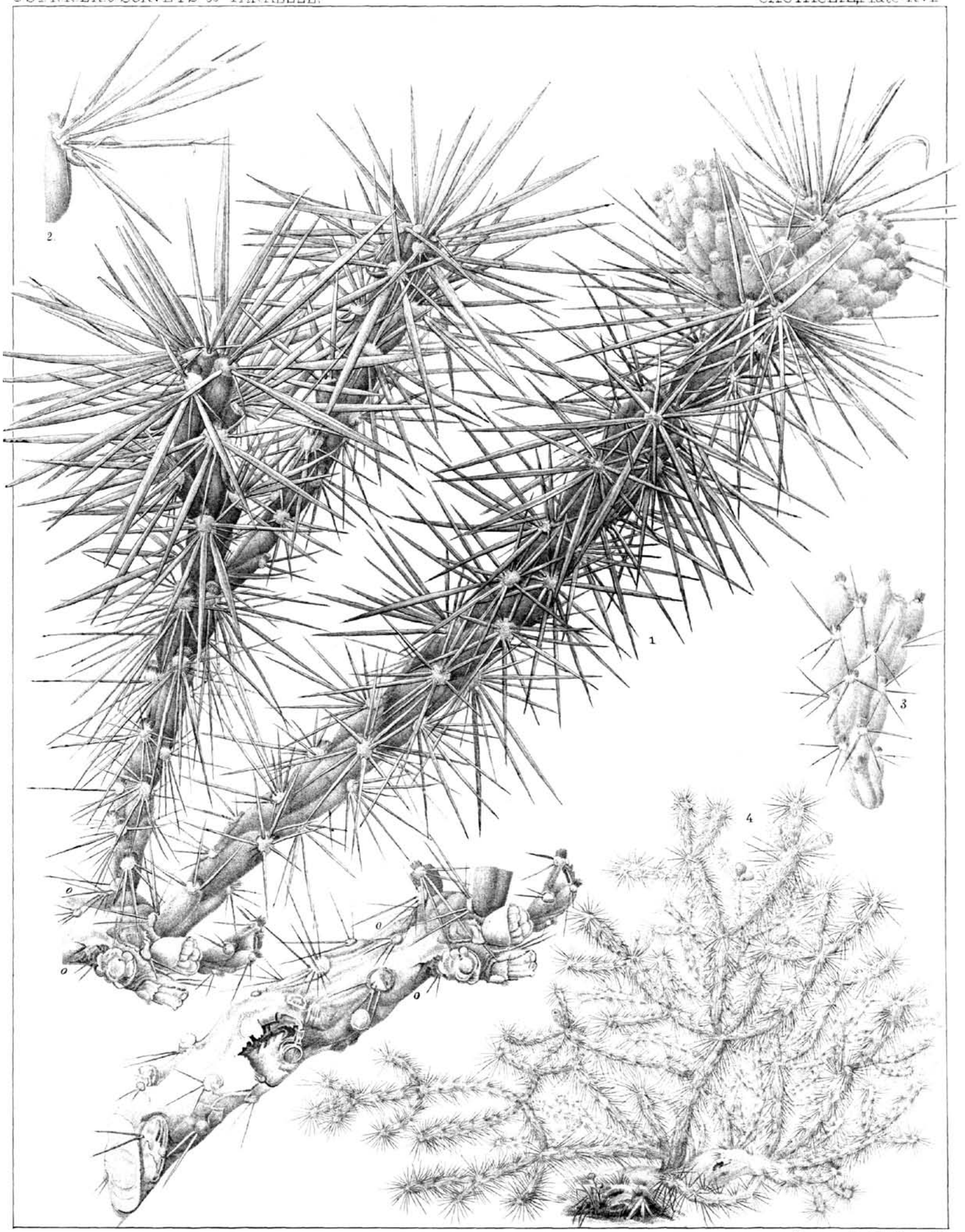
OPUNTIA MISSOURIENSIS, DC.

1-3, *var.* RUFISPINA. 4, *var* PLATYCARPA. 5-7, *var* MICROSPERMA. 8-10, *var* ALBISPINA.



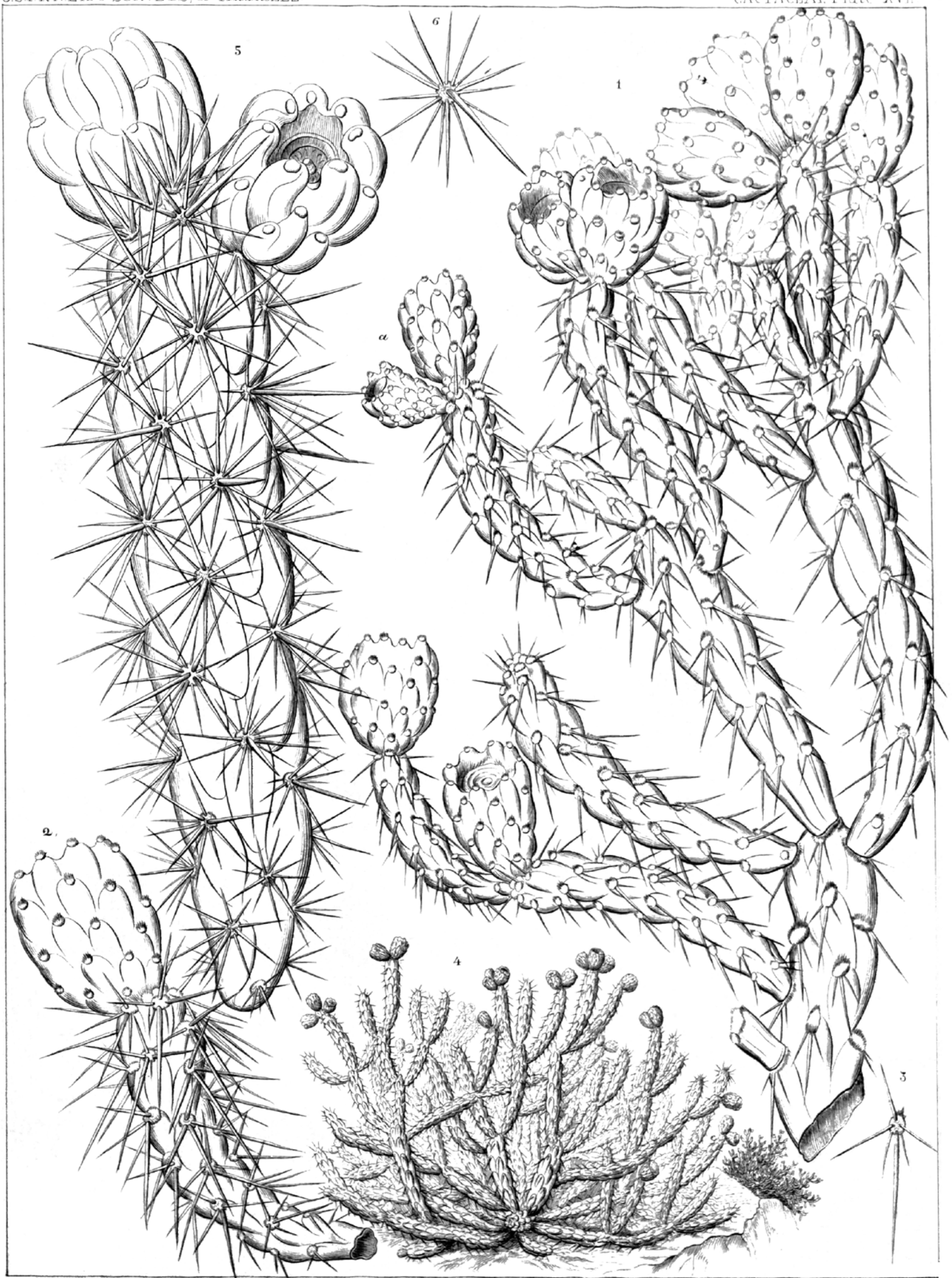
Ackerman Lith. 379 Broadway N.Y.

1-4. OPUNTIA MISSOURIENSIS. DC. var TRICHOPHORA. E & B.
5-6 OPUNTIA HYSTRICINA, E & B.



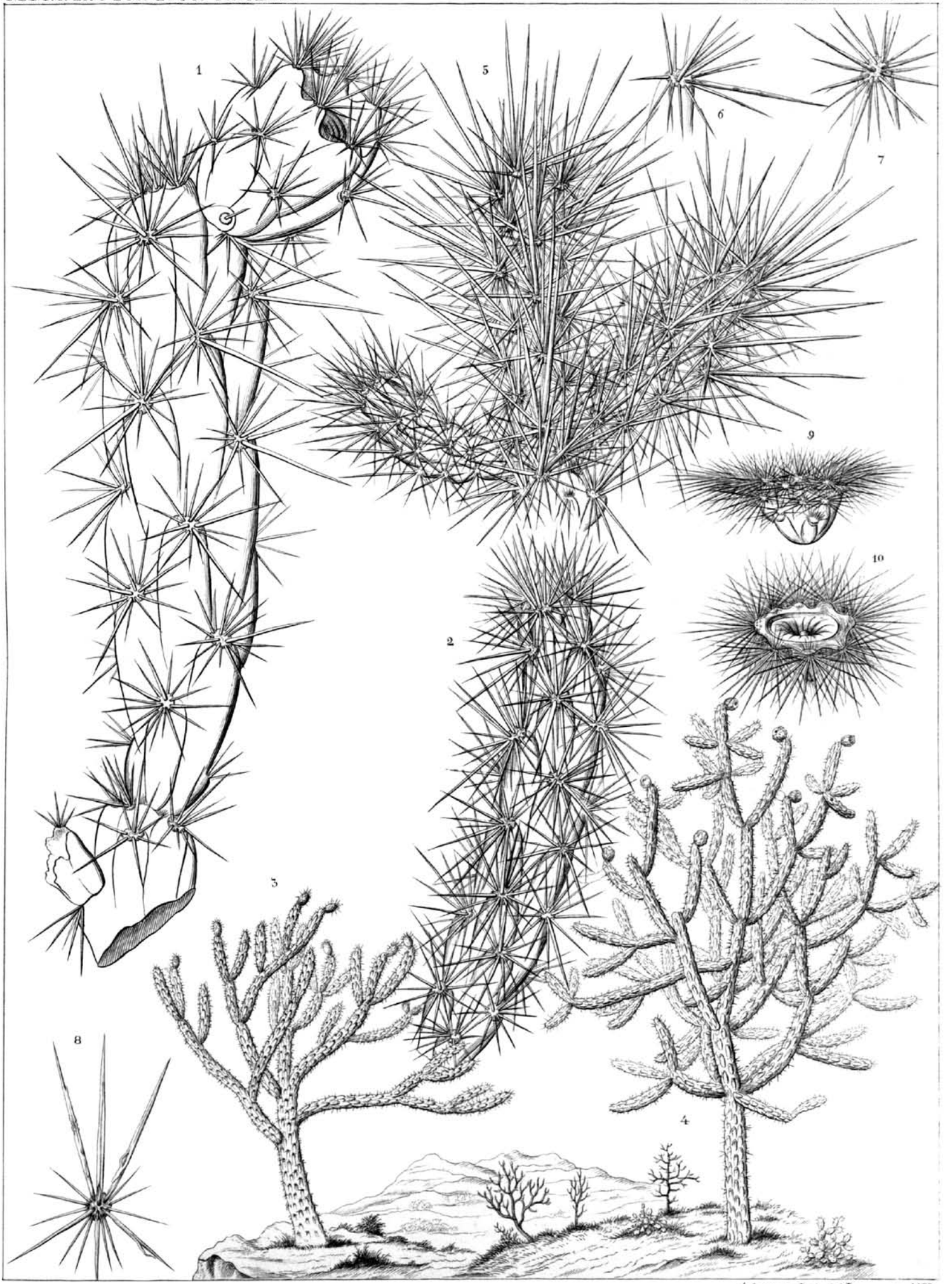
Ackerman, Lith. 379 Broadway NY.

OPUNTIA DAVISII E & B.



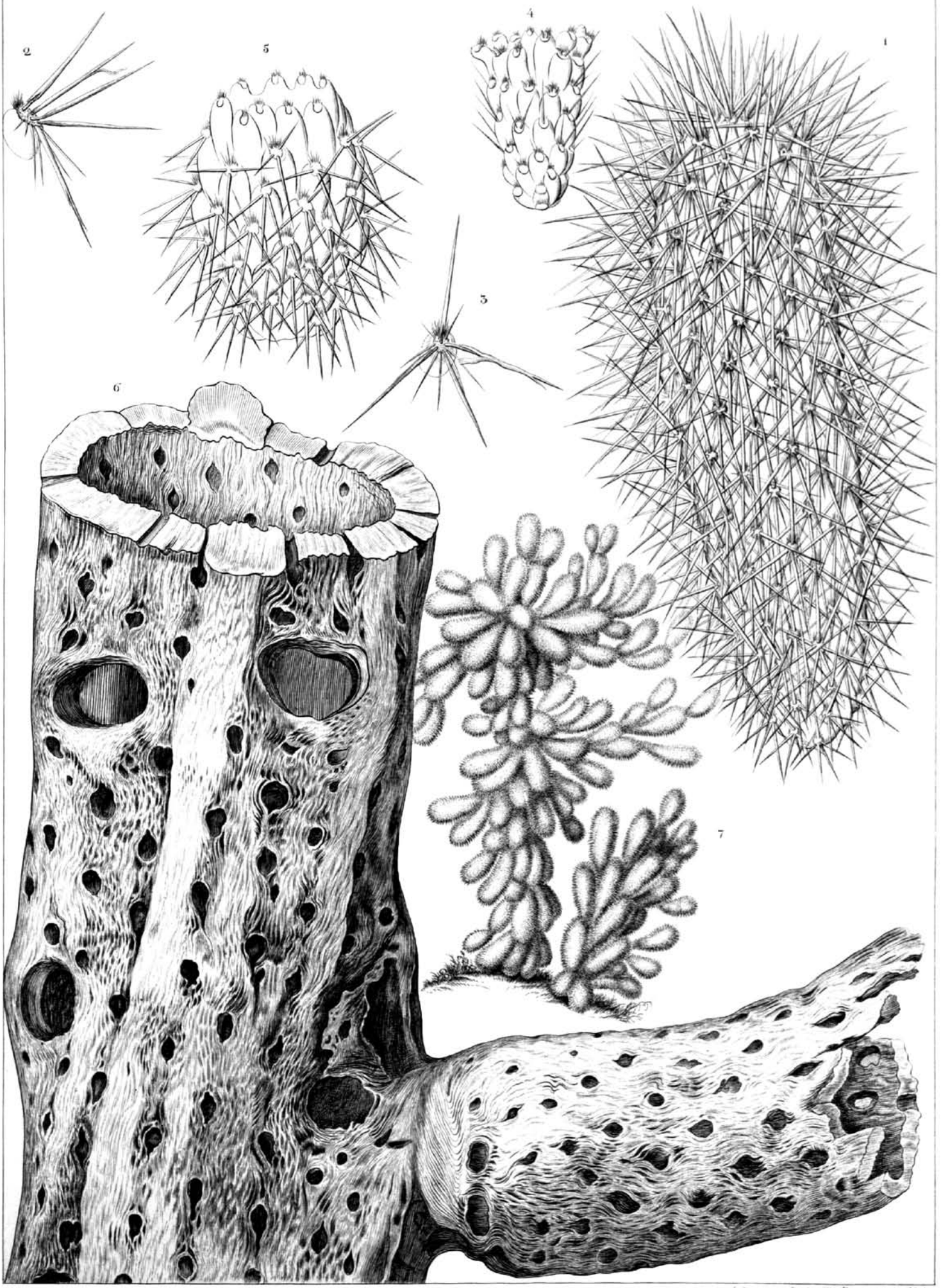
Ackerman Lith. 379 Broadway N.Y.

1-4 OPUNTIA WHIPPLEI, E&B 5-6 OP. ARBORESCENS, E.



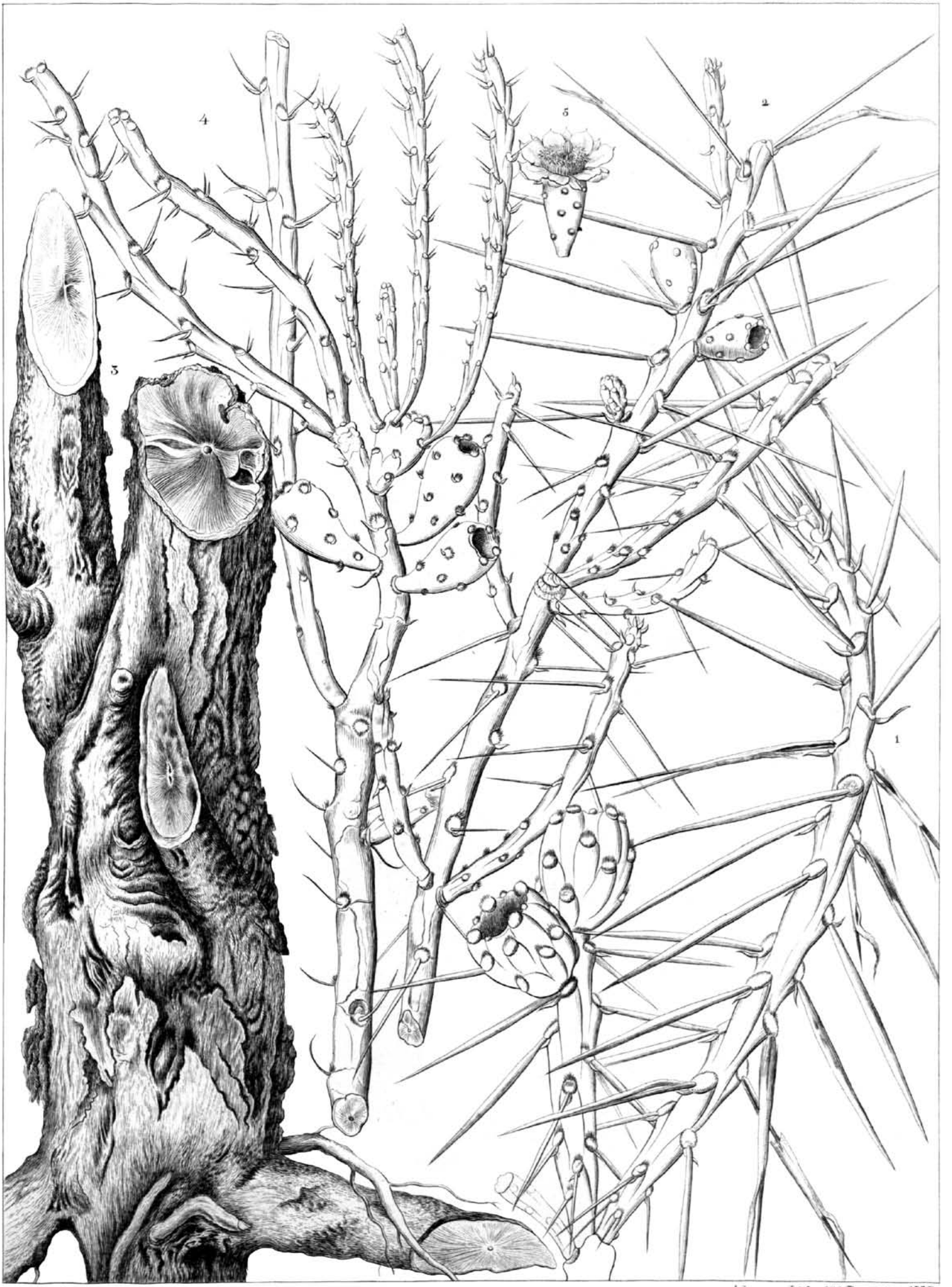
Ackerman Lith. 379 Broadway NY

1-3 OPUNTIA ACANTHOCARPA, E. & B. 4, OP. ARBORESCENS, E. 5-10 OP. ECHINOCARPA E. & B.



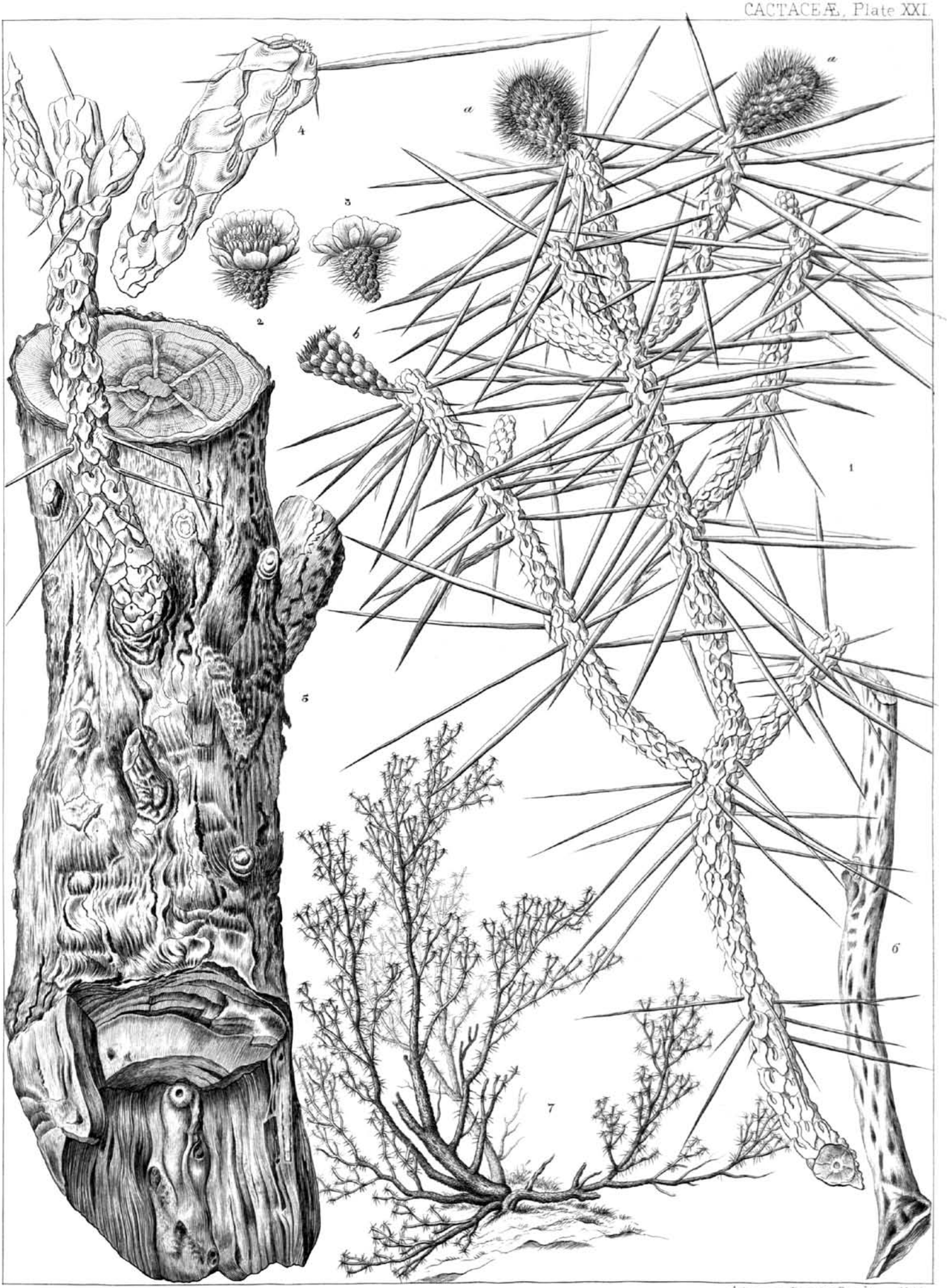
Ackerman Lith. 76 Broadway N.Y.

OPUNTIA BIGELOVII. E



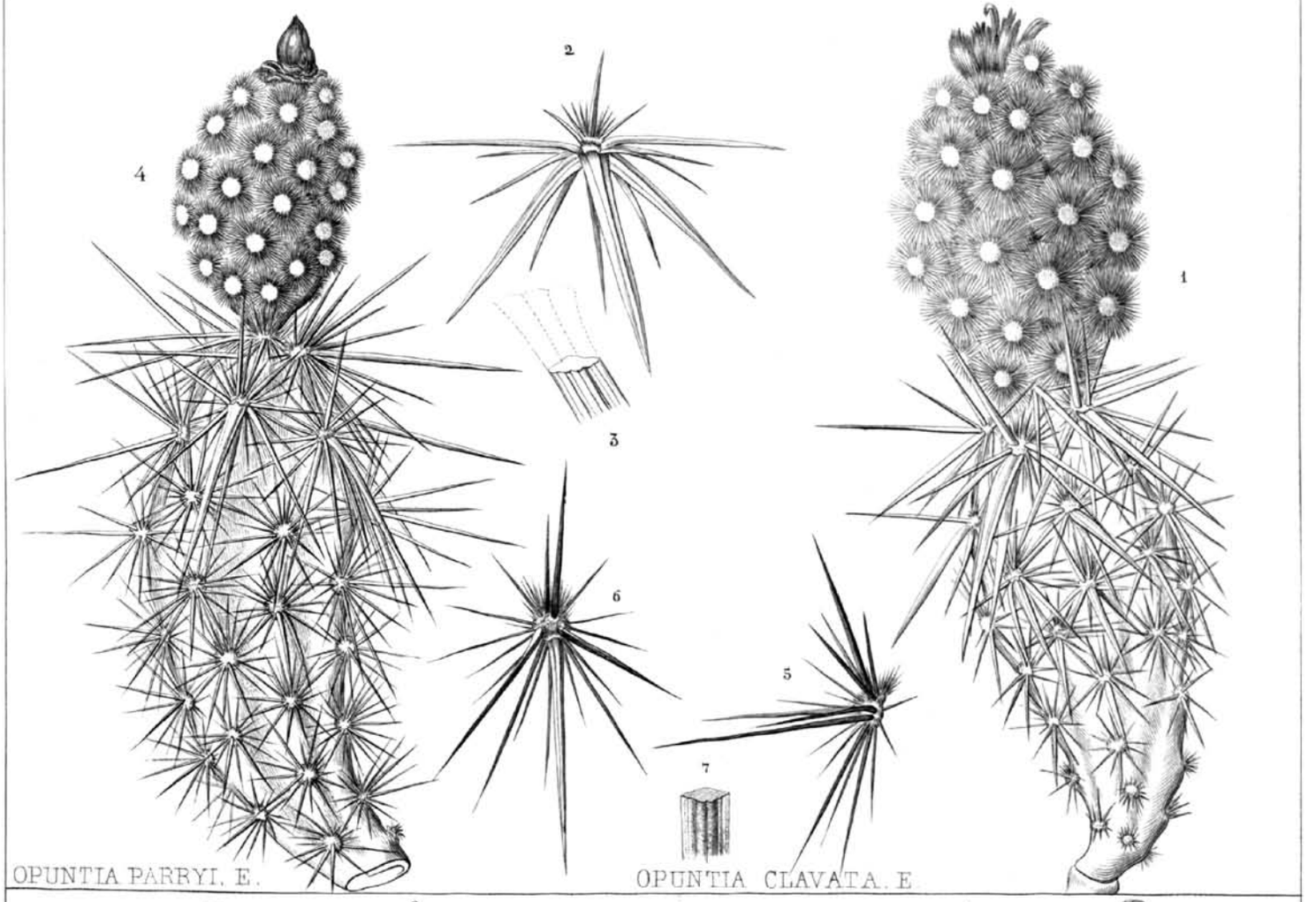
Ackerman Lith 379 Broadway N.Y.

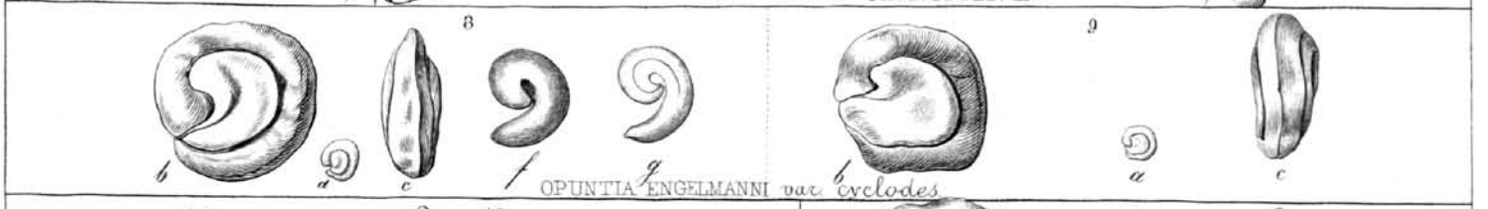
1. OPUNTIA VAGINATA, E. 2-5 OPUNTIA FRUTESCENS, E.
2-3 *var.* LONGISPINA. 4-5 *var.* BREVISPINA.

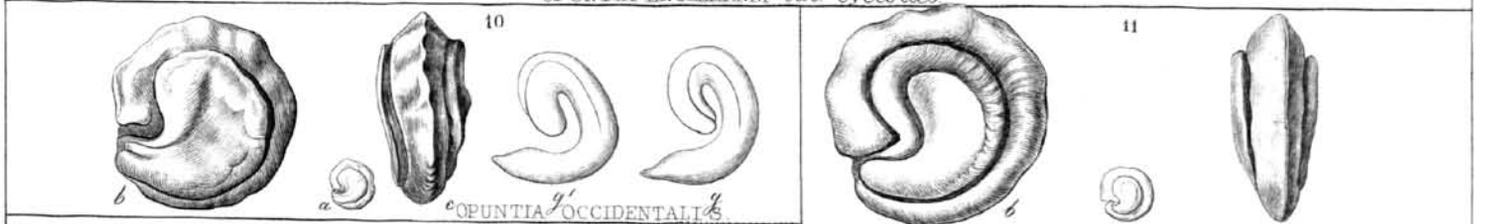


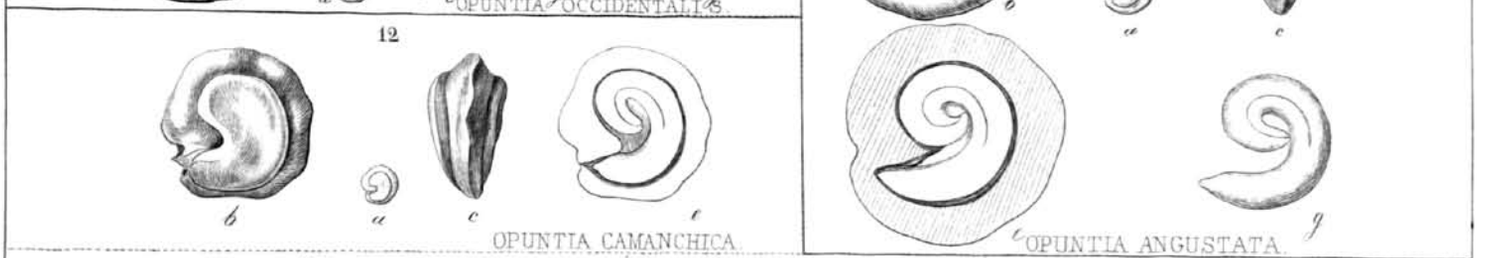
Ackermann Lith. 379 Broadway N.Y.

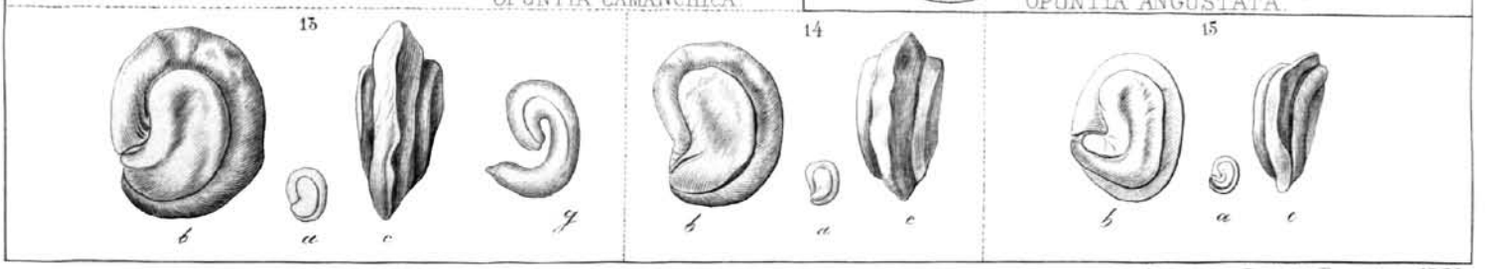
OPUNTIA TESSELLATA, E.



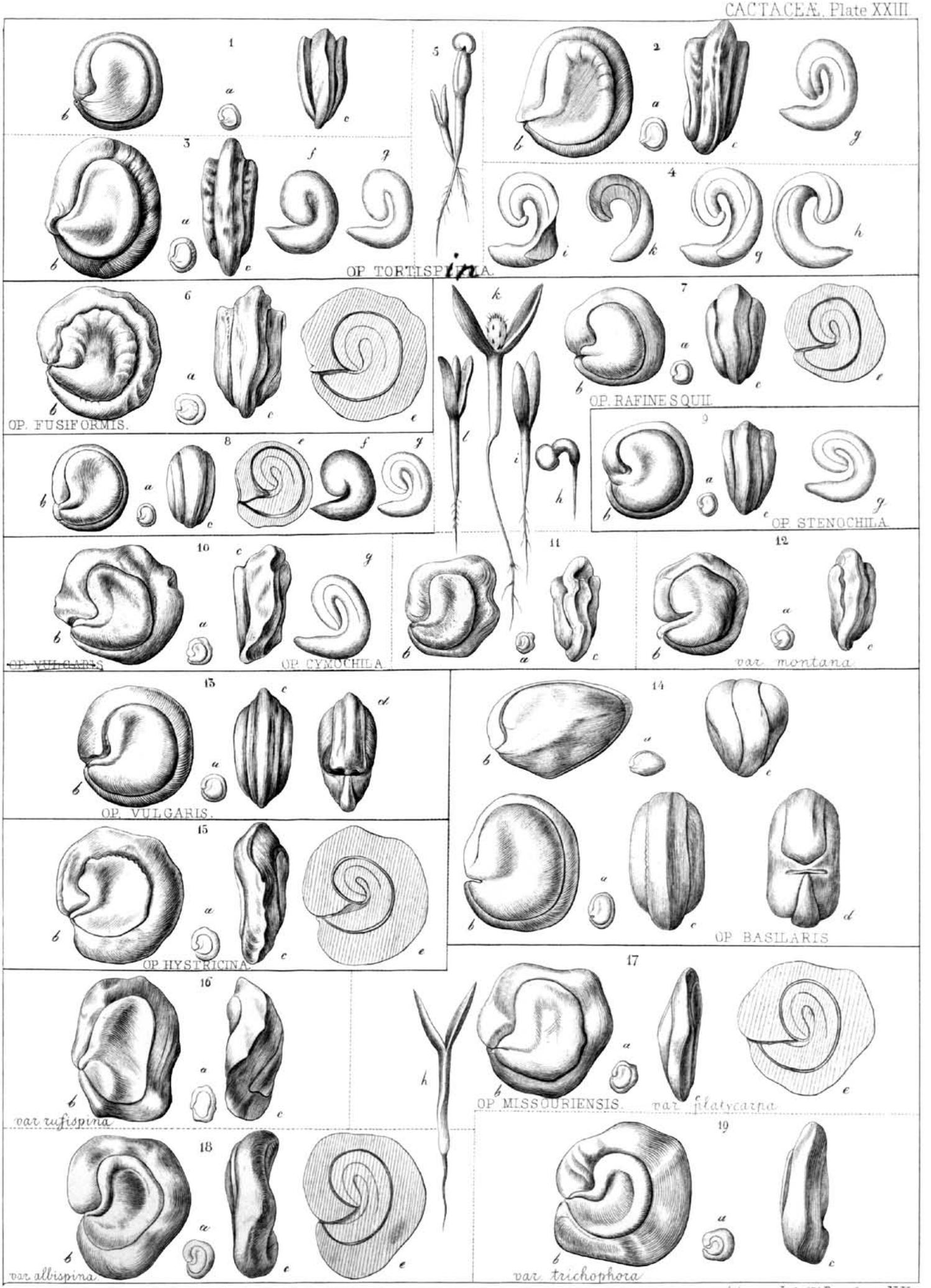




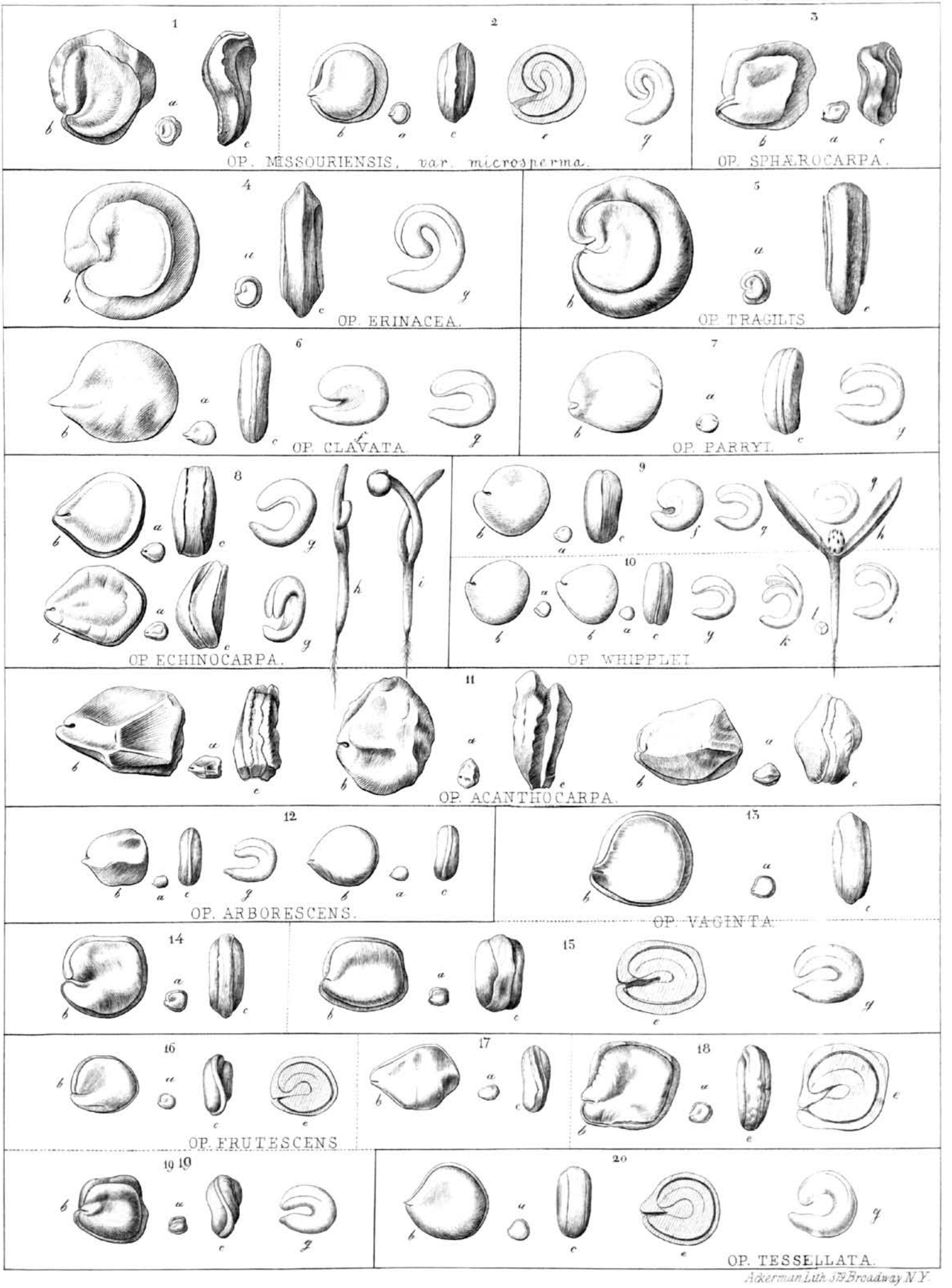




Ackerman Lith. 379 Broadway N.Y.



Ackerman Lith. 379 Broadway N.Y.



Ackerman Luth. 379 Broadway N.Y.