

NOTES OF A MILITARY RECONNOISSANCE,

F R O M

FORT LEAVENWORTH, IN MISSOURI,

T O

SAN DIEGO, IN CALIFORNIA,

INCLUDING PART OF THE

ARKANSAS, DEL NORTE, AND GILA RIVERS.

~~~~~  
BY LIEUT. COL. W. H. EMORY.

MADE IN 1846-7, WITH THE ADVANCED GUARD OF THE "ARMY OF THE WEST."  
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DECEMBER 16, 1847.

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1848.

ST. LOUIS, February 13, 1848.

MY DEAR SIR: Your letter, together with the package containing the drawings of a number of most interesting cactaceæ, arrived safely here about two weeks ago.

On the occasion of my report on the botany of Dr. Wislizenus's voyage, I have made a careful investigation of the cactaceæ, of which he brought home with him more than 20 species, and have been enabled to elucidate several points which had been unknown, or obscure before; no doubt because in the hot-houses of European gardens these curious plants, though they thrive pretty well, rarely produce flowers and fruit; so that from 800 species of cactaceæ at present cultivated in Europe, perhaps not one-fourth is known as to its flower, and a much smaller proportion in fruit.

I am now able to distinguish all the different genera of cactaceæ by their seed, and sometimes even the different sections of one genus.

The small black shining seed sent me, belongs to a true *Cereus*, probably the plant which you mention under the name of pitahaya, the larger opaque black seed is that of an *Echinocactus*, and the largest white seed is the seed of an *Opuntia* of the section *cylindraceæ*.

I have ventured to describe some of your species from the drawing; my description, however, and the names given by me, must remain doubtful till we are able to obtain some more data to characterize the species. I have written it more for your information than for publication, but if you choose to append it to your published report, I have no objection to it, but must request you to make such corrections or alterations as your notes or your recollection of the plants will enable you to do; for example, as to size, as in some of the drawings no size is mentioned,* in which case I have assumed them to represent the natural size. I have, for convenience sake, numbered the different figures, and shall now proceed to copy for you the descriptions and remarks following my numbers.

1. *Mammillaria*, October 18, 1846.

Proliferous in the highest degree, forming hemispherical masses often of a diameter $3\frac{1}{2}$ feet; which are composed of 100—200 different heads or stems. Single heads conical, apparently about 4 or 5 inches high, and $2\frac{1}{2}$ —3 inches in diameter; color, bluish green; spines white or reddish.

This species appears to be allied to *M. vivipara*, but is distinguished by the conical heads, and the hemispherical tufts, while *M. vivipara* has hemispherical or even depressed heads, and forms flat and spreading masses.

It may be an undescribed species, in which case the name of *M. aggregata* appears to be most appropriate.

2. *Mammillaria*, October 26, 1846. Rare.

Apparently a *Mammillaria*, though the habit of the plant is more that of an *Echinocereus*, but all *Echinocerei* have the bunches of

* Where the size is not mentioned; the original drawings are the size of nature. W. H. E.

spines disposed in vertical ridges, which is not the case in the figure in question. Stems irregularly cylindrical, with divers contractions and swelling, about 4—6 inches high, and $1\frac{1}{4}$ and $1\frac{3}{4}$ inches in diameter, many (in the fig. 8) from one base.

The name of *M. fasciculata* would indicate the peculiarity of this species.

3. *Mammillaria*, "November 4, 1846, abundant."

Several (fig. 3) oval stems from one base, $1\frac{1}{2}$ — $2\frac{1}{2}$ inches high, and $1\frac{1}{4}$ inch in diameter; tubercles in about 13 rows; spines whitish, short; 1 small obovate red berry toward the apex not more than $1\frac{1}{2}$ line long.

If the figure is correct, this species ought to be distinguished by the name of *M. microcarpa*, as I know of no other *Mammillaria* with such a small fruit.

4. *Echinocactus Wislizeni*. (Engelm. in Wislizenus's report.) "October 26, 1846." In addition to the description in Dr. W.'s Report, which I have drawn up from dried specimens, I observe in this figure that the species has 21 oblique ribs, is of an oval shape, and bluish green color; the ribs are acute, but not compressed, according to the representation of a section, and the groves corresponding.

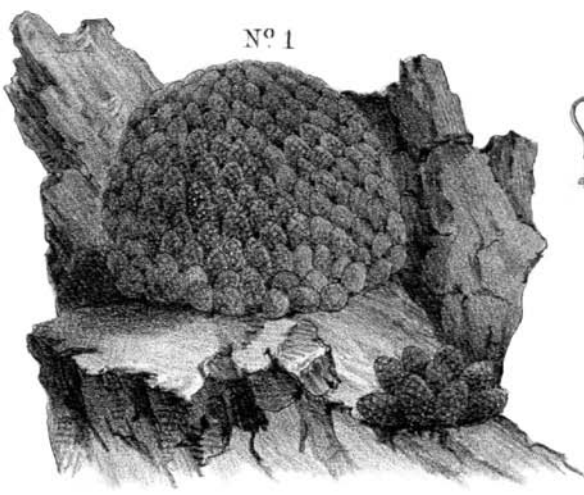
5. *Echinocactus*, "October 25, 1846, 18 inches in diameter." Height equal to the diameter; shape ventricose, contracted towards the vertex, therefore somewhat urceolate; with 21 straight sharp ribs; spines apparently 8, straight, brown, color of plant bright green; vertex whitish, (tomentose?) fruit 1 or $1\frac{1}{2}$ inches long, oval, yellowish or reddish. Seed obovate, obliquely truncated at base, full 1 line long, black, opaque, slightly roughened; embryo curved or hooked, cotyledons accumbent, partly buried in the large farinaceous albumen.

This species is distinct from all other New Mexican species examined by me, and is most probably undescribed. I propose to name it after its zealous discoverer, who has, surmounting numberless difficulties, though occupied by severe and arduous duties, found leisure to do so much for the advancement of our knowledge of the wild countries traversed by him, *Echinocactus Emoryi*.

6. *Cereus*, "November 21, 1846, 3 feet high."

There can be but little doubt but that we have here a species before us, which I have received from Dr. Wislizenus and from Dr. Gregg, from the neighborhood of Chihuahua, and which I have described in Dr. W.'s report by the name of *C. Greggii*, erect, branching, with 5 compressed ribs, dark green, with whitish areolæ, and about 8 short dusky spines.

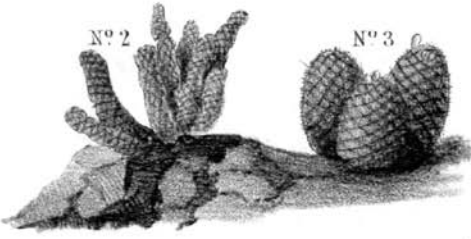
The specimen figured here is very remarkable on account of the fruit, which was unknown to me. Provided the drawing is correct, we have here a smooth oval acuminate fruit, crowned with the remains of the corolla, and supported by a distinct stipe of a bright crimson color. A stipe, as well as such an acumination, I have not see in any other fruit of a cactus. Fruit, with the long acumination, $2\frac{1}{2}$ inches long, $\frac{3}{4}$ to 1 inch in diameter, stipe about $\frac{1}{2}$ inch long.



N° 1



N° 6.

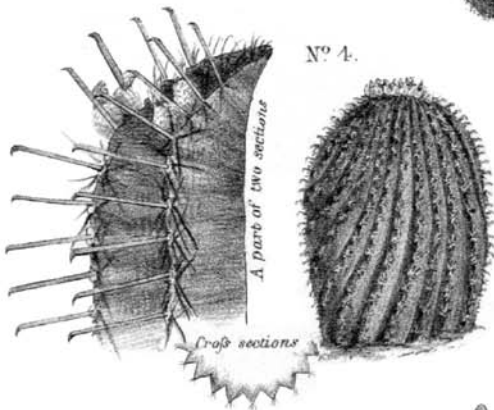


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N° 3



N° 7

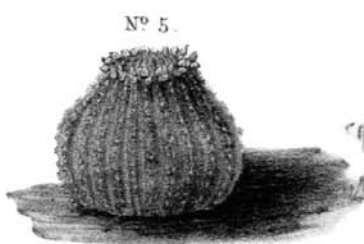


N° 4.

Cross sections



N° 8.



N° 5.

7. *Opuntia*. "Very abundant on the Del Norte and Gila." No date nor statement whether the figure represents the natural size or is smaller.

The species belongs to the section *ellipticæ*, of Salm; it is ascending, older stems prostrate, branches and younger joints erect, 8—10 inches high; joints orbicular obovate, rounded, obtuse or sometimes acutish, of a bluish green color, $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, and little less wide; spines short and whitish; berries obovate, scarlet, only about 3 or 4 inches long. If the figure represents the natural size, this species ought to bear the name *O. microcarpa*.

8. *Opuntia*. "October 28, 1846, common on the Gila" Much branched, sub-erect, joints obovate, often acutish, purplish, with two or three longer brown spines directed downwards; fruits obovate, red. In the figure, the joints are $1\frac{1}{2}$ —2 inches long, and $1\frac{1}{4}$ wide; fruit about 3 lines long.

There are several opuntiaë known with purple colored joints, but none in the least resembling this, and I must consider it as a distinct species to which I would give the name of *O. violacea*.

9. *Opuntia*? "October 22d, 1846. Abundant on the Del Norte and Gila." A remarkable plant apparently more like a *Mammillaria* than like an *Opuntia*. The fruit is also represented without areolæ or tubercles, exactly like the smooth fruit of a *Mammillaria*; but this may be an oversight in the artist. The habit of the plant suggests the belief that it is an opuntia of the section *cylindraceæ*.

Joints or branches ascending, cylindrical, tuberculated, 4—6 inches long; $1\frac{1}{4}$ inches in diameter; tubercles very prominent, with about 8 long ($1\frac{1}{2}$ inches) straight spines; fruit obovate, umbilicate, scarlet, towards the top of the branches, about 9 lines long, and 6 in diameter.

It is a distinct species, which I am gratified to dedicate to the skilful artist who has drawn all these figures, Mr. J. M. Stanly; I therefore propose for it the name *Opuntia Stanlyi*.

10. *Opuntia*. "November 3d, 1846, 4 feet high." Stem erect, with verticillate horizontal, or somewhat pendulous branches; branches cylindrical, strongly tuberculated, about 8 lines in diameter, with short spines on the tubercles; fruit pale yellow, clavate, tuberculate, umbilicate, 1 to $1\frac{1}{2}$ inches long, 6—8 lines in diameter.

This is probably the *Opuntia arborescens*, Engelm. in Wislitz's report, though the spines are represented as being shorter than in my specimens of *O. arborescens* from New Mexico and Chihuahua.

11. *Opuntia*. "November 2d, 1846. Somewhat resembling the last, but forming 'low, wide spreading bushes.'" Joints more slender, only about 4 or 5 lines in diameter, alternating (not opposite nor verticillate,) forming with the stem an acute angle, sub-erect, tubercles more prominent, areolæ whitish at their lower edge, with 3 dusky deflexed spines; fruit clavate, tuberculate, pale yellow, 1 inch long, 4 lines in diameter.

I believe this to be an undescribed species, and would propose the name for it of *O. Californica*.

12. *Opuntia*. "October 10, 1846, abundant," 3 feet high, with spreading branches; the same in circumference.

I can see no difference between this figure and a plant which I have received from El Paso, by Dr. Wislizenus, and which I have described in his report under the name of *O. vaginata*.

Nos. 13—15 are no Cacti. In 13, I recognize the *Kæberlinia zucarini*, a shrub common in the chaparals of northern Mexico, which has been collected in flower about Parras and Saltillo, by Drs. Wislizenus and Gregg. The fruit is unknown so far; the specimen figured is, however, in fruit; the berry (?) is globose, $\frac{3}{4}$ —1 line in diameter, crowned with the rudiment of the style. It was collected October 23d, 1846, and is described as a shrub 3 feet high, with low, spreading boughs.

14. Collected "November 15, 1846, 4 feet high, rare," is, perhaps, another species of the same genus; but the entire absence of flower or fruit makes it impossible to decide.

Branches similar, straight, leafless, ending in robust dark spines; but much elongated and sub-erect, not horizontal, as in No. 13.

15. "October 22d, very abundant, 3 feet high, fruit 5 inches long." It is entirely unknown to me, perhaps an agave? at least some amaryllidaceous plant, if the fruit is correctly represented, with large radical leaves, and a ribbed or angular inferior fruit, crowned with the remains of the flower.

In your letter you figure and describe a cactus plant, of which you have before sent me the seeds; if I am correct about this from your notes, I would describe it in the following manner:

Stem tall, erect, simple, or with a few erect branches, below without spines; ribs about 20, oblique or spiral; fruit large, edible; seeds small (0.7 lines long,) obovate, obliquely truncate at base, black, smooth, shining, embryo hooked, no albumen; cotyledons foliaceous incumbent.

Stems 2—5 feet in circumference, 25 to 60 feet high.

The only true *Cereus* approaching this in size is *Cereus Peruvianus*; but this is vastly different. The question then arises whether our species is not one of the few arranged now under the genus *Pilocereus*; but if it is a constant fact that the cotyledons of *Pilocereus* are thick and globose, our species cannot belong here; the cotyledons are absolutely those of a true *Cereus*. It is called in California *pitahaya*, but it appears that the Mexicans call by that name all large columnar cacti, the fruit of which is edible. The plant, which is commonly called *Cereus variabilis*, is widely different from this California giant.

I propose for it the name *Cereus giganteus*.

The large white seed is that of an *Opuntia* of the section *cylindracee*, embryo circular, curved around a pretty large albumen, but not spiral.

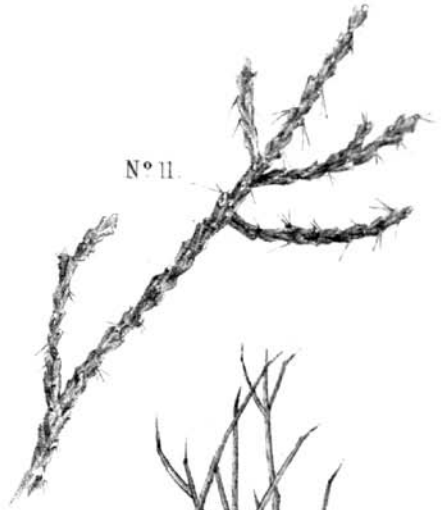
Very truly, yours,

G. ENGELMANN.

N° 12.



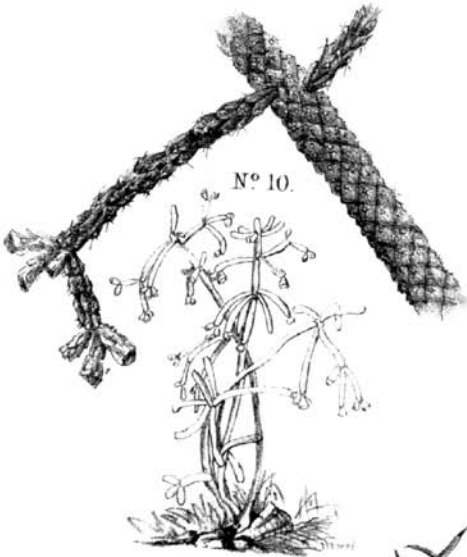
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N° 10.



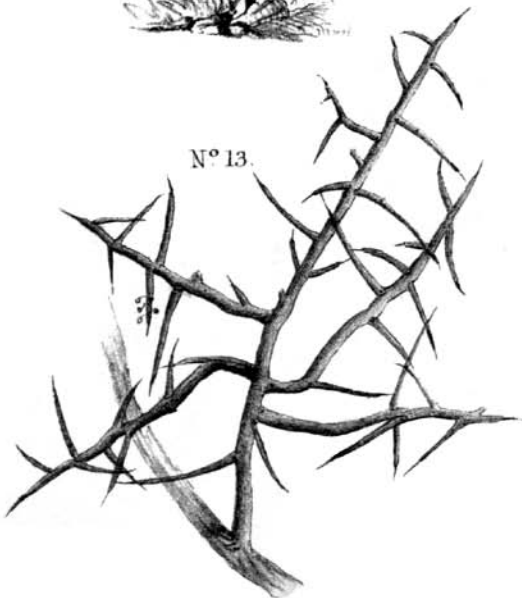
N° 14.



N° 9.



N° 13.



MEMOIRS

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VOL. IV. — PART I.

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1849.

C A C T A C E Æ. (By *Dr. Engelmann.*)

244. MAMMILLARIA VIVIPARA, Nutt. sub Cacto. Common from Bent's Fort to Santa Fé, on rocky hills and elevated plains; flowering in July. — "Heads mostly single, often in pairs, rarely cæspitose from the ramifications of the subterraneous stem"; not proliferous, as some specimens from the Upper Missouri are. — There can be little doubt that this is the true *Cactus viviparus* of Nuttall, although the flowers do not appear to be entirely central. I have living specimens from Santa Fé, and from the Upper Missouri, and shall be able to decide their identity after having seen them flowering. — I possess, also, a living specimen of Nuttall's *Cactus mammillaris* (*Gen. p.* 295), and have observed its flower and fruit. It is, as has been long suspected, entirely different from the West Indian *Mammillaria simplex*, DC., and is nearly related to *M. similis*, *Engelm. in Pl. Lindh.* I have named it after its discoverer.*

245. *M. POPYRACANTHA* (sp. nov.): ovata, prolifera, aculeis omnibus planis chartaceis flexilibus albis, radialibus brevibus 8 centralibus 3 – 4 multo longioribus, 2 – 3 superioribus sursum curvatis, singulo inferiore longiore latiore deorsum flexo; floribus centralibus (albidis); sepalis 12 – 16 ovatis acutis integris; petalis sub-13 lanceolatis acumina-tis integris; stigmatibus 5 suberectis exsertis albidis. — In a valley between the lower hills, near Santa Fé, in loose, red sandy, though fertile soil: found only once; flowering in May. — About 2 inches high, and $1\frac{1}{2}$ inch in diameter; the tubercles in about 8 spiral rows; lower ones proliferous; their shape not well distinguishable in the half-rotten specimen before me. Spines silky-white, shining, of the consistency of stiff paper. None of the 8 radiating spines ($1\frac{1}{2}$ or 2 lines long) are directed upwards, but all laterally or

* *M. NUTTALLII* (sp. nov.): simplex (an semper?), globosa, axillis tuberculorum ovato-cylindricorum supra leviter sulcatorum subtomentosis; areolis junioribus albo-tomentosis; aculeis rectis albidis, radialibus 13 – 16 subinæqualibus setaceis, centrali porrecto robustiore; floribus ex axillis tuberculorum hornotinum centralibus (ex rubello flavicantibus); sepalis petalisque oblongo-lanceolatis; sepalis 10 – 13, brevioribus exterioribus ciliato-fimbriatis obtusiusculis, interioribus apice laceris acutis; petalis 20 – 23 integris breviter abrupte mucronatis; stylo supra stamina (rubella) paulo exserto, stigmatibus circa 5 brevissimis erectis adpressis viridibus; baccis lateralibus subglobosis coccineis. *Cactus mammillaris*, Nutt., non Linn. — On high, dry prairies, about Fort Pierre, on the Upper Missouri; flowering in May. — My specimen is an inch and a half high, and of the same diameter; the tubercles 6 or 7 lines long, in 8 spiral rows, slightly sulcate. Radial spines 4 or 5; the central one 5 to 6 lines long; the young spines at the apex slightly brownish. Flowers an inch long, and, when fully expanded, of the same diameter. Petals about 2 lines wide, acute, abruptly mucronate. Stigmas only from one half to three fourths of a line long, erect. The fruit ripens the following spring, and, as well as the seed, is very similar to that of *M. similis*, but only half as large, although the pits of the globose black seed are of the same size.

downwards; the 2 or 3 central curved spines are directed upwards, and 6 to 8 or 9 lines long, the middle one shorter or wanting. The lower central spine is the longest (10 to 14 lines) and broadest, being from 1 to $1\frac{1}{4}$ line wide. Flowers pearly white, 12 to 13 lines long, 12 to 15 lines in diameter. Lower sepals membranaceous; the upper herbaceous in the middle. Petals about two lines wide.

246. *CEREUS VIRIDIFLORUS*, *Engelm. in Wislitz. Rep. not.* 8, sub *Echinocereo*. Eastern mountains of Santa Fe, on sunny, rocky declivities; flowering in May and June. — I have seen specimens brought from other parts of New Mexico, of much larger size than those of Fendler or Wislizenus, some of them $1\frac{1}{2}$ inch in diameter and 3 to 4 inches high, some with stout central spines, others entirely destitute of them.*

* After a careful revision of the characters which distinguish my genus *Echinocereus* (*Wisl. Rep. note 7*) from *Cereus* proper, I think it most natural to unite the two. *Echinocereus* will then constitute the first section of *Cereus*, and comprise those of low stature and mostly of cæspitose growth, having diurnal flowers with short tubes (and almost straight embryos with very small cotyledons). It appears to comprise Prince Salm Dyck's (*ined.*) first two sections, viz.: 1. *Lophogoni*, and 2. *Sulcati*; but perhaps not all of the latter. Those known to me as belonging to New Mexico, Chihuahua, and Texas, may be divided into two sections, viz.: —

§ 1. *COSTATI*: caule 4 – 10-costato; aculeis radialibus pl. m. porrectis non pectinatis; areolis orbiculatis.

A. *Tuberculis subdistinctis*.

1. *C. PROCUMBENS* (sp. nov. *ined.*): tuberculis 4 – 5-serialibus; aculeis brevibus tenuibus, 5 – 6 radialibus, 1 centrali. — Matamoras.

B. *Tuberculis in costas confluentibus*.

* *Aculeis plus minusve teretibus*.

2. *C. COCCINEUS*, *Engelm. in Wisl. Rep. not.* 9. Costis 9 – 11; aculeis radialibus 9 – 10, centrali 1 recto.
3. *C. POLYACANTHUS*, *Engelm. l. c. not.* 28. Costis 10; aculeis radialibus 10 – 12, centr. 4 rectis.
4. *C. REMERI* (sp. nov. *ined.*): Costis 7 – 9; aculeis radialibus 8, centrali 1 recto. — Western Texas.
5. *C. FENDLERI* (sp. nov. *supra*): Costis 9 – 10, aculeis radialibus 7, centrali 1 curvato.

* * *Aculeis compressis, angulatis*.

6. *C. ENNEACANTHUS*, *Engelm. l. c. not.* 46. Costis 10; aculeis radialibus 8, centrali 1 recto.
 7. *C. TRIGLOCHIDIATUS*, *Engelm. l. c. not.* 9. Costis 6 – 7; aculeis 3 – 6 subcurvatis.
- § 2. *SULCATI*: caule sinibus 10 – 24 parum incisus sulcato; areolis pl. m. elongatis; acul. rad. pectinato-connatis.
8. *C. DASYACANTHUS*, *Engelm. l. c. not.* 19. Septdec. — octodecim-sulcatus; aculeis radialibus subporrectis, centralibus radiales subæquantibus, pluribus flexis.
 9. *C. RUFISPINUS*, *Engelm. l. c. not.* 31. Undecim-sulcatus; aculeis rad. adpressis variegatis elongatis, centrali 1 robusto.
 10. *C. ADUSTUS*, *Engelm. l. c. not.* 29. Tredecim – 15-sulcatus; aculeis rad. pectinatis albidis adustis, centrali nullo seu 1 robusto. The last form is β . *RADIANS* (*Echinocereus radians*, *Engelm. l. c. not.* 30).
 11. *C. VIRIDIFLORUS*, *Engelm. l. c. not.* 8. Tredecim-sulcatus; aculeis rad. pectinatis variegatis, centrali nullo seu 1 robusto.
 12. *C. PECTINATUS*, *Scheidw.* sub *Echinocacto*; *Engelm. l. c. not.* 45, sub *Echinocereo*: Octodecim – 23-sulcatus; aculeis radialibus pectinatis, centralibus 2 – 5 brevissimis.
 13. *C. CÆSPITOSUS*, *Engelm. in Pl. Lindh.* Tredecim – 18-sulcatus; aculeis rad. pectinatis, centrali nullo.

247. *C. COCCINEUS*, *Engelm. l. c.*, sub Echinocereo. Higher mountains about Santa Fé; often in large clusters of 8 or 15 heads; flowering in May. — The areolæ are hardly oval, but almost orbicular, and are distinguished from those of most related species by their large size. — Among a number of plants of this family which Mr. Fendler sent from Santa Fé in a living state, but which unfortunately were all dead when they came to hand, are some specimens which appear to be varieties of this species, viz.: —

β. MELANACANTHUS: aculeis radialibus 10 – 12 cinereis, centrali longissimo atrofusco porrecto recto seu leviter deorsum curvato.—*γ. CYLINDRICUS*: subsimplex, cylindricus; aculeis 8 radialibus, singulo robustiori porrecto.

248. *C. TRIGLOCHIDIATUS*, *Engelm. l. c.*, sub Echinocereo. Higher mountains about Santa Fé; also in gravelly soil on the lower hills; flowering in May and June. — To the description given in Wislizenus's Report I will add here, that the spines are often somewhat curved; the ridges are sharp, but the grooves between them very wide and shallow; the areolæ widely distant from one another (often over an inch and a quarter), and the expression "*areolis sparsis*," in the character, ought to be changed to *areolis distantibus*.

249. *C. FENDLERI* (sp. nov.): globoso-ovatus, simplex vel e basi proliferus, cæspitosus; costis 9 – 10 obliquis tuberculatis interruptis; areolis orbiculatis approximatis; aculeis basi bulbosis robustis, radialibus sub-7 compressis subincurvis fuscis demum cinereis (tribus inferioribus longioribus, superioribus brevioribus, summo nullo); aculeo centrali robustiore longiore teretiusculo sursum curvato atro-fusco; floribus campanulatis; tubo pulvillis sub-30 albo-tomentosis stipato, inferioribus aculeos setaceos albos apice adustos 8 – 12 radiales et singulum centralem, superioribus aculeos sub-3 robustiores longiores curvatos albos gerentibus; sepalis interioribus 12 – 15 lineari-lanceolatis acutis; petalis oblongo-linearibus, acutis vel obtusis 16 – 24; stigmatibus 12 – 14 viridibus stamina numerosissima vix superantibus. — *β. PAUPERCULUS*: aculeis robustis abbreviatis, radialibus 5 – 7, centrali subnullo. — Santa Fé, on elevated sandy plains; flowering in June. — The specimens before me are $2\frac{1}{2}$ inches high, and at the base of the same diameter: the areolæ from 4 to 6 lines distant; the lower radial spines 7 to 10, the upper from 3 or 4 to 6 lines long; central spine somewhat erect, curved upwards, 10 to 15 lines long. In var. *β.* the spines are all from 3 to 6 lines long. The upper spine is wanting in all my specimens, and the opposite lowest one is longer than any except the central spine. Flowers from $2\frac{1}{2}$ to $3\frac{1}{4}$ inches long and wide, violet-purple. The spines on the lower part of the tube are from $2\frac{1}{2}$ to 3, and on the upper from 3 to 5 lines long. Petals variable in shape.

250. *OPUNTIA PHÆACANTHA* (sp. nov.): diffusa; articulis obovatis seu orbiculato-

obovatis compressis; areolis orbiculatis fusco-setosis margine inferiore aculeos robustos 1 – 5 rectos compressos inæquales fuscus apice pallidiores plerumque deflexos gerentibus rariusve nudis; ovario obconico areolis sub-30 tomento pallide fusco instructis, superioribus albo-setosis; sepalis interioribus sub-20 late obovatis retusis seu emarginatis; petalis 10 – 13 obovatis retusis seu emarginatis; stigmatibus 5 – 7 subrectis stamina vix superantibus; bacca obovato-pyriformi nuda. — On rocky hills about Santa Fé, and on the Rio Grande, very common; flowering in May and June. This appears to be the most northern form of the *Opuntia* with yellow or brown and flattened spines, which belong to the section of *O. Tuna*. Another species, with larger joints and larger fruit, occurs in Texas. — Some specimens before me are prostrate, with ascending branches; the joints 5 or 5½ inches long, and 3½ or 4 wide; areolæ an inch distant from each other, most of them bearing stout spines; the lower sometimes only one, the upper from two to five, but mostly three or four: one or two are directed upwards, the other and stouter ones more or less downward. Larger spines 1½ to 2 inches long, dark brown with lighter tips; the smaller from half an inch to one inch long, whitish. — Another specimen has larger, more orbiculate joints, from six to eight inches long, and five or six wide; the spines fewer, all directed downwards, or on many areolæ none at all. The flowers which have been distributed under this number are two or two and a half inches in diameter: ovary about one inch long: sepals yellow with red: petals yellow: stamens red or yellow: stigmas apparently green. The fruit which Mr. Fendler says belongs to this species is about half an inch long, red, smooth, apparently juicy when fresh; the seeds often three lines in diameter, margined like those of *O. vulgaris*. — Several other *Opuntia* with compressed joints, some of them with fleshy, others with dry and spiny fruit, some of them very spiny, and others almost destitute of spines, have been collected by Mr. Fendler about Santa Fé; but for want of more complete materials, a description is not here attempted.

251. *O. CLAVATA*, *Engelm. in Wislitz. Rep. not.* 12. Plains around Santa Fé; never found on the mountains; flowering in June. — I add to the description already published, that the areolæ are very large and closely approximate. From nine to eleven smaller and narrower spines are directed upwards or radiating; about six of them are turned downwards, and are larger and longer; the former are from two to four, or even six or eight, lines long; the latter are from six to fourteen lines long. The joints form a large and spreading, level-topped mass, which attains the diameter of several feet.

252. *O. ARBORESCENS*, *Engelm. l. c. not.* 5. Hills and elevated plains, from Bent's Fort on the Arkansas to Santa Fé; flowering in June.—About five feet high, sometimes

as much as five inches in diameter below; the older stems and branches terete; the younger joints strongly tuberculated. Spines often an inch long, generally from 15 to 25 in each fascicle.

GROSSULARIACEÆ.

253. *RIBES IRRIGUUM*, *Dougl. in Hort. Trans.* 7. p. 516. Margin of Santa Fé Creek; May. — The specimens are in flower only. The pedicels are short, as in *R. hirtellum*, *Michx.* (*Torr. & Gray, Fl.* 1. p. 546), which the plant much resembles; but the leaves are rounder and more downy, the campanulate calyx is yellowish-green, with no purple tinge, and the spines are triple. The stamens are somewhat longer than the petals, but shorter than the oblong calyx-lobes. These are not mentioned in the published character of *R. irriguum*, *Dougl.* But I am confident that this is the species in question, as I have the same from the valley of the Kooskooskee, where it appears to abound. According to Mr. Spalding, who sends it, it grows by the water-side, and yields “a most delicious gooseberry or currant, tasting like a plum.” The same is in Geyer’s collection, (No. 330), in flower, under the name of *R. triflorum*. The fruit scarcely exceeds a large currant in size, and is perfectly smooth. — From Mr. Spalding I also have characteristic specimens of *R. divaricatum*, *Dougl.*, which, he remarks, is often twelve feet high, and which is likewise said by Geyer to form “a robust shrub or small tree, 8 to 15 feet high, very thorny; stems 2 to 4 inches in diameter.”

254. *R. LEPTANTHUM* (sp. nov.): glabrum, esetosum; spinis subaxillaribus solitariis validis rarius geminis ternisve; foliis parvis (4–6 lin. latis) crebris 5-fidis, lobis incisis; pedunculis brevibus deflexis 1–2-floris; pedicellis subnullis; bracteis rotundatis ovario brevioribus; calyce tubuloso gracili extus piloso albido, lobis subspathulatis tubum æquantibus staminibus petalisque integerrimis subduplo longioribus; stylo glabro indiviso; stigmatibus binis; baccis inermibus glabris. — Rocky banks of the Rio del Norte, and ravines near Santa Fé; May. — Shrub 3 to 4 feet high. Flower nearly half an inch in length. — Very distinct from any species in the *Flora of North America*; apparently resembling the *R. microphyllum*, *H. B. K.*, of Mexico, which, however, is said to have very short peduncles, red flowers, a campanulate calyx, retuse petals, and a 2-cleft style.

255. *R. CEREUM*, *Dougl. l. c.; Torr. & Gray! Fl.* 1. p. 551. (*R. pumilum* & *R. reniforme*, *Nutt.! Mss.*) Shaded banks of Santa Fé Creek; May, in flower. Shrub 3 to 4 feet high.

†256. *R.* sp.; leaves only, of a glutinous species, perhaps merely a form of *R. cereum*. Rocky hill-sides, near Santa Fé, and on the Mora River.

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toothed, calyx-segments longer than the tube. Petals deep red in the dried specimens.

241. *G. PARVIFLORA*, *Dougl.* Sandy prairies, &c. July — August. Ovaries and fruit clothed with a close, soft pubescence.

242. *STENOSIPHON VIRGATUS*, *Spach.* High prairies on the Colorado, and on rocky soil.

243. *JUSSIEA OCCIDENTALIS*, *Nutt.* Along rivulets. July. Petals obovate.

244. *OPUNTIA FRAGILIS*, *Nutt.*, var. *FRUTESCENS*. (*O. frutescens*, *Engel. MSS.*) Near the *Musket-thickets*, (vide No. 233,) on the Colorado; often acquiring the height of four or five feet, with a branching ligneous stem, covered with light gray bark, and sometimes with lichens. It bears bunches of small capillary spines, with one larger one (4–5 lines long;) these disappear from the older stems. The wood is hard and close-grained. The younger branches are green and terete, (or angular when withered,) and bear the ultimate articulations, which are about an inch long, and very easily break off. These bear when young, like other *Opuntia*æ, short terete subulate leaves, with a single spine in their axils, and above this a bunch of small ones. The specimens are not in flower, but are covered with the obovate umbilicate scarlet fruits, which are about eight lines long, fleshy, but not juicy, and contain very few (2–5) white, compressed seeds. What is most remarkable, these fruits are often proliferous, and bear from one to four or five new branches from the upper bunches of spines. The fruit either falls off with these branches, or else dries up, persists and finally forms part of the stem.¹

¹ Though unable to institute a proper comparison, I have little doubt that this is *O. fragilis* of Nuttall, attaining a fuller growth in that warm region than on the Missouri. The following species, collected in the same localities by Lindheimer, though not in sufficient quantity for distribution, have been studied in a living and (most of them) in a flowering state, by Dr. Engelmann, whose account of them is here appended. Unfortunately, neither Dr. Engelmann nor myself have access to

245. *SEDUM SPARSIFLORUM*, *Nutt.* Naked places in the San Bernardo prairie, between the Brazos and the Colorado. April — May.

any adequate or authentic collection of Cacti, so as to institute the proper comparisons. A. Gr.

“Mr. Lindheimer has sent seven other Cacti, mostly in living specimens, namely:

1. *OPUNTIA*, *sp.* without fruit or flower, probably *O. vulgaris*. It attains the height of several feet, with large obovate joints, and a few spines.

2. *O. MISSOURIENSIS*? Perhaps *O. vulgaris*, but very spiny.

3. *MAMMILARIA SIMILIS* (*n. sp.*): *cæspitosa*; axillis tuberculorum juniorum paulo tomentosius demum glabris; tuberculis ovatis supra leviter sulcatis (sulco basin versus subtomentoso) apice spiniferis; spinis (circ. 12) æqualibus rectis radiantibus albidis, junioribus puberulis basi que tomento circumdatis; baccis sparsis globosis coccineis. — Sandstone rocks, near Industry. Evidently near *M. simplex*, at least to Nuttall's plant of that name, but *cæspitosa*, forming tufts often a foot in diameter. Flowers not seen. Berries scarlet, of the size of a large pea. Seeds numerous, subglobose, scrobiculate, black, with an elongated white hilum. I have living plants, but they have not yet flowered.

4. *M. SULCATA* (*n. sp.*): *cæspitosa*; tuberculis ovato-oblongis sulco subinde apicem versus prolifero superne exaratis apice spiniferis; spinis rectis radiantibus cinereis e tomento albido deciduo (in plantis adultis spina centralis subrecurva majore) ortis; floribus centralibus fasciculatis e tomento ortis glaberrimis, tubo brevi; sepalis lanceolatis acuminatis viridi-flavescentibus margine integerrimis; petalis longioribus lanceolatis apicem versus ciliato erosio cuspidatis sordide flavis ad basin intus filamentisque brevibus rubicundis; stylo supra stamina exserto; stigmatibus 7–10 flavis; baccis oblongis virescentibus. — With the preceding. Flowers opening for two or three days, in direct sunshine, two inches or more in diameter. On account of the central flowers, this should form, with *M. vivipara*, a distinct section. From that species it abundantly differs, not only in the color of the flower and the spines, but in the entire and smooth sepals, denticulate petals, &c. [This pretty species has also flowered in the Cambridge Botanic Garden.]

5. *ECHINOCACTUS SETISPINUS* (*n. sp.*): subgloboseus, apice retusus; costis plerumque 13 acutis subobliquis; aculeis 15–18 fasciculatis tenuibus flexuosis flavicanti-fuscis, superioribus 3–5 elongatis, 1–3 centralibus longissimis erectis, cæteris radiantibus; floribus minutis solitariis e macula subtomentosa supra fasciculos aculeorum ortis; sepalis in tubum concretis, apicibus liberis late ovatis acuminatis scariosis margine fimbriatis; fructibus; seminibus ovatis nigris opacis minutis tuberculatis. — Musket-thickets, on the Colorado River. Near E. tenuispinus, *Link & Otto*, from Brazil. Our specimens are about two inches in diameter, and an inch and a half high, with pretty sharp ribs separated by deep grooves. The longest spines are fifteen lines long. Flowers about five lines long.

6. *E. LINDHEIMERI* (*n. sp.*): hemispherico-depressus, vertice tomentoso; costis 21 verticalibus acutis subundulatis; spinis e cicatrice ovato-lanceolata tomentosa ortis fasciculatis compressis cinereo-rubellis transversim annulato-striatis, exterioribus 6–7 inæqualibus radiantibus subrectis centrali recurvata multo brevioribus; floribus e vertice depresso tomentoso ex axillis fasciculorum spinarum honorotiorum provenientibus confertissimis; sepalis (80–100) in tubum brevem infundibuliformem lanosum coalitis lanceolatis spinoso-aristatis, interioribus margine fimbriatis;

346. *GALIUM VIRGATUM*, Nutt. Prairies. April.

247. *DIODIA TRICOCCA*, Torr. & Gr. *Fl.* II. p. 30. Fertile places in the prairie, sixteen miles west of San Felipe. (Also collected by Dr. Wright.) June. Cæspitose, depressed, and very much branched. All the specimens examined are tri-carpellary.

248. *SPIGELIA TEXANA*, A. DC. *Prodr.* IX. p. 5. (*Cælostylis*, Torr. & Gr.) Shady woods along the Mill-creek west of San Felipe. July.

249. *ASTER DRUMMONDII*, Lindl. Shady, moist woods and thickets. September—October. This species exhibits many varieties, in respect to pubescence, and smoothness or roughness. Among them the *A. urophyllus* and *A. hirtellus* of Lindley, are probably to be identified.

250. *CHETOPAPPA ASTEROIDES*, DC. Dry prairies. April to July.

petalis (40–50) lineari-oblongis margine fimbriate-laceris apice bifidis aristatis; staminibus numerosissimis æqualibus inclusis e toto tubo ortis stylo compresso brevioribus; stigmatibus irregulariter 14–17-fido. — On deserted ant-hills, near the Colorado River. Often a foot in diameter: our specimens are eight or nine inches in diameter, and four or five inches high. Spines strongly annulate, stout, the larger ones often two inches long. Flowers about two inches in length, twelve or more aggregated in the woolly centre. The petals at the base are scarlet, verging to orange, from which a pale purple or violet midrib extends to the apex, and is prolonged into a delicate bristle of the same color, while the upper part of the petal is pearly white, with feathery margins. The flowers remain for three days, expanding only in bright sunshine.

7. *CEREUS CÆSPITOSUS* (*n. sp.*): ovato-globosus demum cylindricus, apice depresso-umbilicatus; costis sub-15 e tuberculis confluentibus ortis rectis; aculeis numerosis ex areola oblonga albo-tomentosa demum glabrata radiatis nunc recurvis, lateralibus longioribus; floribus ex axillis tuberculorum anni prioris lateralibus; ovario oblongo tuberculis e lana villosa spinigeris stipato; sepalis 40–50 apice spinis setiformibus villoque coronatis virescentibus, intimis lanceolatis acuminato-aristatis glabris coloratis; petalis 30–40 apicem versus ciliato-denticulatis, exterioribus subito acuminatis, interioribus obtusis cuspidatis; staminibus inclusis stylo brevioribus; stigmatibus viridi infundibuliformi 13-partito. — Gravelly soil, near Cat-Spring, west of San Felipe. A singular reduced *Cereus*, quite cæspitose, and even prolific occasionally, in the manner of *Opuntia*, beginning to flower when only two inches high, and scarcely taller than broad, but attaining the height of at least six inches; the ribs from twelve to seventeen. It is in flower for two days; the flowers about two inches broad when fully expanded. Petals rose-purple. Filaments reddish at the base, yellow at the summit." ENGEL.

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little longer than the calyx-tube, three-cleft at the apex; stigmas fleshy, dilated, granulose-fimbriolate. Ovary three-celled, many ovuled. Berry, pulpy, "deep red when ripe, an inch or more in diameter," globose, ripening few seeds. Seeds 3 lines long, roundish-oval, turgidly lenticular. — *Sicydium* was founded by Schlechtendal on a small-flowered Mexican diœcious plant, of which the sterile flowers alone are known. Until the fruit of that plant is identified it must remain doubtful whether ours belongs to the same genus. This has larger blossoms, and a more elongated calyx. But it accords with Schlechtendal's incomplete description in being diœcious, in the 5-petalous corolla, and in the three distinct stamens with straight anther-cells. The leaves vary in the depth and breadth of their lobes. From the Rio Grande, Mr. Wright has communicated fragmentary specimens of what is probably a variety of the same species, with the leaves dissected into linear or filiform lobes and segments.

CACTACEÆ; by *Dr. Engelmann.*

. Mr. Lindheimer has again sent many living specimens of Cactaceæ from New Braunfels, San Antonio, the Pierdenales, and the Liano. Among them I not only recognized all the species described in *Plant. Lindh.* (*Boston Journal*, Vol. V.) but found also a number of new forms. From other sources I have obtained other species from the lower Rio Grande. All these will be enumerated here in order to complete, as far as possible, the catalogue of the Texan Cactaceæ. A correspondence with Prince Salm Dyck, than whom none is better acquainted with these curious plants, and his examination of living specimens of most of the species, enables me to give this revision an authenticity not otherwise attainable.

MAMMILLARIA.

§ 1. *Fructu viridi, ovali; corolla persistente; testa seminum pergamentacea fusca; floribus ex axillis tuberculorum hornotinorum.*

M. CALCARATA (*M. sulcata*, *Engelm. Pl. Lindh. l. c.*, non *Pfeiffer*). Near *M. scolymoides*, *Schdw.* but sufficiently distinct, according to Prince Salm. — Rocky and hard, clayey

soil, on the Upper Guadalupe. My specimens from there are mostly densely cæspitose; tubercles in thirteen oblique rows; proliferous groove producing the buds always near its upper end. Flowers 2 inches long and 2 to 2½ inches in diameter: sepals (or rather outer firmer perigonial leaves) 20 – 35: petals (inner more delicate petaloid perigonial leaves) 30 – 35, yellow (dirty yellow only when fading), reddish at the base.

M. COMPACTA, *Engelm. in Wisliz. Rep. not.* 32, from the mountains of Chihuahua is mentioned here only in order to add to the description of the plant that of the flower which I have had occasion to examine in the living state. — Floribus in vertice dense lanato centralibus; sepalis (17 – 19) lanceolatis acutis integris (rufescentibus, interioribus margine flavis); petalis (28) oblongo-lanceolatis mucronatis versus apicem denticulatis (sulphureis); stigmatibus 7 – 8 cuspidatis flavicantibus supra stamina (sulphurea) paulo exsertis. — Flowers at the end of June and beginning of July (in St. Louis). Flower-bud dark reddish brown: flower about 15 lines long and of the same diameter. Petals 6 lines long and 1¾ lines wide. Stigmata 2 lines long, cuspidate, as in *M. vivipara*, while all other species known to me have obtuse stigmata.

MAMMILLARIA RADIOSA (*sp. nov.*): simplex s. parce prolifera, ovata seu cylindrica; tuberculis teretibus supra plus minus sulcatis apice ex tomento albo aculeatis; aculeis rectis numerosis valde inæqualibus, plurimis (20 – 30) radiantibus tenuioribus albidis, centralibus 4 – 5 robustioribus fuscis s. rarius flavis, 3 – 4 sursum directis, singulo deflexo; axillis nudis, sulco subtomentoso; floribus (violaceis) ex axillis tuberculorum hornotinorum ortis sparsis (nec centralibus); sepalis petalisque lineari-lanceolatis acuminatis aristatis; sepalis (40 – 50) arachnoideo-fimbriatis, exterioribus brevioribus adpressis, interioribus longioribus recurvatis; petalis (30 – 40) integris s. basi subciliatis patentibus; staminibus (violaceis) numerosissimis æqualibus; stylo longe exserto; stigmatibus 7 – 9 (violaceis) erectis obtusis; bacca oblonga viridi floris

rudimento coronata; seminibus fulvis ovatis scrobiculato-punctatis. — Sterile, sandy soil on the Pierdenales: flowers (in St. Louis) about the middle of June. The flowers open for three days, in direct sunshine only, and later than most other Cactaceæ, viz., from 12 or 1 till 3 or 4 o'clock. Stems 2–4 inches high, about 2 inches in diameter, dark green; tubercles in 13 oblique rows;¹ radiant spines 3–4; central spines from 4–6 lines long: flowers $1\frac{1}{2}$ - $2\frac{1}{4}$ inches long, and about the same diameter when fully open, of a lighter violet color or of a splendid dark purple: stigmas deep velvety purple. — Very near *M. vivipara*, Haw., which has been found from the Upper Missouri to Santa Fe: this, however, is distinguished by its low, mostly cæspitose growth, by the smaller number of radiant spines (14–18), the absence of the deflexed central spine, the smaller central flowers, the apiculate stigmata, and smaller seeds: it also flowers earlier (in St. Louis about the middle of May), but, like *M. radiosa*, opens the flowers only after 12 o'clock. In *M. vivipara* the youngest tubercles produce in their axils the flowers which appear central, and remain so till after fructification, whereupon new tubercles are developed in the centre, and the young fruit is pushed aside and becomes more and more lateral. In *M. radiosa* the flower buds are also formed in the axils of the first young tubercles of the season, but are immediately pushed aside by a continuous growth of more tubercles; the buds as well as the flowers and fruits are therefore lateral. *M. vivipara* has not yet been found in Texas, though it may be expected in the mountainous regions bordering New Mexico.

§ 2. *Fructu coccineo; corolla decidua.*

* *Fructu clavato elongato; seminum testa pergamentacea,*

¹ It will hardly be necessary to mention that there are several different sets of rows of tubercles observable, but one set is usually more distinct than the others; they depend on the size of the plant, and the number, size, and closeness of the tubercles. It is well known that in different specimens of the same species they turn to either side, right or left.

*fusca; caule simplici, succo lacteo; floribus ex axillis tuberculorum anni prioris.*¹

MAMMILLARIA APPLANATA (*n. sp.*): simplex, depressa; tuberculis elongato-pyramidatis subquadrangulatis apice ex tomento albo lanoso demum evanescente aculeiferis; aculeis rectis 15–20 tenuioribus inequalibus radiantibus, singulo centrali robustiori erecto; axillis nudis; floribus sordide albidis s. rubellis; ovario glabro, sepalis 8–13 lanceolatis; petalis 12–18 lanceolatis mucronatis, internis versus apicem fimbriato-denticulatis; stigmatibus 5–8 stamina brevia pauca flavida longe excedentibus flavis; baccis elongato-clavatis; seminibus subgloboso-ovatis scrobiculatis rugulosis parvis.—Rocky plains on the Pierdenales: flowers (in St. Louis) in May. Flowers forming a circle or wreath, in the larger specimens, of 1–1½ inches diameter around the growth of tubercles of the same year, while the scarlet fruit is frequently still persistent and forms an outer circle. Plant 2½ to 4½ inches in diameter, 1–2 inches high, with an almost level top and depressed vertex; in larger specimens 34, in smaller ones 13 or 21, spiral rows of tubercles are most conspicuous. Radiating spines 2½–6 lines long, whitish; the 3 or 4 outer or lower are stouter and very light brown; the central spines erect, or rather somewhat inclined upwards and inwards, 2–4 (mostly 3) lines long, light yellowish brown. The innermost tubercles of the preceding year appear to produce the inconspicuous flowers, which are from 9 to 12 lines long, urceolate when not fully expanded in bright sunshine. Berry 8 to 15 lines long.

MAMMILLARIA HEMISPHERICA (*n. sp.*): simplex, hemisphæ-

¹ It has been stated over and over again, that all the *Cactaceæ parallele* (with cotyledons parallel to the more or less compressed sides of the seed,) see *Wisl. Rep.* pp. 91 and 92) produce the flowers from the same year's growth, and the *Cactaceæ contrariæ* (cotyledons contrary to the compressed sides of the seeds) from that of the last preceding or former years. In *Wisl. Rep. l. c.* I have stated that some *Mammillariæ* probably formed an exception to that rule. What was a supposition then I have since ascertained to be the fact. These few species, however, are the only ones in which I have as yet observed this exception.

rica; tuberculis elongato-pyramidatis subquadrangulatis apice ex tomento albo brevi mox evanido aculeiferis; aculeis rectis, 9 – 10 tenuioribus inæqualibus radiantibus, singulo centrali robustiori porrecto; axillis nudis; floribus sordide albidis s. rubellis; ovario glabro; sepalis sub-13 lanceolatis acutis vel obtusiusculis; petalis sub-13 oblongo-lanceolatis mucronatis integris s. versus apicem denticulatis; stigmatibus 5 – 8 ex flavido rubellis supra stamina numerosa rubella exsertis; bacis elongato-clavatis; seminibus elongato-ovatis rugulosis minutis. — Below Matamoras, on the Rio Grande; brought home by the St. Louis Volunteers, in 1846: flowers (in St. Louis) in May. Very similar to the last species, but well distinguished by the hemispherical shape, the much smaller number of shorter spines, the less woolly areolæ, and the much smaller, less rough, and lighter-colored seed. I can see no essential difference in the flower. Body of the plant 3 – 4½ inches in diameter, 2 – 3 inches high: flowers 10 – 15 lines long and about the same diameter when fully open in the forenoon sun, urceolate in the afternoon. Radial spines 2, or 3 – 4; the central spine 2 – 3 lines long.

MAMMILLARIA GUMMIFERA, *Englm. in Wisl. Rep. not.* 33, has now flowered with me, and proved, as was expected, similar to the two foregoing species. I add here the description of the flower.—Floribus rubellis; ovario glabro; sepalis sub-13 oblongo-linearibus obtusiusculis fimbriatis; petalis 16 lanceolatis breviter acuminatis denticulato-erosis; stigmatibus 6 stamina breviter rubella longe excedentibus petala subæquantibus virescentibus.— Flower 15 lines long, 6 – 12 lines wide when fully open, brownish red outside; the petals reddish white, with dark red in the middle. Flower larger than that of *M. applanata*, much darker and more elegantly colored; style longer, etc. Fruit not seen.

* * *Fructu subgloboso; seminum testa dura nigra; caule prolifero (an semper?) succo aqueo; floribus ex axillis tuberculorum hornotinorum.*

MAMMILLARIA NUTTALLII, *Englm. in Pl. Fendl.*, from the

Upper Missouri; the only specimen I possessed was unfortunately destroyed. — *Mammillaria similis*, *Engelm. in Plant. Lindh. l. c.*, first discovered by Mr. Lindheimer near the Brazos, has since been found by him south of the Guadalupe, about New Braunfels and on the Pierdenales in several forms. It has frequently flowered with me and annually produces abundant fruit. I substitute the following character and description.

M. SIMILIS: subsimplex s. plerumque cæspitosa; tuberculis ovato-cylindræis supra plus minus sulcatis (sulco in junioribus basin versus tomentoso sæpe prolifero) axilla tomentosis; areola albo-tomentosa demum nuda; aculeis 10 – 12 rectis albidis, radiantibus tenuioribus æqualibus, centrali nullo s. singulo robustiori; floribus ex axillis tuberculorum hornotiorum subcentralibus s. demum lateralibus (flavis s. ex rubello flavicantibus); sepalis petalisque lineari-lanceolatis acuminato-aristatis; sepalis 15 – 25 ciliato-fimbriatis sæpe plus minus recurvis; petalis 20 – 30 integris s. basi subciliatis; stigmatibus 5 – 8 virescentibus supra stamina numerosissima exsertis; bacca obovato-subglobosa coccinea; seminibus nigris subglobosis scrobiculatis majoribus.

α. CÆSPITOSA: gracilior; aculeis radiantibus sub-12, centrali subnullo; sepalis 15 – 20; stigmatibus sub-5.

β. ROBUSTIOR: subsimplex; aculeis radiantibus sub-10, centrali robustiori; sepalis 20 – 25; petalis 25 – 30; stigmatibus 7 – 8. Flowers (at St. Louis) in May. — Stems $1\frac{1}{2}$ – $2\frac{1}{2}$ inches high, obovate, of smaller diameter; tubercles in *α.* 8, in *β.* often in 13 rows; spines 3 – 4, in *β.* 4 – 8 lines long; central spine, when present, 6 lines long. Grooves proliferous towards the upper or the lower end. Flowers $1\frac{1}{2}$ – 2 inches long, and of the same diameter when fully open, radiating like stars with their pale yellow, silky lustre, giving this species a most beautiful appearance when several open on the same morning: petals 12 – 15 lines long and 2 lines wide. Berries 3 – 5 lines in diameter.

ECHINOCACTUS.

The specimens described in the account of Lindheimer's plants, under the name of *E. setispinus* were the most northern and rather diminutive forms of this beautiful species; the flowers were incorrectly described from a withered bud adhering to one of the specimens. Numerous plants have since been sent by Lindheimer from San Antonio, and by the St. Louis Volunteers from the lower Rio Grande.

ECHINOCACTUS SETISPINUS (*Englm. l. c.*): ovato-subglobosus s. oblongo-cylindræus; costis 13 acutis sæpe undulatis s. subinterruptis plus minus obliquis; areolis remotis, junioribus flavido- s. albido-tomentosis; aculeis radiantibus setiformibus 10 – 16, summis longioribus imisque flavicanti-fuscis, lateralibus albidis, centrali subsingulo robustiori fusco flexuoso s. apice uncinato; floribus solitariis nudis infundibuliformibus, tubo glaberrimo; sepalis inferioribus brevioribus obtusis s. cuspidatis 25 – 40, superioribus elongatis lanceolatis 15 – 25, omnibus margine membranaceis basi auriculato-cordatis tenuiter ciliatis; petalis 20 – 30 (cum basi miniata flavis) oblanceolatis acutis integris s. denticulatis; stylo supra stamina rubella longe exserto; stigmatibus 5 – 8 sulphureis recurvis s. erectis; bacca pulposa globosa rubra rudimentis sepalorum infimorum membranaceis stipata.

α. HAMATUS: major, subovatus; aculeis radialibus 10 – 12, centrali robustiori hamato. *E. hamatus*, Muhlenpf. *E. Muhlenfordtis*, Fen.

β. SETACEUS: minor, subglobosus; aculeis radialibus 14 – 16, centralibus 1 – 3 setiformibus flexuosis. *E. setispinus*, Engelm. *l. c.*—Texas, from the Colorado to the Rio Grande. Flowers from April or May to October, and therefore, on account of its beautiful flower, one of the most valuable species for cultivation. — Plant 2 – 4 inches in diameter, and $1\frac{1}{2}$ – 6 or 8 inches high, flowering when quite small, simple or (in cultivation at least) sometimes proliferous at base. Var. *α* is the larger southern form, with fewer, stouter, and longer spines (radial 6 – 16 lines, central 12 – 16 lines long). Var. *β* is the

smaller, more northern form, with more and thinner spines (radial 5–10, central 12–16 lines long). Flower from 20 to 35 lines long, and 24–30 in diameter when fully open; petals then often somewhat recurved: flowers open two days, only in bright forenoon sunshine. My specimens from the Rio Grande have 5 erect stigmata and a longer flower; all the others have 6–8 spreading or even recurved stigmata and a shorter flower-tube. Berry about 4 lines in diameter. Withered flower finally deciduous. Fruit often bursting, when the filamentous red pulp and the black, thimble-shaped, verrucose seeds are seen: this pulp is formed by the clavate, elongated, twisted funiculi, which most probably form the pulp of all the soft Cactus fruits, but they do not always remain as distinct as in this species.

ECHINOCACTUS TEXENSIS, *Hæpf.* (*E. Lindheimeri*, *Engelm. l. c.*) Mostly depressed, but sometimes globose. Common from the Colorado to the Rio Grande, and from thence to Saltillo (*Dr. Gregg*). Near New Braunfels it prefers the so-called Muskit-flats, or fertile level places with Muskit trees, overflowed in the rainy season. My specimens have several times fructified. Berry subglobose, pulpy, red, about 8 or 9 lines in diameter, covered with spiny bristles and soft wool, crowned by the woolly remains of the flower: seeds reniform, compressed, large, smooth and shining. Ribs in smaller specimens 13–14, in larger mostly 21, sometimes 24. Areolæ about 6 lines long, and 12 lines apart: spines from 6–10 lines long in some, 15–25 lines in others; sometimes the central spine is 2 or 3 lines broad. Flowers all open within a few days, in May (in St. Louis); unlike the last mentioned species.

CEREUS.

402. CEREUS CÆSPITOSUS, *Engelm. Pl. Lindh. l. c.* Common about New Braunfels; in flower in May. — This plant has been cultivated in Europe, as Prince Salm informs me, under the name of *Echinopsis Reichenbachiana*, Hortul., and has been confounded with *C. pectinatus*: compare *Wisliz.*

Rep. Appendix, note 45. This species has also been sent from Saltillo by Dr. Gregg. Mr. Lindheimer has sent from the granitic region of the Liano a beautiful variety with chestnut brown spines; β . CASTANEUS. — The characters given in *Pl. Lindh.* to this species have been corrected in *Wisliz. Rep. l. c.* I add here only that the fruit of this, as well as of all the other northern Cerei seen by me, ripens within a few weeks, contrary to what is observed in our Mammillariæ and Opuntia, and mostly bursts open longitudinally, when ripe. — I cannot omit an interesting morphological observation made on this species. The usual structure of the flower of all Cerei observed by me is the following. The ovary is covered with very short and (for the greater part) adnate sepals; the adnate part forms a protuberance (tubercle); the free part is mostly very small, often only a minute deciduous scale. In the axil of the scale we find the *areola*, covered with a short tomentum, long wool, and almost always with bristles or spines. All this together forms the *pulvillus* of authors. Next in order follow those sepals which form the tube of the flower. The lower of these are entirely similar to the sepals on the ovary. In the upper or interior sepals the tip, or free part, becomes larger and larger, more herbaceous, and finally more or less petaloid; the wool and bristles become scarcer, but the latter longer, and are produced from an areola which is almost always situated in the axil of the sepal, where its free part separates from the common tube. Now in *C. cæspitosus*, the free upper part of these sepals of the tube is more and more elongated, somewhat terete, not foliaceous, and bears the areola with its wool and bristles just below the subulate or (in the innermost sepals) somewhat foliaceous tip, reminding us almost of the tubercles of a *Mammillaria*. The descriptions given in *Pl. Lindh.* and in *Wisliz. Rep.* have to be corrected accordingly.

CEREUS PROCUMBENS (*n. sp.*): humilis; caule subtereti s. angulato articulado ramosissimo; tuberculis aculeiferis distinctis 4 – 5-fariis; areolis parvis orbiculatis, junioribus breviter

albo-tomentosis; aculeis brevibus tenuibus albidis apice fuscis, 5 – 6 radiantibus, centrali singulo erecto paulo longiore; floribus diurnis; ovario tuboque brevi pulvillis sub-40 albidovillosis setas spinescentes breviores fuscas 6 – 9 gerentibus stipato; sepalis interioribus sub-15 lineari-lanceolatis acuminatis; petalis 18 – 20 oblongo-linearibus acutis mucronatis subintegris (violaceis); stigmatibus viridi infundibuliformi 10-partito stamina (pallide flavicantia) paulo superante. — On the lower Rio Grande, below Matamoras, collected by the St. Louis Volunteers, in 1846. — Plant spreading, 3 – 5 inches high: joints or branches $1\frac{1}{2}$ – 2 inches long, $\frac{1}{2}$ inch in diameter, much contracted at the base: tubercles 4 or 5 lines distant from one another, often in 4 rows, whence the plant derives a distinctly quadrangular appearance, or in 5, when it is more cylindrical. Radial spines 6, or mostly only 5, the uppermost being frequently abortive, 1 – $1\frac{1}{2}$ lines long; central spine $1\frac{1}{2}$ – $2\frac{1}{2}$ lines as long, stouter, directed upwards. Flower 3 inches long, and as wide when fully expanded, of a delicate purple color: petals 4 lines wide, often, in a bright noonday sunshine, recurved. Bristles on the tube about twice as long as the wool, below $1\frac{1}{2}$ – 2, above $2\frac{1}{2}$ – 3, lines long. — We have in gardens in St. Louis a similar species in cultivation, under the name of *C. Deppii*; but, as Prince Salm informs me, widely different from the true *C. Deppii*. It is not known whence it was obtained. It is distinguished from *C. procumbens* by the larger, thicker, more cylindrical limbs: tubercles elevated, very distinct, in 5 or 6 rows; spines weaker and longer; 6 – 8 radial spines 5 – 6 lines long; central spine from 5 to 14 lines long: flower with a shorter tube, fewer pulvilli, with shorter wool, but longer and weaker bristles.

CEREUS RŒMERI (*n. sp.*): ovatus, e basi ramosus; costis sub-8 (7 – 9) tuberculatis interruptis; areolis orbiculatis, junioribus breviter tomentosis; aculeis albidis s. flavidulis demum cinereis teretibus, radialibus sub-8, centrali singulo robustiori porrecto; floribus diu noctuque apertis infundibuliformibus, limbo erectiusculo; sepalis ovarii et tubi 17

squamosis in axillis ex tomento albo brevissimo setas spinescentes albas 3 – 5 gerentibus; sepalis interioribus 8 ovato-oblongis carinatis obtusis mucronatis; petalis 10 obovato-spathulatis obtusis integris concavis chartaceis (coccineis); stylo longe supra stamina numerosissima exserto; stigmatibus 7 acutiusculis erecto-patulis viridibus. — Granitic region about the Liano: flowers (in St. Louis) in May. — Named after my friend Dr. F. Roemer, of the University of Bonn, who was the first to explore the geology of Western Texas, and brought the first specimens of this species. Sent also in numerous specimens by Lindheimer. Heads 3 – 4 inches high, $1\frac{1}{2}$ – $2\frac{1}{2}$ inches in diameter, single, or mostly 3 – 5 or even 10 from the same base; ribs interrupted: areolæ 4 – 8 lines distant from one another: radial spines 5 – 12 lines long; lateral spines longest: upper ones usually shortest; central spine 10 – 15 lines long. Flower open by day and night, for 4 or 5, and in cool cloudy weather as much as 6 or 7 days, 2 inches long, and one wide: petals 8 – 9 lines long, 5 lines wide, stiff: bristles on the tube 2 – 3 lines long. — The stiff and almost parchmentaceous petals are uninfluenced by sunshine or darkness like those of most other Cactaceæ. Several other northern species most probably agree in this particular, as especially *C. coccineus* and *C. triglochidiatus* of New Mexico; while other nearly related species have certainly diurnal flowers. — *C. coccineus* differs by the more numerous ribs, more numerous spines, larger and more crowded areolæ, etc. *C. polyacanthus*, Engelm. in Wislitz. Rep., has more numerous spines, and ten ribs, *C. enneacanthus*, Engelm. l. c., is larger with the tubercles less distinct, ten ribs; spines larger, angular.

CEREUS VARIABILIS, Pfeiff., with its beautiful white nocturnal flowers, delighted our volunteers in their camps on the lower Rio Grande. Young plants are procumbent, with terete or rather clavate branches: adult plants several (3 – 10) feet high, mostly triangular, with very long and stout, or sometimes quite short spines. Fruit large, luscious, with red pulp: seeds large, smooth, shining.

OPUNTIA.

§ 1. *Applanatæ*.

O. MACRORHTZA (*n. sp.*): prostrata; articulis obovato-orbiculatis planiusculis; pulvillis setis fuscis et sæpe aculeis singulis binisve instructis; aculeis teretibus validis porrectis s. paulo deflexis basi apiceque fuscis ceterum albidis cum adventitio inferiore graciliore reflexo sæpe deficiente; floribus sulphureis basi intus rubellis; ovario sepalis subulatis deciduis 13 in axillis setulas fuscas brevissimas gerentibus stipato; sepalis interioribus 15 – 18 subulatis et (internis) ovatis acuminato-cuspidatis; petalis 8 sepala superantibus late obovato-spathulatis obtusis cuspidatis eroso-denticulatis; stigmatibus 5 obtusis, adpressis, stamina numerosa æquantibus; bacca subpulposa clavata glabrata; seminibus marginatis. — Naked, sterile, rocky places on the Upper Guadalupe. Flowers (in St. Louis) in June. Root a large and fleshy tuber, sometimes 2 or 3 inches in diameter; joints 3 – 4 inches long, about $2\frac{1}{2}$ – $3\frac{1}{2}$ wide, hardly attenuate at the base. Leaves subulate, about 5 lines long. Areola $\frac{3}{4}$ – 1 inch distant, more crowded toward the base and on the edges: spines (often wanting) 1 inch long, the smaller 4 – 6 lines long. Flower 3 inches in diameter: ovary $1\frac{1}{4}$ inch long: petals 1 inch wide, $1\frac{1}{2}$ inch long, pale yellow, red at the base. Fruit $1\frac{1}{2}$ inches long; the strongly margined seeds comparatively few, 21 lines in diameter. — I have found the same plant in similar situations in Western Arkansas; and it is possible that it may be one of Nuttall's new species (*O. mesacantha*, *O. cæspitosa*, or *O. humifusa*) of which I cannot find a description. — Nearly related to *O. vulgaris*.

O. INTERMEDIA, Salm. The species mentioned in *Pl. Lindh. l. c.* No. 1. has since produced abundant flowers and fruit, and proves to be the above plant. It is near *O. vulgaris*, but more erect, or ascending; the joints much larger; flowers larger ($4\frac{1}{2}$ – 5 inches in diameter); ovary more slender, 2 – $2\frac{1}{4}$ inches long, with 20 – 25 subulate sepals; petals obcor-

date; stigma 5-lobed, erect; fruit $2\frac{1}{2}$ inches long, 6–8 lines wide at the top, deeply umbilicate. Lindheimer's specimens are from Industry, south of the Brazos. I believe I have seen the same species near Natchitoches on Red River.

O. LINDHEIMERI (*n. sp.*): erecta, robusta; caule lignoso; articulis (magnis) ellipticis basi attenuatis planis; pulvillis remotis ad margines confertioribus griseo-tomentosis, setis flavidis aculeisque paucis instructis 1–3 compressis validis deflexis varie divergentibus stramineis, nunc cum 1–2 aculeis adventitiis gracilioribus; flore . . . bacca clavata elongata subpulposa glabrata; seminibus late marginatis. — About New Braunfels. Plant erect, often 6–8 feet high: stems terete ligneous, sometimes 6 inches in diameter, with gray bark, and very light, spongy wood. Larger joints 9–12 inches long, 5–7 broad. Areolæ $1\frac{1}{2}$ –2 inches distant on old joints; bristles on them 1–3 lines long. Spines all pale yellow, much compressed, indistinctly annulated, $\frac{1}{2}$ –1 inch long, various; the 3 longer spines, or the one longer, with one or two shorter spines. The fruit, which Lindheimer has sent as belonging to this species, resembles very much that of *O. vulgaris*, 2– $2\frac{1}{2}$ inches long, slender, with a deep umbilicus, very different from that of the following species. Seeds 2– $2\frac{1}{4}$ lines in diameter, not numerous. Young plants grown from this seed have the same compressed spines, but are brown at the base; the lower areolæ produce no spines, but a quantity of long, coarse hair. — I add here the following species, though not properly belonging to the flora of Texas, because I suspect that it is also found at the mouth of the Rio Grande, within the limits of Texas. There, and especially on the barren sand islands at the Brazos, near Point Isabel, the St. Louis Volunteers found large and impenetrable thickets formed by an *Opuntia* with large joints, covered with almost globose fruits, with innumerable small seeds, and a very luscious deep red pulp. The fruit and seed are before me, but unfortunately I did not obtain a living specimen.

O. ENGELMANNI (*Salm. Mss.*): erecta; articulis orbiculato-

obovatis planiusculis; pulvillis remotis ad margines confertioribus griseo-tomentosis setis flavidis aculeisque paucis compressis ancipitibus instructis, 1 – 4 validis sæpe inæqualibus plus minus deflexis varie divergentibus basi rufis, ceterum stramineis cum adventitio infimo graciliore albido sæpe deficiente; fl. . . . bacca ovata subglobosa late umbilicata pulvillis pluribus tomentosis stipata; seminibus minoribus anguste marginatis. — From El Paso to Chihuahua, indigenous and cultivated, *Dr. Wislizenus*. No doubt, also, on the Texan side of the Rio del Norte. — Erect, 5 – 6 feet high. Upper and larger older joints 12 inches long by 9 broad. Areola; $1\frac{1}{2}$ – 2 inches distant: bristles 2 – 6 lines long: spines 1 – $1\frac{3}{4}$ inches long, very stout. Fruit $1\frac{1}{2}$ – $1\frac{3}{4}$, inches long, about $1\frac{1}{2}$ in diameter; umbilicus large, (10 – 12 lines) flat; pulvilli on the fruit about 5 lines distant. Seeds very numerous, about half as large in *O. vulgaris*, $1\frac{1}{2}$ – $1\frac{3}{4}$ lines in diameter, of an irregular shape. — Near *O. Dillenii* and *O. polyantha*, as Prince Salm informs me.

§ 2. *Cylindricæ.*

O. FRUTESCENS, *Engelm. in Pl. Lindh. l. c.* under *O. fragilis*, from which it widely differs, stands near *O. gracilis*, Salm. (raised from Mexican seeds), but is sufficiently distinct. (Salm.) Fruit by the abortion of the seeds very often sterile. — I had occasion to observe this species in blossom, and add the description of the flowers:

Floribus ex ramis anni prioris provenientius; ovario clavato basi 5-gono sepalis subulatis sub-13 stipato; sepalis interioribus 8 lanceolatis ex viridi sulphureis; petalis 8 obovato-lanceolatis cuspidatis (sulphureis s. subvirescentibus); staminibus numerosis (40 – 50) inæqualibus (externis majoribus); stylo exserto; stigmatibus 5 adpressis albidis. — The flower cannot be distinguished from that of the *Opuntia appianata*, but it is only 8 – 10 lines in diameter: ovary 9 – 12 lines long. Flowers (in St. Louis) July and August.

O. ABBORESCENS, *Engelm. in Wisl Rep.*, is recognized by Prince Salm as identical with his *O. stellata*; but as no de-

scription of his plant has ever been published, he adopts the above name. G. E.

CRASSULACEÆ.

(245.) *SEDUM SPARSIFLORUM*, Nutt. Rocky soil, on the Upper Guadalupe. May, June.

UMBELLIFERÆ.

† *HYDROCOTYLE INTERRUPTA*, Muhl.; Torr. & Gray, *Fl.* 1. p. 599. Swamps, along the Guadalupe. July.

† *H. UMBELLATA*, Linn.; Torr. & Gray, *l. c.* In pools and clear streamlets on the Liano. October.

(613.) *H. REPANDA*, Pers.; Torr. & Gray, *l. c.* Near Fredericksburg, in moist places along creeks, creeping among high grass. September.

(614.) *SANICULA CANADENSIS*, Linn.; Torr. *Fl. New York*, 1. p. 265. t. 32.

403. *ERYNGIUM LEAVENWORTHII*, Torr. & Gray, *Fl.* 1. p. 604. Margin of woods, on clayey prairies, Comale Creek and San Marco. August.—Plant annual, ornamental in cultivation, when the heads turn red or purple.¹

¹ Lamarck first properly distinguished from *Eryngium aquaticum*, Linn., the var. β ., and characterized it as a distinct species, under the name of *E. Virginianum*. Later, Michaux, giving to the original *E. aquaticum* of Linnæus the name of *E. yuccæfolium*, described under the name of *E. aquaticum*, a plant which appears to be, not the *E. Virginianum* of Lamarck (which is described as only a foot or so in height, with long and narrow, ensiform, radical leaves, finely striate and ciliate, with distant spinules, Lamarck moreover citing the figure of *Pluk. Alm. t. 396*), but the much larger and broader-leaved plant which Elliott has well characterized under that name. Elliott's *E. Plukenetii* is truly *E. Virginianum*, Lam. I am indebted to H. W. Ravenel, Esq., of St. Johns, Berkley, S. Carolina, for full specimens and notes, accurately distinguishing these species, and another, which perhaps has also been confounded with *E. Virginianum*, but which may properly bear the name of this acute and zealous botanist, who has directed my attention to its characters. The latter should stand next *E. aquaticum*, L.

1. *E. RAVENELLI* (*sp. nov.*): caule simpliciter; foliis linearibus elongatis complicato-equitantibus subteretibus nervulosis obsolete denticulatis, involucralibus trifidis capitulo æqualibus; paleis receptaculi uninervatis æqualiter 3-spinosis calycis lobos mucronato-acuminatos superantibus.—In flat and damp Pine land; common at Black Oak, St. Johns, Berkley District, South Carolina. September, October.—Stem from $1\frac{1}{2}$ –3 feet high, slender. I possess no strictly radical leaves; those from near the base of the stem are from 12–18 inches long, conduplicate in the dried plant, and

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repay the obligation by affording the most ready and complete facilities by which those labors are, at the present time, safely and expeditiously conducted.

Such are the general character and objects of the Nautical Almanac; but the American Nautical Almanac, besides sustaining this character and fulfilling these objects, will, it is expected, remedy some defects, and accomplish some special ends, which no similar work prepared in Europe is qualified to take into account.

And what these ends are, may be gathered from a consideration of the isolated position of this vast continent of North America, in respect to the other great divisions of the globe, the enterprising character of the people, and the wide extent of territory that still remains to be explored, surveyed and settled.

This consideration makes it apparent that neither the authorities nor standards of Europe can satisfy our demands.

In the useful arts of life, the United States have no superior, and but one rival; in the successful application of the sciences to the useful arts the nation has already accomplished signal performances; and in the present case of a Nautical Almanac, which has been regarded as a beneficial example of such application by every nation undertaking it, the very work which consults the practical wants of the community, has proved in a high degree subservient to the advancement of science and the diffusion of sound knowledge.

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ART. XXXII.—*Notes on the Cereus giganteus of South Eastern California, and some other Californian Cactaceae*; by Dr. GEO. ENGELMANN, of St. Louis, Missouri.

IN Emory's *Notes of a military Reconnaissance*, published in 1848 by order of Congress, I have ventured, from the data furnished by Col. Emory, to describe one of the largest Cacti ever known. Since then several travellers have met with this giant of the Gila country, and have confirmed the extraordinary accounts of the first discoverer. But no further scientific details were obtained till Col. Emory, now again in those regions, as the chief of the scientific corps of the U. S. boundary commission, had occasion early this spring (1852) to send an expedition down the Gila river. Dr. C. C. Parry, who was connected with this party, paid particular attention to the Cacti of that region, and made it an especial object carefully to examine the *Cereus giganteus*. From his very full notes, kindly communicated by Col. Emory, I have completed the description of the plant, with the exception of the flower and fruit, the account of which rests as yet on the verbal information obtained by Dr. Parry.

CEREUS GIGANTEUS, *Engelm. in Emory's Rep.*, p. 158. — Erectus, elatus, simplex, sæpius parce ramosus; ramis erectis caule cylindrico versus apicem sensim attenuato brevioribus; vertice parum depresso lanato; costis ad basin 12 versus apicem 18–20 rectis compressis obtusiusculis (versus basin obtusissimis) subrepandis; sinubus profundis angustis; areolis prominentibus orbiculatis albido-tomentosis; aculeis rectis, radialibus 11–17 brevioribus setaceis albis, centralibus 6 robustioribus longioribus (quorum imus robustissimus deflexus) tenuiter sulcatis albidis basi bulbosa nigris apice rubellis; floribus . . . bacca . . . seminibus oblique obovatis nigris lævibus lucidis.

Dr. Parry found this splendid species, which the Indians name "Suwarrow," in rocky crevices and on gravelly table lands, from Tucson, north to the Rio Gila; he learned that it also occurs in Central Sonora, near the heads of streams which empty into the Gulf of California. Col. Emory observed it in 1846, from the middle towards the lower Gila; and Dr. LeConte, who explored California in 1850, informs me that he found it "common along the Gila to within thirty miles of its mouth, where it suddenly disappears." It is no doubt the same plant of which Humboldt makes mention in his work on New Spain, (II, p. 225,) where he says that the Spanish missionaries found at the foot of the Californian mountains nothing but sand or rocks, on which grew a cylindrical Cactus (*Organos del Tunal*) of extraordinary height.

Stems 25 to 60 feet high and 1 to 2 feet in diameter, not absolutely cylindrical, but thickest about the lower third, where generally the few (mostly 2–3) alternate or sometimes opposite branches start, and from thence slightly tapering toward the summit. Stems and branches marked by superficial transverse furrows, indicating, as it seems, the annual periods of growth, forming rings of 4 to 8 inches in height. Branches unequal, and always of less height than the main stem, mostly 5–10 feet long, with 12–18 ribs.

The stem consists of an exterior fleshy substance, 3–6 inches in thickness; this encloses a circle of bundles of ligneous fibres, corresponding with the intervals between the ribs; these bundles are of a loose texture, but tough and elastic, and form continuous columns or sticks of one-half to three inches in diameter, frequently anastomosing, increasing in thickness towards the base, and swelling into irregular, knotted, horizontally spreading roots. This frame-work remains after the decomposition of the fleshy parts. The exterior fleshy tissue passes between the bundles and forms in the centre of the stems the pith, of 4–6 inches diameter.

The ribs are mostly vertical, at the base about 12 in number, broad, rounded, 4 inches or more wide, with broad and shallow intervals, (also 4 or 5 inches wide,) worn, and destitute of spines.

Upwards, the number of ribs increases by bifurcation, or additional ribs originate in the intervals. There the ribs are "sharply rounded,"  $1\frac{1}{2}$  inch wide, with deep intervals,  $2\frac{1}{4}$  inches wide, densely set with spines. Areolæ somewhat elevated, circular, one inch distant from another. Radiate spines  $\frac{1}{2}$ – $\frac{3}{4}$  inch long; central spines stouter and longer; the lowest deflexed,  $\frac{1}{2}$ – $2\frac{1}{2}$  inches long, the two next lateral, the three upper ones pointing upwards and outwards, and shorter.

Dr. Parry was informed that the flowers were produced in May and June, from the summit of stem and branches; they are said to be white, with a red centre, and three inches in diameter. The fruit matures in August, and is set with small spines: it is obovate, one and a half inches in diameter, red, pulpy, of sweet taste. The seeds obtained by Col. Emory and by Dr. LeConte have already been noticed in Emory's Report; they are 0.7 lines long, obovate, obliquely truncate at base, black, smooth, shining. Embryo hooked, without an albumen; cotyledons foliaceous, unequal, incumbent.

My opinion that our plant is a true *Cereus* and not a *Pilocereus*, which was based on the structure of the seeds (the foliaceous, not globose cotyledons), appears to be further confirmed by the fact that this Cactus bears no hair-like spines, and no *cephalum*, or distinct woolly head, and that the fruits are (as is said) spinulose and not scaly. It is by far the largest *Cereus* known; and only some *Pilocerei* approach it in size.

The only *Cactaceæ* thus far known to grow in California were those vaguely noticed by Humboldt (the "Organos del Tunal" and some *Opuntia*); the *Echinocactus viridescens* and *Cereus Californicus* discovered by Nuttall in 1834; the Cacti found on the Gila by Col. Emory in the fall of 1846 and mentioned in his report; *Mamillaria Goodrichii*, lately described by Scheer, of Kew, and *Echinocactus Californicus* of Monville.

Dr. Parry has in the years 1849 and 1850, when he was also attached to Col. Emory's corps in the survey of the Mexican boundary, examined and described ten or eleven distinct species of *Cactaceæ*, all found along the southern boundary of California, from the sea-coast to the mouth of the Gila. He, as well as Dr. LeConte, states that much farther to the north no species of this family are found, except an *Opuntia*, cultivated and now naturalized about the missions.

I subjoin here a short memorandum of Dr. Parry's Californian *Cactaceæ*, reserving a fuller description for a more extended memoir.

1. *MAMILLARIA TETRANCISTRA*, n. sp.: subglobose; aculeis radialibus brevibus albis numerosis, centralibus 4 longioribus cruciatis uncinatis; floribus centralibus parvulis flavido-rubellis; stig-

matibus 3; bacca coccinea pyriformi; seminibus nigris hilo spongioso fusco auctis.

From San Diego to the junction of the Gila with the Colorado.—*M. Goodrichii*, Scheer, obtained on the island of Cerro on the coast of California, is distinguished by the lower central spine only being hooked, by much smaller tubercles, etc.

2. ECHINOCACTUS VIRIDESCENS, *Nutt.* Depressed; berry subglobose green, coated with lunate membranaceous scales. On dry hills and ridges near San Diego.

3. *E. VIRIDESCENS*,  $\beta$ ? CYLINDRACEUS, is distinguished by its oval or cylindrical shape, larger size, longer spines. Found near San Felipe, on the eastern slope of the California mountains.

*Note.*—*E. CALIFORNICUS*, *Monv.*, is the name of young plants raised from seed in Europe. I am informed that neither the identity nor the native country of these seedlings is satisfactorily known.

4. *CEREUS EMORYI*, n. sp.: caule prostrato; ramis erectis cylindraceis 15-costatis; aculeis radialibus 40–60, centrali singulo robustiore porrecto; bacca globosa spinulosa.

In thick patches, on dry hills near the sea shore, about the boundary line. Erect branches 6–9 inches high.

5. *C. ENGELMANNI*, *Parry in litt.*: caulibus pluribus pedibus; costis 13 tuberculatis; aculeis 4 centralibus inæqualibus radiales tenuiores superantibus; bacca ovali aculeata pulposa.

Mountains about San Felipe, on the eastern declivity of the Cordilleras.

*Note.*—*C. CALIFORNICUS*, *Nutt. in Torr. and Gray's Flora*, is most probably a cylindraceous *Opuntia*, with “small yellow flowers,” which I cannot now identify.

6. *OPUNTIA ENGELMANNI*, *Salm.* San Diego, on dry hillsides, in patches, 4 to 6 feet high. Originally discovered about Chihuahua, this species appears to extend westward to the Pacific.

7. *O. TUNA*, *Mill.*, is cultivated for fences, and naturalized about the missions; called “Tuña.” It is 10–15 feet high; the fruit large and edible.

8. *O. PROLIFERA*, n. sp.: caule erecto ligneo; ramulis cylindricis tuberculatis divaricatis; aculeis fuscis vaginalis; bacca spinulosa.

San Diego, on arid hills and in dry creek beds. Plant 3–8 feet high, forming impenetrable thickets. Near *O. arborescens* of New Mexico; but the red flowers smaller, the berry spinous, etc.

9. *O. SERPENTINA*, n. sp.: procumbens; articulis cylindricis elongatis tuberculatis; aculeis 7–9 vaginalis; bacca sicca hemispherica aculeatissima.

Dry hillsides, San Diego.

10. *O. RAMOSISSIMA*, n. sp.: caule erecto ligneo divaricato-ramosissimo; articulis gracilibus cylindricis tuberculatis cæsiis; aculeis subsolitariis saccato-vaginatiss; bacca sicca tuberculata setosa et aculeata.

Gravelly soil near the Colorado, and in the desert. Plant two feet high; the joints half an inch in diameter. Approaches the *Opuntia cylindraceæ graciliores*.

11. *O. PARRYI*, n. sp.: caule prostrato; articulis adscendentibus tuberculatis; setis fuscis; aculeis brevibus albidis, singulo longiore deflexo; bacca subglobosa setoso-aculeata.

Eastern slope of the California mountains, near San Felipe. Joints four to eight inches long; the longest spines half an inch long. Flower one arid a half inch in diameter, yellowish-green. Approaches the *Opuntia clavata*.

Mr. Charles Wright, well known to the botanical world by his collections made in the southwest, now also attached to the Mexican boundary commission, has, under the instruction of Col. Graham, made large and interesting collections of Cacti in western Texas and southern New Mexico, and sent them to me for examination.

It is impossible here to give as full an account of them as would be desirable; but most of them are now in cultivation and will be described hereafter. Most of the Cactaceæ discovered by Wislizenus, Fendler and Gregg are among them, together with a considerable number of new species. I will here only state that my doubts in regard to the fruit of *Cereus Greggii*, expressed in my account of the plant in Emory's Report, have been entirely dispelled by Mr. Wright. He says that the plant is large, much branched, has a very large fleshy root, generally implanted in hard stony soil, and the pulpy scarlet fruit is just as figured in Emory's Report, stiped at base and attenuated above. The seeds he sends are black and opaque, rugose and pitted, about one line in diameter. They have germinated well with me. This same plant has been sent from Chihuahua to Kew by Mr. Potts; and has been described by Prince Salm as *Cereus Pottsii*, which name however must give way to the prior name, *C. Greggii*. It is every way a very singular plant, and though found from western Texas and Chihuahua to El Paso, the copper mines, and the lower Gila, appears to be rare every where.

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CONDUCTED BY  
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JAMES D. DANA.

IN CONNECTION WITH  
PROF. ASA GRAY, OF CAMBRIDGE,  
PROF. LOUIS AGASSIZ, OF CAMBRIDGE  
DR. WALDO I. BURNETT, OF BOSTON  
DR. WOLCOTT GIBBS.

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gons below are twice as distant; each set in turn may be seen in its own plane, and without confusion from the other. We do not refer to these hexagons as an instance of the interior membrane referred to in the passage just now extracted, which seems to indicate a different one. The appearances are the same on every specimen, and fragment, whether lying flat or edgewise. The striæ are similar, only more difficult to distinguish with accuracy, to the *fine* diagonal markings on the surfaces of *Triceratium*, *Actinocyclus*, *Coscinodiscus*, and other genera which have large hexagonal cells.

An able optician from Berlin says that the importance of spherical correction is but imperfectly understood in Germany: we thus find accounted for the mistakes of Ehrenberg, which have caused so much surprise, and Dr. Hannover's omitting all mention of a screw collar, in a work of such merit as to be selected for translation into English.

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ART. XXIII.—*Further Notes on Cereus giganteus of Southeastern California, with a short account of another allied species in Sonora*; by Dr. GEORGE ENGELMANN, St. Louis, Missouri.

SPECIMENS of flowers and fruit, together with interesting notes and drawings communicated by Mr. George Thurber, and specimens of ribs of the plant with spines presented by Dr. Parry, enable me to perfect the history of this giant Cactus.\* Mr. Thurber travelled through the Gila country and Sonora, as one of Mr. Commissioner Bartlett's party, in the summer of 1851, and is believed to be the only scientific gentleman who has seen the plant in question in flower. These materials enable me to furnish the following detailed character.

CEREUS GIGANTEUS, *Engelm.*: erectus, elatus, simplex, s. ramis paucis erectis caule cylindrico versus apicem sensim attenuato brevioribus candelabriformis; vertice applanato tomentosus; costis ad basin caulis sub-12 versus apicem 18–20 rectis obtusis (veterioribus ad caulis basin obtusissimis) subrepandis; sinibus ad basin caulis latissimis versus apicem profundis angustioribus angustissimisque; areolis prominentibus ovato-orbiculatis junioribus albido-tomentosis; aculeis rectis basi valde bulbosis tenuiter sulcatis angulatisque albidis demum cinereis, radialibus 12–16 imo summisque brevioribus, lateralibus (præcipue inferioribus) longioribus robustioribus subinde cum aculeis adventitiis paucis setaceis summo areolæ margini adjectis; aculeis centralibus 6 robustis albidis basi nigris apice rubellis demum totis cinereis, 4 inferiori-

\* See this Journal, New Series, vol xiv, page 335, Nov, 1852.

bus decussatis quorum infimus longissimus robustissimus deflexus, 2 superioribus lateralibus brevioribus; floribus versus apicem caulium ramorumque sparsis, tubo ampliato breviusculo petalisque patulis; ovario ovato sepalis 25–30 squamiformibus triangulatis acutis in axilla fulvo-villosis stipato; sepalis tubi sub-30 orbiculato-subtriangularibus mucronatis, inferioribus in axilla lanigeris, superioribus nudis, sepalis intimis 10–15 spathulatis obtusis carnosis (pallide viridibus albescentibus); petalis sub-25 obovato-spathulatis obtusis integris crispatis coriaceo-carnosis crassis (flavescenti-albidis); staminibus numerosissimis, filamentis superiori tubi parti adnatis (inferiore nudo); stylo stamina paulo superante; stigmatibus multifido; bacca obovata squamis sepaloideis triangularibus carnosis minutis ad axillam fulvo-lanatis stipata, pericarpio duriusculo carnosio, demum valvis 3–4 patentibus reflexisve dehiscente; seminibus numerosissimis in pulpa saccharina nidulantibus oblique obovatis lævibus lucidis exalbuminosis; embryone cotyledonibus foliaceis incumbentibus hamato.

This species ranges from north of the Gila river southwardly into Sonora, to within 20 miles of Guaymas on the Californian Gulf. It doubtless also occurs on the Peninsula of California; where, according to Vanegas in his history, published about 100 years ago, the fruit of a great Cactus forms an important article of food to the natives of the eastern coast, the harvest time of which was a season of great festivity. The flowers are produced in May and June, and the fruit ripens in July and August. Mr. Thurber collected the last flowers and the first ripe fruit in the beginning of July. He has collected abundance of seed, and will be pleased to communicate it to those who take an interest in the cultivation of Cacti. The youngest plants Mr. Thurber noticed were three or four feet high, with narrow furrows and long spines; the smallest flowering plants were about 12 feet high, and the tallest specimens observed appeared to reach the elevation of 45 or 50 feet.

The ligneous fascicles correspond with the intervals between the ribs, and not with the ribs themselves; of which Dr. Parry has fully satisfied himself, and which indeed is the case in all ribbed Cacti. From between these bundles ligneous fibres radiate horizontally towards the ribs, and especially to the areolæ.

At the base of the stem the ribs are broad and obtuse, with wide and shallow intervals; upwards the ribs are somewhat triangular, rounded or obtuse, with deep and acutish grooves between them; towards the top of the plant the ribs are equally obtuse, but quite compressed, and the grooves are deep and narrow.

The elevated areolæ are 7 lines long, nearly 6 lines in diameter, about an inch distant from one another, sometimes more closely approximated.

Lowest and upper radial spines 6 to 12 lines long, sometimes the upper ones with a few additional, shorter, flexuous, setaceous spines: lateral ones 12–18 lines long, the lower ones longest; the four lower central spines straight or very slightly curved downwards, 20–30 lines long; the two upper central spines 15 to 18 lines long. The stoutest spines are one line in diameter, their bulbous base being fully twice as thick. The old spines together with the whole areola readily come off in one bunch, but generally the 6 central spines fall off first, leaving the radiating ones appressed to the stem, till finally they also fall away.

The flowers are produced near the summit of the plant, but not on it, and the fruit is usually 6–12 inches from it.

The dried flower communicated by Mr. Thurber is 3 inches long; but the drawing represents the flowers as fully 4 inches in length and diameter. The ovary in the dried specimen is  $\frac{3}{4}$ ths of an inch long; the lower naked part of the tube 1 inch, the upper stamiferous much widened part  $\frac{3}{4}$ ths of an inch long. Upper sepals fleshy, greenish white,  $\frac{3}{4}$ ths of an inch long, below 2, above 4 lines wide. Petals of a light cream color, an inch long, 6–7 lines wide above, very thick and fleshy, and very much curled. Filaments light yellow, adnate to the upper half of the tube: anthers 0.8 to 0.9 of a line long, linear, emarginate at the base and apex. Style not seen; the drawing represents the numerous (15–20?) stigmata as half an inch long, suberect, of a green color. The flowers appear to be open night and day, and probably for several days in succession.

The fruit sent by Mr. Thurber (in alcohol) is obovate  $2\frac{1}{2}$  inches long, by  $1\frac{1}{2}$  in diameter, beset with about thirty scales, having short brownish wool in their axils, but entirely destitute of spines. Mr. Thurber informs me that this specimen is unusually long: the fruit, he says, is usually 2 or 3 inches long by  $1\frac{1}{2}$  to 2 in diameter; the color is green, reddish towards the summit; the remains of the flower fall off, leaving a broad and convex scar. The pericarp has the hardness of a green cucumber, somewhat softer towards the apex, and is about 2 lines thick: it bursts open on the plant with 3 or mostly 4 irregular, interiorly red valves, which spread horizontally, and appear like a red flower, when seen at a distance, which accounts for the report of this species having red flowers. The crimson-colored and rather insipid pulp has the consistency of a fresh fig; it completely separates from the rind, and drying up from the heat of the sun, falls to the ground, or is beaten down, when it is collected by the natives and rolled into balls, which keep several months, or is pressed for (he thick molasses-like saccharine juice which it contains. The innumerable seeds are 0.7 to 0.8 lines long.

Another, apparently nearly allied species, was collected in Northern Sonora. From the half of a flower before me, together

with Mr. Thurber's meagre notes, (other specimens unfortunately having been lost,) I have ventured to make out the following description:

*CEREUS THURBERI* (n. sp.): erectus, elatior, e basi ramosus sub-14-costatus, sulcis parum profundis, aculeis brevibus nigricantibus; floribus tubuloso-campanulatis virescenti-albidis; ovario globoso sepalis 80–100 carnosiss squamiformibus triangularibus acutis imbricatis ad axillam villosis stipato; sepalis tubi inferioribus 24 lanceolatis acutiusculis axilla nudis, superioribus 20–25 orbiculato-obovatis obtusis; petalis 16–20 obovato-spathulatis obtusis crassis.

Collected in June 1851, in a rocky cañon near the mountain pass of Bacuachi, a small town on the road to Arispe, in Sonora; afterwards found with *Cereus giganteus*, near Santa Cruz: it abounds also near Magdalena and Ures. Santa Cruz appears to be the northern limit of this species, which does not extend to the Gila river. Stems 4 to 12 feet high, many from the same base, 6 to 10 inches in diameter, sometimes articulated, occasionally branching above, with about 14 ribs and shallow grooves. Flowers greenish white, borne about a foot below the summit of the stem. Dried flower  $2\frac{3}{4}$  inches long; the tube narrower, and more elongated than in *C. giganteus*; the globose ovary and the naked and stamiferous part of the tube each about  $\frac{3}{4}$  inch long; free part of petals of the same length, and 4 lines wide. Anthers much larger than in the foregoing species, 1.3 to 1.4 lines long. Style not seen.

I have dedicated this to the collector, Mr. George Thurber, of Rhode Island, an excellent botanist, who has kindly furnished me with the materials for this article.

*Cereus Thurberi* and *C. giganteus* appear to be closely allied species. They have high and erect stems, flowers with a short tube, half of which is naked, the filaments occupying only the upper half of the tube; both have short and fleshy sepals on the ovary, with short wool in their axils, unaccompanied by any bristles or spines; in both the petals are whitish, obtuse, and fleshy.

Both, and especially *C. giganteus*, stand very near the *Pilocerei* on account of the great height of the stem, the short ventricose tube of the flower, and the thick petals; but they have not the least indication of a *cephalium* (or woolly head) nor of any particular development of wool; their flowers spring from the axils of the ordinary and unaltered areolæ; and the seed is quite different, at least from that of *Pilocereus senilis*, the only species of that genus, I believe, which has been well examined; these seeds are said to be obliquely thimble shaped, densely dotted, and to have an embryo with thick globose cotyledons. It is also said that the filaments cover the whole inside of the tube of the flower,

and even the free upper part of the ovary. In all the *Cerei* and *Echinonacti* examined by me, I find the lowest part of the tube free, the filaments being adnate to some distance above the ovary. It is not improbable that the Chilian velvety *Cerei* (*Velutini*, Pr. Salm.) are to be classed near our species. The flower of what appears to be *Cereus Chilensis*. Pfr., obtained near Valparaiso, and figured by the artist of the U. S. Exploring Expedition, greatly resembles that of *C. Thurberi*: it is a little larger, but has the same shape, and the same closely imbricated sepals on the ovary; the tube has about 100 sepals, and the white petals are acute; whether fleshy or not is uncertain.

ART. XXIV.—*On the Chemical Composition of Recent and Fossil Lingule, and some other Shells*; by W. E. LOGAN, F.R.S., and T. S. HUNT.

IN the Report of Progress of the Geological Survey of Canada for 1851-52, we have mentioned the existence of small masses containing phosphate of lime, and having the characters of coprolites, which occur in several parts of the Lower Silurian rocks. In a bed of silicious conglomerate towards the top of the calciferous sandstone, at the Lac des Allumettes, on the Ottawa, they are abundant in cylindrical and imitative shapes, sometimes an inch in diameter. The same material forms casts of the interior of a species of *Holopea* or *Pleurotomaria*, and often fills or completely incases the separated valves of a large species of *Lingula*, which Salter has referred to *L. parallela* of Phillips. The phosphatic matter is porous, friable, and of a chocolate brown color; it contains intermixed a large quantity of sand; and small pebbles of quartz are sometimes partly imbedded in it. The analysis of one specimen gave 36 per cent. of phosphate of lime, with 5 p. c. of carbonate and fluorid, besides some magnesia and oxyd of iron, and 50 p. c. of silicious sand.

Similar masses occur in the same formation at Grenville, and in the lower part of the Chazy limestone at Hawkesbury, in both cases containing fragments of *Lingula*. Those from the latter place, are rounded in shape, and from one-fourth to one-half of an inch in diameter, blackish without, but yellowish-brown within, and having an earthy fracture; the analysis of one of them gave:

|                                                    |   |       |
|----------------------------------------------------|---|-------|
| Phosphate of lime, ( $\text{PO}_5, 3\text{CaO}$ ), | - | 44.70 |
| Carbonate of lime, - - - -                         | - | 6.60  |
| Carbonate of magnesia, - - -                       | - | 4.76  |
| Peroxyd of iron, and a trace of Alumina,           |   | 8.60  |
| Insoluble silicious residue, - - -                 | - | 27.90 |
| Volatile matter, - - - - -                         | - | 5.00  |

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97.56

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the *Scrophulariaceæ*, and to some observations made by his pupil, Mr. Clark, several years ago, upon *Mimulus*, showing that this genus of the *Antirrhinideæ* not rarely has the lobes of the lower lip of the corolla external in æstivation, as in the *Rhinanthideæ*. Professor Gray had recently noticed the same thing in an anomalous still unpublished *Pentstemon*, which presented both modes of æstivation in different flower-buds of the same inflorescence.

The Corresponding Secretary communicated, from the author, the following

“*Synopsis of the Cactaceæ of the Territory of the United States and Adjacent Regions*, by GEORGE ENGELMANN, M. D., of St. Louis, Missouri.

“The only Cactus known to Linnæus from the countries north of Mexico was his *Cactus Opuntia (Opuntia vulgaris)*. Long after him, more than forty years ago, Nuttall, the pioneer of West American botany, discovered two *Mamillariæ* and two *Opunticæ* on the Upper Missouri, and again, twenty years later, in California, a new *Echinocactus*. About ten years ago we became acquainted with numerous new Cactaceæ, in Texas through Mr. F. Lindheimer; in New Mexico through Dr. A. Wislizenus; and in Northern Mexico through the same explorer and Dr. J. Gregg: some others (and among them the giant of Cacti) were indicated in the Gila country by the then Lieutenant W. H. Emory. Soon afterwards Mr. A. Fendler collected several new species about Santa Fé. Mr. Charles Wright, a few years later (1849), discovered in Western Texas and Southern New Mexico still other undescribed Cacti.

“But the greatest addition to our knowledge of the Cactaceæ of the southern part of the United States was made by the gentlemen connected with the United States and Mexican Boundary Commission, at first under Colonel Graham, and subsequently under Major Emory. Science is indebted principally to Dr. C. C. Parry, Mr. Charles Wright, Dr. J. M. Bigelow, Mr. George Thurber, and Mr. A. Schott, for valuable collections of living as well as dried specimens, and for full notes taken on the spot.

“About the same time, Mr. A. Trecul of France, and after him Dr. H. Poselger of Prussia, traversed Southern Texas and Northern Mexico, collecting many Cactaceæ, and increasing our knowledge of this interesting branch of botanical science.

“The Pacific Railroad expeditions since 1853 have opened fields not before explored; and Dr. Bigelow, the botanist and physician of Captain A. W. Whipple’s expedition along the 35th parallel, availed himself of these opportunities in a most successful manner; while Dr. F. V. Hayden, almost unaided in his adventurous expedition, has extended our knowledge of the northernmost Cactaceæ in the regions of the Upper Missouri and Yellowstone Rivers.

“The last, but by no means least addition, was made in 1854 and 1855, by Mr. Arthur Schott, during the exploration under Major Emory of the country south of the Gila River, known as the Gadsden Purchase.

“Most of the materials brought together by these different explorers have come into the hands of the writer; but few of the discoveries made since 1847 and 1848 have been given to the public; — partly because the material on hand very often was incomplete, and partly because it seemed desirable to publish the whole in an elaborate form with the Reports of the Boundary Commission and those of the Pacific Railroad Surveys. These reports are now in preparation; but the splendid plates which are to illustrate the natural history of these plants cannot be finished for some time; it is therefore deemed advisable now to publish short descriptions of the new species, and systematically to arrange them with those before known.

## CACTACEÆ.

### Tribus I. TUBULOSÆ, Miquel.

Subtrib. 1. PARALLELÆ. Cotyledones margine hilum versus spectantes, lateribus seminis parallelæ.

#### I. MAMILLARIA, Haw.

Ovarium baccaque læves. Semina fere exalbuminosa. Cotyledones abbreviatæ, plerumque erectæ, subconnatæ. — Plantæ mamillato-tuberculatæ; inflorescentia laterali s. verticali.

Subgen. 1. EUMAMILLARIA. Flores ex axillis tuberculorum anni prioris nunquam sulcatorum: ovarium plerumque immersum versus fructus maturitatem emergens.

#### § 1. *Polyacanthæ*, Salm.

1. M. MICROMERIS, E. in Bound. Comm. Rep.: parvula, simplex, globosa; tuberculis minimis verrucæformibus confertissimis; areolis



junioribussolumlanalaxavestitis;aculeissetiformibuscinereispluri-seriatis, in plantis junioribus sub 20 æqualibus lineam longis, radiantibusintuberculisfloriferis30 – 40undiquestellato-porrectis, superioribus 6 – 8 longioribus clavatis; floribus minimis subcentralibus.

Var.  $\beta$ . GREGGH: major, tuberculis majoribus aculeis paucioribus rigidioribus.

From El Paso eastward to the San Pedro River. “Var.  $\beta$ . near Saltillo. From  $\frac{1}{2}$  to  $1\frac{1}{2}$  inches in diameter;  $\beta$ . often 2 inches or even more in diameter; tubercles  $\frac{1}{2}$  – 1 line long, spines  $\frac{1}{2}$  –  $1\frac{1}{2}$  lines long, in  $\beta$ . 1 – 2 lines long; uppermost spines of each areola in the fully developed plant 3 to 4 times as long as the others, and strongly clavate, surrounded by long and loose wool, which, together with the upper part of the long spines, breaks or falls off after fructification. Flowers (and even fruits) nearly central, 3 lines in diameter, light pink. — Near *M. microthele*, Muhlenp., which, however, has 2 central spines.

2. *M. LASIACANTHA*, E. l. c.: parvula, simplex, globosa; tuberculis teretibus; aculeis setiformibus pilosulis s. denudatis 40 – 80 pluri-seriatis omnibus radiantibus; floribus lateralibus albidis.

On the Pecos River, in Western Texas: fl. in May. — Plant  $\frac{1}{2}$  to 1 or even  $1\frac{1}{2}$  inches high, and scarcely less in diameter; tubercles 2 – 3 lines long, spines  $1\frac{1}{2}$  –  $2\frac{1}{2}$  lines long. Flower whitish or very pale pink, 6 lines long. — *M. Schiedeana*, Ehrenb. seems to be similar, but is much larger, and has large tubercles with woolly axillæ, etc.

## § 2. *Crinitæ*, Salm.

### A. *Aculeis centralibus rectis*.

3. *M. PUSILLA*, DC, var. TEXANA, E. l. c.: ovato-globosa, prolifera, cæspitosa; tuberculis teretibus axilla longe-lanatis; aculeis pluri-seriatis, extimis 30 – 50 capillaceis crispatis, interioribus 10 – 12 rigidioribus brevioribus albidis, intimis 5 – 8 longioribus rigidis rectis versus apicem fuscatis; floribus lateralibus rubellis.

On the Rio Grande, near Eagle Pass and southward: fl. April – June. — Plant 1 – 2 inches high; spines 3 – 6 lines, flowers 7 – 10 lines, long. — Seems scarcely distinct from the well-known West Indian *M. pusilla*.

### B. *Aculeis centralibus uno alterove uncinato*.

4.? *M. BARBATA*, E. in Wisl. Rep.: aculeis radialibus biseriatis, centrali singulo deorsum hamato; floribus subcentralibus; seminibus tenuiter scrobiculatis.

Cosiquiriachi, west of Chihuahua. This species has borne flower and fruit with me, and my notes and my recollections indicate that they were central: hence the mark of doubt above, as to the proper position of this species here, where all the other closely allied forms belong.

5. *M. PHELLOSPERMA*, E. in B. C. R. (*M. tetrancistra*, *E. inpart*, *Sill. Jour. Nov.* 1852): ovata, subsimplex; tuberculis teretibus axilla lanata setigeris; aculeis radiantibus 40 – 60 biseriatis, exterioribus brevioribus tenuioribus, centralibus 3 – 4 robustioribus atrofuscis inferiore s. pluribus hamatis; floribus lateralibus; bacca pyriformi subsicca coccinea; seminibus globosis rugosis nigris massa fusca suberosa majore arilliformi auctis.

From the Gila to the eastern slope of the California mountains. — The name originally given had to be altered, because very rarely, if ever, are 4 hooked spines seen. In the original description this and the next species were confounded. — Plant 2 – 4 inches high. Radial spines 4 – 6 lines, central ones 5 – 9 lines long. — Apparently near *M. ancistroides*, Lem., which, however, has the radial spines all homogeneous.

6. *M. GRAHAMI*, E. l. c.: subglobosa, simplex s. demum e basi ramosa; tuberculis ovatis, axilla nudis; aculeis radiantibus 20 – 30 uniseriatis, centrali sursum hamatofuscato, additis sæpe 1 – 2 superioribus rectis; floribus lateralibus rubicundis; bacca ovata virescente; seminibus minutis scrobiculatis nigris.

Mountains from El Paso southward and westward to the Gila and Colorado, and up the latter river: fl. from June or July to August. — Plant 1 – 3 inches high; hooks much longer than the radial spines, which are 3 – 6 lines long. Flowers below the top, nearly one inch in diameter. Berry and seed small, the latter only 0.4 line long.

7. *M. WRIGHTII*, E. l. c.: depresso-globosa, simplex; tuberculis teretibus axilla nudis; aculeis radiantibus sub 12 albidis; centralibus sub-binis uncinatis fuscis vix longioribus; floribus lateralibus (?) purpureis; bacca subgloboso-ovata majuscula; seminibus scrobiculatis nigris.

New Mexico, on the Pecos and near the Copper Mines. — Plants  $1\frac{1}{2}$  – 3 inches in diameter. Spines 4 – 6 lines long. Flowers fully one inch in diameter, bright purple, with narrow acuminate petals. Berry large and purple: seed 0.7 line long.

8. *M. GOODRICHII*, Scheer: ovato-globosa, subsimplex; tuberculis

brevi-ovatis axillalanas et tigris; aculeis radiantibus 11 – 15 albidis, centralibus 3 – 4 fusco-atris, inferiore paulo longiore deorsum uncinato; floribus lateralibus.

San Diego, California. — Two or three inches high. Radial spines  $2\frac{1}{2}$  –  $3\frac{1}{2}$  lines long; the lower central spine a little longer. Flowers apparently yellowish-white, and half an inch in diameter.

§ 3. *Setosæ*, Salm.

9. *M. BICOLOR*, Lehm.: depressa, ovata, s. cylindræa, prolifera; axillis lanatis; tuberculis parvulis conicis; aculeis exterioribus 16 – 20 tenuissimis recurvato-radiantibus, centralibus 2 – 4 rigidis, majoribus albis apice nigris interdum subpollicaribus, supremo plerumque longissimo incurvo; floribus parvulis purpureis; stigmatibus 5.

Abundant on the calcareous hills of the Rio Grande below Laredo, Texas, *Dr. Poselger*: fl. June and July. — Plant 3 – 12 inches high, the larger specimens 2 – 3 inches in diameter; radial spines 1 – 2, lower central ones 4 – 5, the upper 6 – 10 lines long. Flower about 9 lines long.

§ 4. *Centrispinæ*, Salm. (All our species are simple and have a milky juice.)

10. *M. HEYDERI*, Muhlenpf. (1848): simplex, depresso-globosa; tuberculis elongatis pyramidatis subquadrangulatis; aculeis radiantibus 10 – 20 rectis, inferioribus longioribus, centrali singulo brevioribus; floribus lateralibus sordide rubellis; baccis elongato-clavatis; seminibus parvis rugulosis fulvis.

Var. *α*. *APPLANATA* (*M. applanata*, *E. in Pl. Lindh.* 1850): vertice applanato s. depresso, aculeis radialibus 15 – 22.

Var. *β*. *HEMISPHERICA* (*M. hemisphærica*, *E. l. c.*): vertice convexo, aculeis radialibus 9 – 12.

From San Antonio and New Braunfels, Texas, to Matamoras and westward to El Paso: fl. April, May. — Var. *α*. is the Northern and Western, and *β*. the Southern form. — *M. declivis*, Dietr. seems to belong here; but I have never met with a description of this plant.

11. *M. MEIACANTHA*, E. in B. C. R.: hemisphærica; tuberculis quadrangulato-pyramidatis compressis; aculeis paucis (5 – 9) rigidis rectis s. recurvatis, inferioribus paulo longioribus, centrali singulo erecto s. sursum flexo et cum ceteris radiante; floribus et baccis præcedentis.

Western Texas and New Mexico. — Very similar to the last; but tubercles larger, more compressed, more loosely arranged; the spines fewer and stouter; perhaps only a variety of it.

12. *M. GUMMIFERA*, E. in Wisl. Rep. Similar to the last two, but stouter; flower larger, darker, but otherwise little different. Radial spines 10 – 12; the lower ones much stouter and longer than the upper ones: central spines 1 or 2, shorter.

§ 5. *Longimammæ*, Salm.

13. *M. SPHÆRICA*, Dietr.: prolifera, cæspitosa; tuberculis ovato-elongatis acutatis; aculeis setaceis radialibus 12 – 14, centrali singulo subbreuiore vix robustiore; floris magni tubo supra ovarium emersum constricto elongato; petalis flavis acuminato-aristatis.

Hill-sides on the Rio Grande near Eagle Pass; also Corpus Christi, on the Gulf. — Single specimens clavate, but often forming dense hemispherical masses. Tubercles 6 – 8 lines; spines 3 – 5 lines long. Flower  $1\frac{1}{2}$  – 2 inches long. Fruit not seen.

Subgen. 2. *CORYPHANTHA*. Flores e basi tuberculorum hornotinarum aculeiferorum sulcatorum, vel in vertice ipso oriundi: ovarium emersum.

§ 1. *Albiloræ*.

14. *M. PYPYRACANTHA*, E. in Pl. Fendl. (Mem. Amer. Acad. 1849). This interesting plant has been collected only in a single specimen, near Santa Fé, which, together with the dried flowers, is in my possession. Shape of tubercles not well distinguishable, doubtful whether sulcate or not; the lower ones proliferous. Spines compressed, flexible, of the consistency of stiff paper; 8 radiating and 3 or 4 central; the lowest one of these longest and broadest. Flowers white, central, an inch or more in length and width. Fruit not seen.

§ 2. *Flavifloræ*.

\* *Laxifloræ*. (The originally central flowers are pushed aside by the continuous development of new tubercles.)

15. *M. NUTTALLII*, E.: simplex s. prolifera, cæspitosa; aculeis radialibus 10 – 17 setaceis rectis plerumque puberulis albidis, centrali singulo robustiore sæpius deficiente; sepalis fimbriatis et petalis flavidis apice parce denticulatis lanceolatis, s. lineari-lanceolatis acutis; stigmatibus 2 – 8 erectis vel patulis; bacca subglobosa tuberculis brevioribus coccinea; seminibus globosis scrobiculatis nigris.

Var. *α*. *BOREALIS* (*M. Nuttallii*, E. l. c. *Cactus mamillaris*, Nutt. Gen., 1818, non Linn.): subsimplex; aculeis setaceis 13 – 17 cum centrali sæpe deficiente puberulis; stigmatibus 2 – 5; baccis semibusque minoribus.

Var.  $\beta$ . CÆSPITOSA (M. similis, E. in Pl. Lindh. 1845): cæspitosa; aculeis radialibus 12 – 15 puberulis, centrali plerumque deficiente; floribus baccis seminibusque majoribus; stigmatibus 5 patulis.

Var.  $\gamma$ . ROBUSTIOR, E. in Pl. Lindh. 1850: subsimplex; tuberculis longioribus laxioribus, aculeis robustioribus lævibus, radialibus 10 – 12, centrali singulo; floribus majoribus; stigmatibus 7 – 8 patulis; seminibus ut in  $\beta$ .

Plains east of the Rocky and New Mexican Mountains. Var.  $\alpha$ . on the Upper Missouri;  $\beta$ . from Kansas River to New Braunfels in Texas;  $\gamma$ . from the Canadian River to the Colorado of Texas. The heads are one or two inches in diameter; the cæspitose masses of  $\beta$ . often a foot broad; spines 3 – 8 lines long. Flowers 1 – 2 inches long and wide, of a greenish or reddish or pure pale yellow color. Seeds 0.8 – 1.1 lines in diameter, more regularly globose than in most other Cactaceæ.

16. M. SCHEERII, Muhlenpf. 1847;  $\beta$ ? VALIDA, E. in B. C. R.: magna, ovato-globosa, subsimplex, glaucescens; tuberculis remotis patulis magnis e basi lata subcylindricis supra sulco profundo glandulis paucis munito (juniore lanato) subbilobis; areolis junioribus dense lanatis; aculeis 10 – 20 rectis robustis basi bulbosis albidis s. citrinis apice fuscatis, radialibus 9 – 16; centralibus 1 – 5 validioribus angulatis; floribus flavis ex axillis junioribus tomentosissimis.

Sandy ridges in the valley of the Rio Grande near El Paso: fl. July. The largest of our Northern Mamillariæ, 7 inches high and 5 in diameter; tubercles 1 – 1½ inches long; spines 10 – 18 lines in length, very stout, especially the central and lower radial ones. Flower 2 inches long, yellow. Fruit not seen. — *M. Scheerii* from Chihuahua, according to Prince Salm's description, is a smaller plant, with single central spines one inch in length, and 8 – 11 much shorter radial spines; the areolæ are described as naked: — nevertheless our plant is probably only the northern form of this species.

17. M. ROBUSTISPINA, A. Schott, in litt.: simplex s. cæspitosa; tuberculis patulis teretibus magnis sulcatis; areolis junioribus dense tomentosis; aculeis radialibus 12 – 15 robustis inferioribus robustioribus sæpe curvatis, superioribus rectis fasciculatis paullo tenuioribus, centrali singulo valido compresso recurvato, omnibus subpollicaribus corneis apice atratis; floribus luteis ex axillis junioribus tomentosissimis; seminibus magnis obovatis fuscis lævibus.

Sonora, on grassy prairies: fl. July. Tubercles nearly an inch

long, and an inch distant from one another; spines 9 – 15 lines long. Flowers 2 inches long, characterized by a very slender, constricted tube, very different from the wide tube of the foregoing species. Seeds fully  $1\frac{1}{2}$  lines long, larger than those of any other *Mamillaria* examined by me: embryo with some albumen, curved; cotyledons foliaceous! approaching the structure of the seed of most *Echinocacti*.

18. *M. RECURVISPINA*, E. in B. C. R.: simplex, depresso-globosa; tuberculis ovatis profundo sulcatis confertis; areolis obliquis ovatis, aculeis radialibus 12 – 20 rigidis recurvis intertextis albidis corneisve, aculeo centrali singulo (raro binis) robustiore longiore decurvato; floribus flavicantibus extus fuscatis ex axillis junioribus villosissimis.

Sonora: fl. July. Single heads 3 – 8 inches in diameter; tubercles 5 – 6 lines long; spines 4 – 9 lines long, upper ones often a little longer than the lower ones; central spine 6 – 10 lines long, darker. Flowers  $1\frac{1}{2}$  inches long. — This plant bears the closest resemblance to the next species, and must perhaps be classed with it; but in the dry specimen before me the flowers are not exactly vertical, as in that species.

\* \* *DENSIFLORÆ*. (Flowers and fruit remain central in the very woolly vertex of the plant, no new tubercles being developed before the fruit falls off; berries of all the species known to me oval, green; seeds brown, smooth.)

19. *M. COMPACTA*, E. in Wish Rep.: simplex, depresso-globosa; tuberculis abbreviato-conicis sulcatis confertis; areolis ovato-lanceolatis, aculeis radialibus 13 – 16 rigidis recurvis intertextis albidis corneisve, aculeo centrali erecto plerumque deficiente; floribus flavis extus fuscatis minoribus.

Cosiquiriachi, west of Chihuahua: fl. June and July. Plant 2 – 4 inches in diameter; distinguished from the last species by the acutish (not obtuse) tubercles, the more elongated areola, the erect central spine, which however is wanting in most specimens, and principally by the smaller and truly vertical flowers. Spines 5 – 10 lines long; flower  $1\frac{1}{4}$  –  $1\frac{1}{2}$  inches long and wide; seed 0.7 line long.

20. *M. PECTINATA*, E. in B. C. R.: simplex, globosa; tuberculis conicis abbreviatis, summis floriferis teretibus longioribus sulcatis; areolis oblongis; aculeis 16 – 24 rigidis recurvis intertextis subæqualibus s. in tuberculis summis superioribus longioribus fasciculatis omnibus radiantibus corneis s. albidis; floribus magnis sulphureis.

On the Pecos River, in Western Texas: fl. July. — Plant 1 – 2

inches in diameter. Lower tubercles 2 – 3, floriferous ones 5 – 6 lines long; spines 3 – 5, upper fasciculated ones 6 – 9 lines long. Flower  $2\frac{1}{2}$  – 3 inches in diameter; seed 0.9 line long.

21. *M. ECHINUS*, E. l. c.: simplex, globosa; tuberculis tereticis; areolis orbiculatis; aculeis rectis s. paullo curvatis intertextis albidis; radiantibus 16 – 30 summis paullo longioribus, centralibus 3 – 4, inferiore robustissimo subulato porrecto, superioribus 2 – 3 et cum radiantibus erectis; floribus magnis.

With the former. — Plant  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches in diameter; tubercles 5 – 6 lines long; lower and lateral spines 4 – 6, upper ones 6 – 10 lines long; upper central spines of the same length, and the lower central one a little shorter. This last one is unusually stout, subulate from a very thick base, and perpendicular on the centre of the plant, which gives it a very peculiar aspect. Flowers apparently about  $1\frac{1}{2}$  or 2 inches long.

22. *M. SCOLYMOIDES*, Scheidw. (1841): globosa s. ovata, subsimplex; tuberculis conicis, superioribus elongatis incurvis imbricatis; aculeis radiantibus 14 – 20 rectis s. plerumque recurvis albidis s. corneis, superioribus longioribus, centralibus 1 – 4 longioribus obscurioribus curvatis, superioribus sursum versis cum radialibus implicatis, inferiore robustiore longiore decurvo.

South of the Rio Grande; not yet discovered in our territory. — Plant 2 – 3 inches high; tubercles 5 – 8 lines long; radial spines 5 – 10 lines, the central ones 9 – 16 lines long. Flowers yellow, 2 inches long. — Perhaps this and both the foregoing species are only forms of the Mexican *M. cornifera*, of De Candolle. Only a close examination of these plants in their native wilds will enable us to decide this point.

23. *M. CALCARATA*, E. in Pl. Lindh. 2, 1850 (*M. sulcata*, E. in Pl. Lindh. 1, 1845. *M. strobiliformis*, *Muhlenpf.*? non Scheer): globosa, prolifera, cæspitosa; tuberculis e basi dilatata ovatis conicis; aculeis albidis, radialibus 8 – 10 rigidis subulatis rectis s. paullo recurvis, additis subinde ex summa areola aculeis adventitiis 3 – 5 fasciculatis tenuioribus, centrali singulo robustiore subulato recurvato, in plantis junioribus deficiente; floribus magnis sulphureis intus basi rubicundis.

Texas, from the Brazos to the Nueces rivers: fl. May. — Larger heads 2 –  $2\frac{1}{2}$  inches in diameter; cæspitose masses a foot or more large; tubercles spreading, or in older flowering plants often somewhat adpressed and imbricate, 7 – 9 lines long; spines 4 – 8 lines

long. Flower  $2\frac{1}{4}$  –  $2\frac{1}{2}$ - inches long, and of same diameter. Seeds a line long.

§ 3. *Rubrifloræ.*

\* *Sepalis integerrimis.*

24. M. CONOIDEA, DC. (M. strobiliformis, *E. in Wisl. Rep. non Scheer*): found only south of the Rio Grande.

\* \* *Sepalis fimbriatis.*

25.? M. POTTSII, Scheer: cylindrica, subramosa; tuberculis ovatis obtusis levissime sulcatis, axillis sublanuginosis; aculeis radialibus numerosissimis gracilibus albis, centralibus 6 – 12 validioribus expansi basi nodulosis apice sphacelatis; floribus magnis e viridi rubellis; baccis roseis.

Texas, on the Rio Grande, below Laredo, and from there to Chihuahua. — I have not seen this plant; the description is taken from Salm and Poselger.

26. M. TUBERCULOSA, E. in B. C. R.: ovata s. ovato-cylindrica, simplex s. ad basin parce prolifera; tuberculis e basi rhomboidea ovatis abbreviatis obtusis profunde sulcatis demum suberosis persistentibus confertis, axillis villosissimis; aculeis exterioribus 20 – 30 rigidis albidis, interioribus 5 – 9 robustioribus cæsiopurpureis sphacelatis, superioribus longioribus erectis, infimo brevioribus robusto porrecto s. deflexo; floribus in vertice densissime tomentosocentralibus pollicaribus dilute roseis; baccis elongato-ovatis rubris; seminibus minimis scrobiculatis.

On the mountains near El Paso, and eastward.: fl. May and June. Plant 2 – 5 inches high; tubercles  $2\frac{1}{2}$  – 3 lines long, dry and hard, not fleshy unless very young, nor shrivelling when old, but losing the spines and covering the lower part of the plant like corky protuberances. Outer spines usually 2 – 4, rarely 5 or 6, lines long; interior spines 4 – 9 lines long; those of the upper tubercles forming a tuft of grayish-purple color on top of the plant. Flowers very pale purple, one inch in diameter. Berry red, three fourths of an inch long, one fourth of an inch thick, crowned with the remains of the flower. Seeds short, thick, about half a line long. — The short, corky tubercles, with very deep grooves, and very woolly when young, together with the long red fruit, distinguish our species from all the allied forms.

27. M. DASYACANTHA, E. in B. C. R.: simplex, subglobosa; tuber-



culis teretibus laxis leviter sulcatis; axillis subvillosis; aculeis rectis tenuibus setaceis patulis, exterioribus 25 – 35 albidis, interioribus 7 – 13 longioribus purpureo-fuscis, centrali infero æquilongo; baccis centralibus ovatis; seminibus obovato-globosis nigricantibus scrobiculatis.

El Paso and eastward. — Specimens before me are  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches high, and a little less in diameter; tubercles 4 – 5 lines long; spines more slender and soft than in the allied species, often capillary, spreading, but not radiating, 6 – 12 lines long, only the lower exterior ones a little shorter. Seeds about half a line long. Very nearly allied to the next.

28. *M. VIVIPARA*, Haw.: simplex s. cæspitosa; tuberculis teretibus laxis leviter sulcatis; aculeis rectis rigidis, exterioribus patentissime radiantibus albidis 12 – 36, centralibus 3 – 12 robustioribus longioribus obscurioribus, singulo robustiore porrecto deflexove, ceteris sursum divergentibus; floribus subcentralibus purpureis magnis; baccis sublateralibus ovatis viridibus; seminibus obovatis scrobiculatis fulvis.

Var. *a. VERA*: depresso-globosa, simplex s. plerumque prolifera, cæspitosa; aculeis radialibus 14 – 20, centralibus 3 – 8.

Var. *β. RADIOSA*: ovata s. subcylindrica, simplex s. e basi ramosa; aculeis radialibus 12 – 36, centralibus 3 – 12. Subvar. *a. RADIOSA BOREALIS*: subglobosa; aculeis radialibus albidis 12 – 20, centralibus 3 – 6 purpureo-maculatis; floribus minoribus. — *b. RADIOSA NEOMEXICANA*: ovata; aculeis radialibus albidis 20 – 36, centralibus 3 – 12 supra purpurascensibus sphacelatis; floribus majoribus. — *c. RADIOSA TEXANA*: ovato-cylindrica; aculeis radialibus albidis 20 – 30, centralibus 4 – 5 flavis s. fulvis; floribus seminibusque magnis. *M. radiosa*, *E. in Plant. Lindh. 2.* 1850.

In the Western plains, and on the Rocky Mountains: var. *a.* on the Upper Missouri and Yellowstone Rivers; *β. a.* in Northern New Mexico; *β. b.* from Western Texas to New Mexico and Sonora; *β. c.* in Texas, west of New Braunfels. — The extreme forms are certainly very unlike one another, but the transitions are so gradual that I cannot draw strict limits between them. Even the proliferous growth of the original *M. vivipara* is not constant, and I have seen many simple specimens from the Upper Missouri. The simple ones seem to flower better than the proliferous ones, which are often sterile. — Plants from 1 to 5 inches high,  $1\frac{1}{2}$  – 2 inches in diameter; tubercles 4 – 6 lines long; spines always rigid, 3 – 10 lines long. Flowers different in size,  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches in diameter, beautifully purple, with numerous narrowly lanceolate acuminate petals. Seeds  $\frac{1}{2}$  – 1 line long.

29. *M. MACROMERIS*, E. in Wisl. Rep. (*M. dactylothele*, *Lab.*): simplex s. e basi ramosa, ovata; tuberculis magnis patulis, laxis, tenuiter ultra medium sulcatis; aculeis tenuibus elongatis rectis s. paullo curvatis exterioribus 10 – 17 albidis, centralibus sub-4 longioribus robustioribus subangulatis, fuscis s. nigricantibus; floribus ex areolis supra-axillaribus in tuberculo ipso oriundis magnis; bacca subglobosa viridi; seminibus parvis lævibus fuscis.

In the valley of the Rio Grande, from Southern New Mexico to the middle course of the river near Presidio, and even lower down: fl. July and August. — A most remarkable species in many respects, and forming a transition to *Echinocactus*, though the mamillate form is so very striking. plant 2 – 4 inches high; tubercles variable, 6 – 8 or 10 – 12 and even 15 lines long. Radial spines  $\frac{1}{2}$  –  $1\frac{1}{2}$  inches long; central ones often  $1\frac{1}{2}$  –  $2\frac{1}{4}$  inches in length. Axils always naked. Flower springing from the lower end of the groove, which runs down about two thirds of the tubercle,  $2\frac{1}{2}$  – 3 inches in diameter, rose-colored or purple; not rarely with a few sepaloïd scales on the ovary (and fruit). Seeds thick, but only 0.6 – 0.8 line long.

Subgen. 3. *ANHALONIUM*. (Gen. *Anhalonium*, *Lem.* *Ariocarpus*, *Scheidw.*) Flores e basi tuberculorum hornotinorum triangularium subinermium vel in vertice ipso oriundi: ovarium emersum.

30. *M. FISSURATA*, E. in B. C. R.: simplex, depresso-globosa s. applanata; tuberculis e basi applanata crassis extus infraque lævibus, supra sulco centrali villosolateralibusque glabris profunde quadripartitis sulcisque transversalibus superficialiter multifidis, inermibus; floribus e villo longo sericeo centralibus roseis; baccis ovatis virescentibus in lana densa occultis; seminibus nigris tuberculatis.

On the limestone hills, near the junction of the Pecos with the Rio Grande: fl. October. Heads 2 –  $4\frac{1}{2}$  inches in diameter; tubercles 6 – 10 lines long, and a little less broad; central longitudinal groove in the very young ones bearing dense silky wool over half an inch long, which by age becomes dirty and matted, and finally disappears entirely in the very old ones. The lower end of the groove, which only extends down as far as the rough or verrucose part of the tubercle goes (about two thirds downward), bears the flower and fruit, very much like the floriferous areola of the last-mentioned species. Flower about one inch long and wide. Seed very roughly tuberculated, different from that of any other *Mamillaria* examined by inc, but quite similar to that of other *Anhalonia*.

## II. ECHINOCACTUS, Link. &amp; Otto.

Ovarium emersum baccaque sepalis stipata. Semina sæpe albuminosa. Cotyledones plus minus foliaceæ plerumque hamatæ. — Plantæ subglobosæ, costatæ; inflorescentia verticali.

§ 1. *Hamati*, Salm.

1. E. SCHEEHI, Salm: globosus s. ovatus; costis 10 obtusis interruptis; tuberculis supra ad medium sulcatis; aculeis radialibus 15 – 18 setaceis, centralibus 3 – 4 angulatis variegatis, superioribus rectis longioribus sursum divaricatis, inferiore robustiore brevioribus hamatis; floribus minoribus flavo-virescentibus; bacca virescente; seminibus fuscis.

About Eagle Pass, on the Rio Grande: fl. August to October. — A most elegant little species,  $1\frac{1}{2}$  – 2 inches high; larger spines black and white variegated; radial ones 3 – 6, central ones 6 – 12 lines long; floriferous areola united by a groove of 1 –  $2\frac{1}{2}$  lines in length with the spines, resembling the groove of the *Coryphanthæ*, especially of *Mamillaria macromeris*. Green flower an inch long, much less in diameter.

2. E. BREVI-HAMATUS, E. in B. C. R.: obovato-globosus; costis 13 compressis obtusis interruptis; tuberculis supra usque ad basin sulcatis; aculeis radialibus 12 teretibus albidis, centralibus 4 complanatis, lateralibus rectis sursum versis paullo longioribus, summo debiliore et infimo robustiore deorsum hamato brevioribus; floribus minoribus roseis.

On the San Pedro, and about Eagle Pass: fl. April. — Very similar to the last; but larger, 3 – 4 inches high, with fewer spines, the lower central usually hardly longer than the upper radial ones, about one inch long; lower radial spines shorter, and upper central ones longer. The rose-colored flowers are 12 – 16 lines long, much less wide. Fruit unknown.

3. E. WHIPPLEI, E. & B. in Pacific R. R. Rep.: ovato-globosus; costis 13 – 15 interruptis; aculeis radialibus 7 compressis albidis, centralibus 4 longioribus robustioribus compresso-quadrangulatis, summo latiore longiore, infimo robustiore deorsum hamato; seminibus magnis nigris.

On the Colorado-Chiquito, in Western New Mexico. — Plant 3 – 5 inches high; exterior spines 6 – 9 lines, upper central spine 12 – 18

lines long, and  $\frac{1}{2}$  –  $1\frac{1}{4}$  lines broad; other central spines a little shorter. Seed very large, over  $1\frac{1}{2}$  lines in the longest diameter. — Principally characterized by the few radial spines and the very broad upper central one, which with the former forms an almost regular circle.

4. *E. POLYANCISTRUS*, E. & B. l. c.: ovatus, s. ovato-cylindricus; costis 13 – 17 interruptis; aculeis radialibus sub-19 complanatis albis, superioribus latioribus longioribus, inferioribus setaceis, centralibus difformibus, summo complanato elongato sursum curvato albo, reliquis 5 – 10 teretiusculis purpureo-fuscis, superioribus 2 rectis, ceteris uncinatis.

Eastern slope of the California mountains, at the head of the Mojave River. — Plant 4 – 10 inches high, 3 – 4 in diameter; radial spines  $2\frac{1}{2}$  – 2 inches long; upper central spine 3 – 5, the others  $1\frac{1}{2}$  –  $3\frac{1}{2}$  inches long, the lowest shorter than the others. The number of the hooked spines varies from 3 to 7, according to age and development.

5. *E. UNCINATUS*, Hopf., var.? *WRIGHTII*, E. in B. C. R.: glaucescens, ovatus; costis 13 interruptis; tuberculis usque ad basin sulcatis; aculeis radialibus 8, inferioribus 3 uncinatis fuscis, reliquis 5 rectis, centralis singulo angulato complanato flexuoso hamato elongato erecto stramineo apice fusco; floribus fusco-purpureis minoribus.

Near El Paso and on the Rio Grande below: fl. March and April. — Plant 3 – 6 inches high, 2 –  $3\frac{1}{2}$  inches in diameter; the tuft of long, erect, straw-colored spines is very characteristic. Lower hooked radial spines about an inch long; upper ones a little longer; central spine 2 – 4 inches long. Flowers 1 –  $1\frac{1}{2}$  inches long. Berry fleshy, scaly. Seeds much compressed. — The Mexican *E. uncinatus* has 7 – 8 radial spines, similarly arranged, and 4 central spines; the three upper ones not much longer than the upper radial ones and straight, the lower one elongated and hooked. The flower and seed differ also to some extent.

6. *E. SETISPINUS*, E. in Pl. Lindh. 1845: globosus, ovatus s. sub-cylindricus; costis 13 compressis acutatis angulatis; tuberculis brevissime sulcatis; aculeis radialibus 10 – 16 setaceis; centrali subsingulo robustiore terete fusco uncinato s. flexuoso curvato; floribus magnis flavis intus coccineis; bacca pisiformi coccinea; seminibus tuberculatis.

Var. *α*. *HAMATUS*: aculeis radialibus sub 12, centrali hamato robusto. — *E. hamatus*, *Muhlenpf.* E. Muhlenpfordtii, *Fen.*

Var. *β*. *SETACEUS*: minor; aculeis pluribus, centralibus 1 – 3 tenuioribus vix hamatis.

Texas, from the Colorado to the Rio Grande, and westward as far as the San Pedro River: fl. April to October. — It is unnecessary further to describe this well-known and well-characterized species, which is now frequently cultivated; the compressed ribs, setaceous spines, small red berry, and tuberculated seeds easily distinguish it from all its allies.

7. *E. SINUATUS*, Dietr. (1851): globosus; costis 13 compressis acutiusculis interruptis; aculeis radialibus setaceis, 3 superioribus et 3 inferioribus rectiusculis fuscatis 1, lateralibus 2 – 6 tenuioribus albidis flexuosis, rarissime hamatis; centralibus 4 robustioribus, 3 superioribus rectis purpureo-variegatis, inferiore compresso seu canaliculato elongato flexuoso vel hamato stramineo; floribus magnis flavis; bacca ovata viridi; seminibus minutissime punctatis.

Country along the Rio Grande near Eagle Pass, and from there eastward. — Intermediate between the foregoing and the next species, and considered by Dr. Poselger a connecting link between them; but easily distinguished from the former by the larger size, thicker ribs, flattened central spine, and by the shining, finely dotted seeds; from the latter, to which it approaches much more closely, by the more compressed and less strongly tuberculated ribs, the smaller number of stigmata (8 – 12), smaller fruit, and much more finely dotted seed. — Poselger considers this a variety of *E. setispinus*. His *E. setispinus*, var. *robustus*, has the same seeds, and no doubt also belongs here; it is said to have all the 4 central spines, and some of the radial ones, hooked. *E. Treculianus*, Lab. belongs here, or perhaps to the next.

8. *E. LONGEHAMATUS*, Gal.: subglobosus; costis 13 – 17 obtusis tuberculato-interruptis; tuberculis breviter sulcatis; aculeis radialibus rigidis subteretibus, infimis summisque ternis, lateralibus 2 – 6 longioribus; centralibus 4 robustis angulatis annulatis, quorum infimus deorsum hamatus rectus seu flexuosus, additis subinde 2 – 4 superioribus cum radialibus superioribus fasciculatis; floribus magnis flavis; stigmatibus 15 – 18; bacca oblonga virescente squamosa; seminibus lucidis exsculptis.

Var. *α*. *CRASSISPINUS*: aculeis robustissimis radialibus 8 – 11, centralibus 4 angulatis, infimo flexuoso plus minus hamato. *E. flexispinus*, *E. in Wisl. Rep. non Salm.*

Var. *β*, *GRACILISPINUS*: aculeis gracilioribus 16 – 20, exterioribus 12 – 14, centralibus 4 – 8, infimo elongato hamato. *E. hamatocanthus*, *Muhl.*

Var.  $\gamma$ . BREVISPINUS: aculeis gracilioribus radialibus 8 – 11, centralibus 4 teretibus cum infimo hamato radiales vix superantibus.

East of El Paso, near the Pecos and San Pedro Rivers, and along the middle course of the Rio Grande: var.  $\alpha$ . south of the Rio Grande. Fl. July and August. — Plants from  $\frac{1}{2}$  – 2 feet high; the larger ones ovate; areola distant; spines very different in size, in the different varieties; radial spines 1 –  $3\frac{1}{2}$ , central spines  $1\frac{1}{2}$  –  $6\frac{1}{2}$  inches long; flowers  $2\frac{1}{2}$  –  $3\frac{1}{2}$  inches long; seeds similar to the last, but with much larger pits.

§ 2. *Cornigeri*.

A. *Heteracanthi*.

9. E. WISLIZENI, E. in Wisl. Rep.: giganteus, globoso-ovatus; costis 21 compressis crenatis; areolis elongatis; aculeis radialibus summis infimisque 6 robustis rectis seu curvatis, lateralibus 14 – 20 (additis subinde summis brevioribus fasciculatis) tenuibus elongatis flexuosis; centralibus 4 robustis angulatis annulatis rubellis, 3 superioribus rectis, inferiore canaliculato deorsum hamato; floribus flavis; bacca ovata squamosissima; seminibus reticulatis.

Valley of the Rio Grande about El Paso, and thence to the Upper Gila: fl. July and August. — Plant 2 – 4 feet high; diameter smaller; radial spines 1 – 2, central ones  $1\frac{1}{2}$  – 3 inches long. Flowers  $2\frac{1}{2}$  inches long.

10. E. LECONTEI, E. in P. R. R.: giganteus, obovato-claviformis; costis 20 – 30 compressis crenatis; areolis elongatis; aculeis radialibus summis infimisque 6 – 10 robustis angulatis plus minus curvatis, lateralibus 10 – 16 (additis subinde summis brevioribus fasciculatis) tenuibus elongatis flexuosis, centralibus 4 robustis compressis annulatis corneis, 3 superioribus sursum inferiore subinde subhamato deorsum curvatis; floribus flavis; bacca ovata squamosa; seminibus scrobiculatis.

On the lower parts of the Gila and Colorado Rivers, and in Sonora: fl. August and September. Very similar to the last, but a more slender, often quite clavate plant; larger specimens 3 – 4 feet high, and of only one third that diameter; arrangement of spines similar, but generally 5 (not 3) radial spines below the lowest central one; central spines more compressed, upper ones curved, lower one rarely somewhat hooked; flower, fruit, and seed smaller; seed more oblong and pitted.

E. INGENS, Zucc., in the number and arrangement of spines, is the simple type of our more northern species: it has on the oval areolæ 4 stout cruciate central spines, 3 upper and 3 lower radial ones, and only 2 slender lateral spines. Seeds smooth. The flower seems to refer it, however, to the *Eriocarp*.

B. *Homœacanthi*.

\* *Lepidocarp*.

11. E. EMORYI, E. (in Emory's Rep. 1848, and B. C. R.): grandis, ovatus; costis 13 – 20 obtusis tuberculatis; areolis ovatis; aculeis radialibus 7 – 8 subæqualibus robustis subangulatis annulatis paullo recurvatis rubellis 1 – 2 pollicaribus, centrali singulo recurvo s. subhamato paullo robustiore; floribus magnis purpurascensibus.

Lower Colorado, and principally in Sonora: fl. August and September. Larger plants  $2\frac{1}{2}$  – 3 feet high; spines usually 1 – 2, and, in a large specimen from Guaymas, nearly 3 inches long. Flowers about 3 inches long. Fruit unknown.

12. E. VIRIDESCENS, Nutt.: globosus, simplex seu raro ramosus; costis 13 – 21; aculeis robustis compressis annulatis plus minus curvatis rubellis, radialibus 12 – 20 infimo brevioribus magis curvatis; centralibus 4 angulatis robustioribus longioribus, infimo rectiore longiore; floribus virescentibus; bacca squamosa; seminibus minutissimis scrobiculatis.

San Diego, California. — Less than a foot in diameter, globose or flattened; radial spines 5 – 10 lines long, 3 upper central ones a little longer, and lower central spine 12 – 18 lines long. Flower  $1\frac{1}{2}$  inches long.

13. E. CYLINDRACEUS, E. in Sill. Jour. 1852: ovatus seu subcylindricus, plerumque e basi ramosus; costis 21 vel pluribus; aculeis robustis compressis annulatis plus minus curvatis flexuosisve rubellis, radialibus sub-12, aculeis adventitiis sub-5 gracilioribus supra sæpe adjectis, infimo hamato, centralibus 4 angulatis robustissimis cruciatis, superiore latiore sursum recto, inferiore decurvato; floribus flavis; bacca squamosa.

San Felipe, on the eastern slope of the Californian mountains: fl. in June. — The largest specimens seen were 3 feet high and one foot in diameter; the branches or young single plants are globose. Radial spines 1 – 2 inches long; central spines 1 –  $1\frac{1}{2}$  lines broad, about 2 inches long. Similar to the last, but well distinguished by the characters indicated.

\* \* *Eriocarpi*.

14. *E. POLYCEPHALUS*, E. & B. in P. R. R.: ovatus seu demum cylindricus, e basi ramosus; costis 13 – 21 acutis; aculeis robustis compressis annulatis plus minus curvatis rubellis, radialibus 4 – 8, infimo deficiente, superioribus (si exstant) gracilioribus; centralibus 4 angulatis compressis, superiore latiore suberecto vel sursum curvato, inferiore longiore decurvo; floribus flavis dense lanatis; bacca sicca; seminibus magnis angulatis.

On the Mojave, Colorado, and Gila Rivers: fl. February and March. — Single only when young, forming bunches of 20 – 30 cylindrical equal-sized heads when older; the largest seen were 2 – 2½ feet high and about 10 inches in diameter. Exterior spines 1 – 2, interior ones 1½ – 3½, inches long. — Shape very much like the last, but the flower very distinct.

15. *E. PARRYI*, E. in B. C. R.: simplex, globosus vel depressus; costis 13 acutis; aculeis robustis angulatis annulatis albidis, radialibus 8 – 11, rectis s. paullo curvatis superioribus gracilioribus, infimo deficiente, centralibus 4 paullo longioribus robustioribus, infimo longiore decurvo; bacca sicca dense lanata.

West and southwest from El Paso. — Plant always single; largest specimens 8 – 12 inches high by 10 – 15 in diameter. — Very similar to the last; but apparently distinct by the manner of growth and the white spines. Unfortunately, no seeds were collected.

16. *E. HORIZONTALONIUS*, Lem., var. *CENTRISPINUS*, E. in B. C. R.: glaucus, depressus seu demum ovatus; costis 8 obtusissimis latissimis; areolis orbiculatis basitruncatis; aculeis robustis compressis annulatis recurvatis rubellis demum cinereis, radialibus 5 – 7 superioribus debilioribus, infimo deficiente, centrali singulo robustiore decurvato; floribus purpureis dense lanatis; bacca sicca lanata; seminibus magnis angulatis.

From Doñana, above El Paso, to the Pecos, and southward: fl. April and May. — Plant 2 – 8 inches high and 3 – 6 in diameter; spines ¾ – 1½ inches long, nearly equal. Flower 2½ inches long, but partly enveloped in dense wool. The original *E. horizontalonius* is said to have no central spine, and linear-lanceolate acuminate pale rose-colored petals: in our plant the petals are oblong-lanceolate and obtuse.

17. *E. TEXENSIS*, Hopf. (*E. Lindheimeri*, *E. in Pl. Lindh.* 1845):



depressus; costis 13 – 27 acutis undulatis; areolis cordatis; aculeis robustis annularis, plus minus curvatis rubellis, radialibus 6 – 7 infimo deficiente, centrali singulo robustiore compresso decurvato; floribus roseis dense lanatis; petalis laciniatis aristatis; bacca coccinea lanata; seminibus lævibus lucidis.

Southern Texas, and Northeastern Mexico, from the Colorado to Saltillo; not westward beyond the San Pedro River: fl. April and May. — Heads 8 – 12 inches in diameter, flat, or very old ones sometimes globose; spines from  $\frac{1}{2}$  – 2 inches long. Flowers about 2 inches long.

### § 3. *Theलोidei*, Salm.

18. *E. BICOLOR*, Gal., var. SCHOTTH, E. in B. C. R.: ovatus; costis 8 obtusis interruptis; aculeis radialibus 15 – 17 rectis, summis 2 – 4 longioribus latioribus compressis, centralibus 4, summo latiore longiore; floribus majoribus purpureas.

Mier, on the Rio Grande: fl. September. — Plant 4 – 6 inches high, 2 – 3 in diameter; upper radial spines about 1 inch, upper central one  $1\frac{1}{2}$  inches long; lower radial and central spines reddish variegated. Flower 2 – 3 inches long, bright purple or rose-colored. — Distinguished from the Mexican *E. bicolor*, principally by the larger number of radial spines, and the greater length of the upper central spine, which is carinate underneath.

### § 4. *Intertexti*.

19. *E. INTERTEXTUS*, E. in B. C. R.: minor, ovato-globosus; costis 13 acutis interruptis; tuberculis sulcatis; aculeis rigidis rubellis apice fuscatis, radialibus 16 – 25 arcte adpressis, superioribus 5 – 9 tenuioribus subfasciculatis, infimorobustobrevi; centralibus 4, superioribus 3 radiales superiores excedentibus cum iis implicatis, inferiore singulo abbreviato porrecto; floribus parvis in vertice dense lanato congestis roseis; bacca vix squamata sicca; seminibus lucidis sca-phoideis.

Var.  $\beta$ . *DASYACANTHUS*, E. l. c.: ovatus; aculeis setaceis longioribus purpureo-cæsiis, radialibus patulis, centrali inferiore ceteris paullo brevior.

From El Paso to the Limpio, and southward to Chihuahua: var.  $\beta$ . more common about El Paso: fl. March and April. — Plant 1 to 4, the var.  $\beta$ . even 6 inches high, 1 – 3 in diameter; spines 2 – 6, central ones 1 – 9 lines long, in  $\beta$ . 6 – 8 and central spines 9 – 11 lines long. Flower about 1 inch long. Fruit 4 lines in diameter.

*E. UNGUISPINUS*, E. in Wisl. Rep., from the country between Chihuahua and Parras, belongs here. The fruit described as belonging to this species is that of *E. uncinatus*.

Subtrib. 2. *CONTRARIÆ*. Cotyledones facie hilum versus spectantes, lateribus seminis parallelæ.

### III. *CEREUS*, Haw.

Ovarium baccaque sepalis squamiformibus in axillis plerumque pulvilligeris stipate. Stamina tubo floris breviori seu elongato infundibuliformi gradatim adnata. Semina fere exalbuminosa. Cotyledones abbreviate seu foliaceæ, plerumque hamatæ. — Plante costatæ, inflorescentia laterali.

Subgen. 1. *ECHINOCEREUS*, E. in Wisl. Rep.: ovarium aculeolatum: tubus floris abbreviatus, subcampanulatus: stigmata crassa viridia: semina tuberculosa: cotyledones suberecte. — Plantæ humiles, sæpe subglobosæ, e basi ramosæ vel ramosissimæ.

§ 1. *Pectinati*, multicotati; areolis confertissimis plerumque elongatis, aculeis rigidis brevibus pectinatis.

#### \* *Viridiflori*.

1. *C. VIRIDIFLORUS*, E. in Wisl. Rep.: ovatus seu demum cylindricus, simplex vel parce ramosus; costis sub-13; areolis ovato-lanceolatis; aculeis arcte radiantibus 12 – 18 cum superioribus 2 – 6 setaceis, lateralibus cæteris longioribus, inferioribus plerumque purpureo-fuscis, cæteris albidis, centrali plerumque nullo, subinde singulo robustiore variegato; floribus versus apicem lateralibus e flavo virescentibus minoribus; baccis ellipticis parvis; seminibus tuberculatis.

Var. *a. MINOR*: subglobosus; aculeis gracilibus brevibus.

Var. *β. CYLINDRICUS*: major, elongatus; aculeis rigidioribus longioribus.

Throughout Western Texas and New Mexico. Var. *a.* about Santa Fé and northeastward: *β.* east of El Paso. Fl. May and June. — The small form is 1 – 2 inches high, with spines rarely more than 2 lines long: the larger form, *β.* is 3 – 6 or more inches high, its spines 2 – 5 or 6 lines long: central spines, when present, longer and stouter. Flower about 1 inch long.

2. *C. CHLORANTHUS*, E. in B. C. R.: cylindricus, simplex, seu parce ramosus; costis 13 – 18; areolis ovatis; aculeis laxè radiantibus 12 –

20 cum superioribus 5 – 10 setaceis plerumque albidis; centralium 3 – 5 superioribus 2 brevioribus purpurascens, inferioribus 1 – 3 longioribus deflexis albidis; floribus in caule inferiore lateralibus e flavo virescentibus minoribus; baccis parvis; seminibus tuberculato-scrobiculatis.

Common about El Paso: fl. April. — Stems 3 – 10 inches high,  $1\frac{1}{2}$  – 2 inches in diameter; radial spines 2 – 5, central ones 9 – 15, lines long. Flowers very similar to those of the last species, but seeds different.

\* \* *Flaviflori.*

3. *C. DASYACANTHUS*, E. in Wish Rep.: subcylindricus, simplex vel e basi ramosus; costis 16 – 21; areolis ovatis; aculeis 20 – 30 patuliscinereis apicesæpe rubellis, interioribus 3 – 8 paullo robustioribus deflexis; floribus subterminalibus magnis; bacca subglobosa; seminibus tuberculatis.

Var.  $\beta$ . MINOR: aculeis paucioribus; bacca minore.

Common about El Paso: fl. April. — Plant 5 – 12 inches high, densely covered with numberless spines. Flowers 3 inches wide, yellow, an uncommon color in Cerei. Fruit an inch in diameter; in var.  $\beta$ . only half as large.

4. *C. CTENOIDES*, E. in B. C. R.: subsimplex, ovatus, 15-costatus; areolis lanceolatis; aculeis albidis, radialibus 14 – 20 pectinatis, centralibus 2 – 3 uniseriatis brevibus; floribus magnis.

Eagle Pass on the Rio Grande: fl. June. — Plant 2 – 4 inches high, thick in proportion; spines 1 – 4 lines long. Flower large. — Similar to the last, but distinguished by the characters given, which, with the exception of the yellow flower, bring it close to *C. pectinatus*.

\* \* \* *Rubriflori.*

5. *C. PECTINATUS*, E. (*Echinocactus pectinatus*, *Scheid.*): ovato-cylindricus, 18 – 23-costatus; areolis lanceolatis; aculeis radialibus 16 – 20 subrecurvis pectinatis apice roseis, centralibus 2 – 5 brevissimis uniseriatis; tubo floris purpurei pulvillis 60 – 70 aculeolos rigidos 10 – 15 gerentibus stipato.

Var.  $\beta$ .? ARMATUS, Poselg.: costis 15 – 16; aculeis radialibus 16 – 20, centrali singulo cæteris longiore.

Var.  $\gamma$ .? RIGIDISSIMUS, E. in B. C. R.: costis 20 – 22; aculeis e basi bulbosasubulatis rigidissimis albidis seurubellis 15 – 22 centralibus nullis; florum subverticalium tubopulvillis 80 – 100 dense stipato.

South of the Rio Grande, Chihuahua, &c. — The var.  $\beta$ . from Monterey may belong either here or to the next species. The var.  $\gamma$ . from Sonora, without any central spines, and with very rigid radial ones, 1 –  $4\frac{1}{2}$  lines long, is not yet sufficiently known to decide about its affinities.

6. *C. CÆSPITOSUS*, E. in Pl. Lindh. 1845: ovato-cylindricus, 12 – 18-costatus; areolis lanceolatis; aculeis radialibus 20 – 30 rectis seu subrecurvis pectinatis albidis, centrali nullo vel raro, uno alterove brevissimo; tubo floris purpurei pulvillis 80 – 100 aculeolos capillares 6 – 12 obscuros lanamque longam cineream gerentibus dense stipato.

Var.  $\alpha$ . MINOR: aculeis brevioribus gracilioribus non intertextis; floribus minoribus.

Var.  $\beta$ . MAJOR: aculeis longioribus robustioribus intertextis; floribus majoribus.

Var.  $\gamma$ . CASTANEUS: aculeis rubellis seu castaneis.

From the Canadian near Delaware Mount, to the Rio Grande, and south to Monterey; west not farther than the San Pedro River: fl. in May and June. — This species, now not rare in cultivation, seems to be sufficiently distinct from the preceding, and may always be recognized by the characters indicated.

7.? *C. ADUSTUS*, E. in Wisl. Rep.: ovatus, 13 – 15 costatus; areolis ovatis seu ovato-lanceolatis; aculeis radialibus 16 – 20 adpressis albidis apice adustis, lateralibus inferioribusque longioribus, summis setaceis brevissimis, centrali nullo seu valido porrecto atrofusco.

Mountains west of Chihuahua: flower and fruit unknown. — *Echinocereus radians*, E. is the form with stout central spines.

8.? *C. RUFISPINUS*, E. l. c.: ovato-cylindricus, 11-costatus; areolis lanceolatis; aculeis radialibus 16 – 18 adpressis intertextis, lateralibus cæteris multo longioribus fuscis recurvatis, centrali singulo valido fusco porrecto; flore infundibuliformi, tubo subelongato, limbo patulo; stigmatibus 8 tenuibus albidis.

Mountains west of Chihuahua: fl. in May. — Stem four inches high: radial spines 4 – 9 lines, central one about an inch, long. Flower different from that of all other *Echinocerei* in the length of the tube (over 2 inches long, and half as wide) and the whitish stigmata. Seems to form a transition to other sections of the genus.

9.? *C. LONGISETUS*, E. in B. C. R.: subsimplex, ovato-cylindricus; costis 11 – 14 tuberculatis; areolis orbiculatis; aculeis setaceis albis,

radialibus 18 – 20, centralibus 5 – 7, quorum 3 inferiores elongati deflexi.

Santa Rosa, south of the Rio Grande. — Stem 6 – 9 inches high; tubercles well marked; lower radial spines 5 – 7 lines long, much longer than the upper ones; lower central spines 1 – 2 inches long. Flower said to be red.

§ 2. *Decalophi.*

\* *Purpurei; floribus diurnis.*

10. C. FENDLERI, E. in Pl. Fendl.: ovato-cylindricus; costis 9 – 12; areolis subconfertis; aculeis basi bulbosis, radialibus 7 – 10 rectis seu curvatis albidis et fuscis, inferioribus robustioribus, centrali valido sursum curvato atrofusco plerumque elongato; floribus sub verticelateralibus magnis; seminibus obliquis tuberculato-scrbiculatis.

New Mexico, from Santa Fe to below El Paso, and from east of the Pecos to Zuni: fl. in May and June. — Stems 3 – 8 inches high, not many from the same base; spines very variable, but always very bulbous at the base, and some of them white, some deep brown or black, and others party-colored; radial ones  $\frac{1}{2}$  – 1 inch, and the central one 1 – 2 inches long. Flower  $2\frac{1}{2}$  –  $3\frac{1}{2}$  inches in diameter, of a deep purple color. Berry 1 –  $1\frac{1}{2}$  inch long, edible. Seed deeply and irregularly pitted by the confluence of many of the tubercles, unusually oblique.

11.? C. MOJAVENSIS, E. & B. in P. R. R.: ovatus, dense cæspitosus, glaucescens, 10 – 12 costatus; areolis remotis; aculeis validis curvatis, radialibus 7 – 8, lateralibus robustioribus longioribus, centrali singulo sursum curvato elongato.

Var.  $\beta$ .? ZUNIENSIS: 10-costatus; aculeis debilioribus 4-angulatis bulbosis rectis vel flexuosis, radialibus 8, summo longiore robustiore; centrali recto seu sursum curvato longiore, omnibus bulbosis.

On the Mojave River in California, and  $\beta$ . farther east, on the Colorado Chiquito. Ovate heads 2 – 3 inches high, forming dense cæspitose masses; upper and lower spines 9 – 15 lines, lateral ones 15 – 25 lines long, central spine  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches long, dusky. Var.  $\beta$ . is distinguished by having the upper radial spine almost as stout and long as the central spine, the former being 12 – 18, the latter 18 – 24 lines long. Both seem to be distinguished from the nearly allied C. *Fendleri* by having the lowest spines weakest, while in that species they are the stoutest of the exterior ones. The resemblance to C.

*Fendleri* induces me to place this species here, though the flower remains unknown.

12. *C. ENNEACANTHUS*, E. in Wisl. Rep.: ovato-cylindricus, viridis, cæspitosus, 7 – 10 costatis; aculeis rectis, radialibus 7 – 12 (plerumque sub-8) albis, inferioribus longioribus; centrali singulo (rarius 2 – 3) basi bulboso teretiusculo seu compresso angulato albido vel stramineo; ovario pulvillis 25 – 35 aculeolos 6 – 12 gerentibus stipato; seminibus tuberculatis.

In the Rio Grande valley from El Paso to Laredo, and lower down, and far into Mexico: fl. April and May. — A very cæspitose plant, of a wrinkled or withered appearance; 3 – 6 inches high; spines above 3 – 5, below 8 – 16 lines long; lateral ones intermediate; central spine extremely variable, in smaller specimens terete, in very perfect ones elongated, flattened, 8 or 10 – 15 or 20 lines long. Flowers 2 – 3 inches long and equally wide: ovary and tube covered with numerous bunches of spines. Fruit about an inch long, edible.

13. *C. STRAMINEUS*, E. in B. C. R.: ovato-cylindricus, cæspitoso-conglomeratus, 11 – 13-costatus, læte viridis; aculeis radialibus 7 – 10 rectis vel curvatis albis subæqualibus, centralibus 3 – 4 angulatis elongatis sæpe flexuosis; floribus magnis purpureis; ovario pulvillis 30 – 40 aculeolos subsingulos gerentibus stipato; bacca magna fasciculis aculeolorum elongatorum stipata; seminibus tuberculatis.

Mountain slopes, from El Paso to the Pecos and Gila Rivers: fl. June. Often from 100 to 200 heads in one hemispherical mass, each 5 – 9 inches high; radial spines mostly  $8\frac{3}{4}$  –  $11\frac{1}{4}$ , central ones 2 –  $3\frac{1}{2}$  inches long, younger ones dirty yellow and brown, like old straw. Flower 3 – 4 inches long, very full, bright purple. Berry  $1\frac{1}{2}$  – 2 inches long, luscious.

14. *C. DUBIUS*, E. in B. C. R.: ovato-cylindricus, cæspitosus, pallide viridis, 7 – 9 costatus; aculeis radialibus 5 – 8 albidis, superioribus sæpe nullis, centralibus 1 – 4 angulatis plus minus elongatis sæpe curvatis; floribus pallide purpureis; ovario pulvillis sub-20 aculeolos 1 – 2 gerentibus stipato; bacca minore aculeolata; seminibus tuberculato-scröbiculatis.

Sandy bottoms of the Rio Grande at El Paso: fl. May and June. Stems 5 – 8 inches high, somewhat cæspitose, of a pale green color, and a soft flabby texture: ribs broad, fewer; radial spines 6 – 12 or 15 lines long; central spines  $1\frac{1}{2}$  – 3 inches long, flowers  $2\frac{1}{2}$  inches long, with fewer and narrower petals. Fruit 1 –  $1\frac{1}{2}$  inches long, covered

with bunches of spines which, as in the last species, on the flower are indicated only by few and short bristles. Seed with tubercles confluent, and leaving pits between them. Nearly allied to the two last, but sufficiently well distinguished by the characters given.

15. C. ENGELMANNI, Parry in Sill. Journ. 1852: ovato-cylindricus, 11 – 13 costatus; aculeis radialibus sub-13 albidis, superioribus cæteris multobrevioribus, centralibus 4 longioribus angulatis rectis, 3 superioribus fulvis arrectis, inferiore longiore albedo porrecto seu deflexo; floribus lateralibus; seminibus tuberculato-scrobiculatis.

Var.  $\beta$ . CHRYSOCENTRUS, E. & B. in P. R. R.: aculeis radialibus 12 – 14 albidis, centralibus 3 superioribus validis vitellinis erectis, inferiore albo compresso deflexo.

Var.  $\gamma$ . VARIEGATUS, E. & B. l. c.: aculeis radialibus sub-13 albidis, centralibus 3 superioribus recurvatis divaricatis nigris corneo-variegatis, inferiore longiore albo decurvo.

Lower Gila, Colorado, and westward to the California mountains: fl. June and July. — Stems 5 – 10 inches high; radial spines slender, 3 – 6 lines, central ones 1 – 2 inches long. Fruit near the top of the plant. — Dr. Bigelow collected a little farther north, on Bill Williams's Fork, the two forms which I have put under  $\beta$ . and  $\gamma$ .; though they differ from the species by having the fruit lower down on the plant; the arrangement of the spines, however, is entirely identical. Var.  $\beta$ . has very stout central spines, 2 – 3 inches long, of a deep golden-yellow color, and the lower one shorter. In var.  $\gamma$ . the central spines are only 1 – 2 inches long, much curved, and the upper ones white and black mottled.

\* \* *Coccinei; floribus diu noctuque apertis.*

16.? C. GONACANTHUS, E. & B. in P. R. R.: ovatus, subsimplex, 7-costatus; areolis remotis; aculeis robustis angulatis sæpe curvatis, radialibus 8 flavidis sæpe basi obscuris, summo cæteris multo majore centrale multangulatum validum sæpe flexuosum subæquante.

Near Zuni, in Western New Mexico, under cedars. — Radial spines 8 – 15 lines long, upper one and central spine  $1\frac{1}{4}$  –  $2\frac{1}{2}$  inches long, remarkably stout, angular and channelled. — I have not seen the flower of this plant, but place it here from its resemblance to the next species; on the other hand, it seems to be allied to *C. Mojavensis*.

17. C. TRIGLOCHIDIATUS, E. in Wisl. Rep.: ovato-cylindricus, 6 – 7 costatus, parce ramosus; areolis remotis; aculeis 3 – 6 robustis an-

gulatis compressis rectis seu curvatis laxe radiantibus; floris coccinei staminibus petala obtusa subæquantibus; stigmatibus 8 – 10.

Northern New Mexico, at Santa Fé, and to the east and westward: fl. June. — Stems 4 – 6 inches high, 2 – 3 in diameter, with sharp ridges and very shallow grooves; spines 6 – 15 lines long. Flower 2 – 3 inches long; petals rigid. Fruit unknown.

18. *C. PHENICEUS*, E. in P. R. R. (*C. coccineus*, *E. in Wisl. Rep. non Salm.*): ovatus seu subglobosus, obtusus, cæspitosus, 9 – 11-costatus; areolis ovato-orbiculatis subconfertis; aculeis setaceis rectis, radialibus 8 – 12 albidis, superioribus cæteris paulo brevioribus, centralibus 1 – 3 basi bulbosis teretibus paulo robustioribus; staminibus petalis brevioribus; stigmatibus 6 – 8.

Northern New Mexico, from the Upper Pecos to Santa Fé, Zuni, and the San Francisco mountains: fl. May and June. — Heads 2 – 3 inches high, 2 inches thick, generally forming dense hemispherical masses, often of a foot or more in diameter; radial spines 3 – 6, central ones 5 – 10 lines long. When there are several, the lowest one longest. Fruit unknown.

*C. CONOIDEUS*, E. & B. l. c.: ovatus, versus apicem acutatus, conoideus, e basi parce ramosus 9 – 11 costatus; aculeis radialibus 10 – 12 gracilibus rigidis, summis brevioribus, centralium 3 – 5 infimo 4-angulato elongato demum deflexo.

Rocky places on the Upper Pecos, and perhaps San Francisco mountains. — Heads 3 – 4 inches high, few, of unequal height from one base; upper radial spines 2 – 5 lines, lateral ones 6 – 15 lines long; upper central spines hardly longer than the lateral ones; lower one 1 – 3 inches long, angular and often compressed. The Mexican *C. acifer*, Otto, seems similar, but is a higher plant, with much stouter spines. *C. Ræmeri*, Muhlenpf. A. G. Z. 1848, from Western Texas, may belong here or to *C. enneacanthus*. A specimen among Dr. Bigelow's collections seems to unite this form with *C. phæniceus*, where for the present it is perhaps best to leave our plant, as a variety or sub-species.

19. *C. POLYACANTHUS*, E. in Wisl. Rep.: ovato-cylindricus, cæspitosus, subglaucescens, 9 – 13 costatus; aculeis robustis rigidis rectis albidis seu rubello-cinereis, centralibus 3 – 4 bulbosis paulo robustioribus æquilongis seu longioribus, junioribus sæpe fusco-variegatis; stigmatibus 8.

Common about El Paso, and thence to the mountains of Chihuahua:



fl. March and April. — Heads 5 – 10 inches high,  $2\frac{1}{2}$  – 4 in diameter; upper radial spines  $\frac{1}{2}$ , lateral and lower ones  $\frac{3}{4}$  – 1 inch long; central spines hardly longer, or the lower sometimes  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches long. Flowers 2 – 3 inches long, profusely covering the plant for four or six weeks. Seed the largest of any *Echinocerei* known to me, 0.8 – 0.9 of a line long.

20. C. RÆMEREI, E. in Pl. Lindh. 1850: ovatus, cæspitosus, læte viridis; costis 7 – 9 tuberculatis interruptis; areolis orbiculatis, junioribus breviter tomentosus; aculeis teretibus robustis albidis seu junioribus flavidulis demum cinereis, radialibus sub-8, centrali singulo robustiore porrecto; floribus lateralibus infundibuliformibus limbo erectiusculo; pulvillis ovarii tubique 16 – 18 albo-tomentosis aculeolos 3 – 5 gerentibus; sepalis interioribus 7 – 8 ovato-oblongis carinatis obtusis mucronatis; petalis 9 – 12 obovato-spathulatis obtusis integris concavis rigidis suberectis; stylo longe supra stamina albida sursum rosea exserto; stigmatibus 6 – 7 petala æquantibus erecto-patulis viridibus acutiusculis.

In the granitic region about the Llano River, Western Texas: fl. May: fruit unknown. — Often 5 – 12 from the same base, densely cæspitose; single heads 3 – 4 inches high, 2 –  $2\frac{1}{2}$  in diameter; areolæ 6 – 8 lines apart; radial spines 5 – 12 lines long, upper ones usually a little shorter than the rest; central spine 10 – 15 lines long. Flower 2 inches long and only one in diameter, remaining open day and night for a whole week, if the weather is not too warm. — Allied to the last species; but distinct by the shorter heads, fewer ribs, fewer and paler spines, and smaller flower, with less numerous parts.

21.? C. PAUCISPINUS, E. in B. C. R.: ovato-cylindricus, parce ramosus vel simplex, 5 – 7-costatus; areolis remotis; aculeis robustis 3 – 6 radiantibus fuscatis, centrali nullo vel raro robusto subangulato.

Western Texas, from the San Pedro to the mouth of the Pecos. — Stem 5 – 9 inches high, 2 – 3 in diameter; spines 9 – 16 lines long, dark-colored, the central one almost always wanting. Flower and fruit unknown.

22.? C. HEXÆDRUS, E. & B. in P. R. R.: ovatus subsimplex, 6-costatus; areolis remotis; aculeis rectis rigidis tenuibus angulatis, radialibus 5 – 7 flavo-rubellis, inferiore brevior, centrali paullo robustiore (juniore fuscato) sæpe deficiente.

Near Zuni, in Western New Mexico. — Heads few in each plant, or single, 4 – 6 inches high, 2 –  $2\frac{1}{2}$  inches in diameter. Radial spines

mostly 6 lines, lower ones 6 – 10 lines, upper ones 8 – 15 lines long; central spine, if present, 12 – 15 lines long.

§ 3. *Pentalophi*.

23. C. BERLANDIERI, E. in B. C. R.: humilis, perviridis; caule diffuso subtereti articulato ramosissimo; tuberculis conicis 5 – 6-fariis; aculeis 6 – 8 setaceis brevibus radiantibus albidis, centrali singulo multo longiore fusco; floribus magnis; petalis angustis recurvatis; seminibus tuberculatis.

On the Nueces, in Southern Texas: fl. May and June. — Stems  $1\frac{1}{2}$  – 6 inches long, one inch thick; radial spines 4 – 5 lines long, central one 6 – 12 lines long, toward the base of the branches shorter. Flower 2 – 4 inches long.

24. C. PROCUMBENS, E. in Pl. Lindh. 1850: humilis, perviridis; caule diffuso subtereti 4 – 5 angulato articulato ramosissimo; aculeis 4 – 6 radiantibus albidis, centrali nullo vel singulo paullo longiore obscuro; floribus magnis; petalis obovato-spathulatis patulis seu subrecurvis; seminibus tenuissime verrucosis.

On the Rio Grande, below Matamoras: fl. May and June. — Similar to the last; but more slender, 6 – 8 lines in diameter; radial spines 1 – 2 lines long, central one, if present, 2 – 3 lines long. Flower above 3 inches long.

§ 4. *Graciles*.

25. C. TUBEROSUS, Poselger: e radice tuberosa tenuissimus, teres, sursum incrassatus, demum articulatus, 8-costatus; aculeis minutis setaceis, 9 – 12 radiantibus, centrali singulo longiores sursum adpresso; flore subterminali; seminibus minutis scrobiculatis.

Between Laredo and Mier on the Rio Grande. Tuberos root 4 –  $1\frac{1}{2}$  inches thick. Stem above 4 – 8 lines thick; radial spines hardly 1 line, central ones 2 – 3 lines long. Seed smaller than in any other *Echinocereus*, 0.4 line long, with the tubercles confluent.

Subgen. 2. EUCEREUS. Caulis elongatus: fasciculi aculeorum steriles et florigeri similes: floris tubus elongatus, sæpissime aculeolis capillaceis munitus: stigmata pallida: semina lævia seu raro rugosa: embryo hamatus.

26. C. EMORYI, E. in Sill. Journ. 1852: prostratus; ramis adscendentibus 15-costatis; areolis confertis; aculeis setaceis rigidis flavis,

radialibus 40 – 50 stellatis, centrali unico longiore robustiore; flore flavo breviusculo; bacca aculeatissima; seminibus magnis lucidis.

On hills near San Diego, California, growing in thick patches. — Stems several feet long; branches 6 – 9 inches high, 14 inches in diameter. Fruit very spinose, with seeds over one line in length.

27. *C. VARIABILIS*, Pfeiff.: erectus, 3 – 4 angulatus; areolis remotis; aculeis 4 – 6 brevibus radiantibus, 2 – 4 interioribus validis elongatis inæqualibus divaricatis, centrali deflexo; flore magno albo nocturno; bacca coccinea aculeolata; seminibus magnis lævibus.

On the lower Rio Grande: fl. in May and June. — Well known from all parts of tropical America. Fruit 3 to 10 feet high, 2 inches in diameter; larger spines 12 – 18 lines long. Fruit 2 – 3 inches long, nearly 2 inches in diameter.

28. *C. GREGGII*, E. in Wisl. Rep.: gracilis, e radice crassa napi-formi erectus; ramis 3 – 6-angulatis, rufescentibus; areolis confertis; aculeis basi bulbosa abrupte subulatis brevissimis nigricantibus, radialibus 6 – 9, centralibus 1 – 2; floris elongati albidii tubo aculeolis capillaceis flexuosis munito; bacca sessili obovata apice rostrata; seminibus rugosis.

Var. *α*. CISMONTANUS: areolis elongatis; petalis latioribus.

Var. *β*. TRANSMONTANUS: areolis ovato-orbiculatis; petalis angustioribus.

From Western Texas to Sonora, and south to Chihuahua: fl. May and June. — Root a large fleshy tuber, sometimes 6 inches in diameter. Stems 2 – 3 feet high, 9 – 12 lines thick, usually 4- or 5-angled; spines  $\frac{1}{2}$  – 1 line long, very sharp; lower ones longer. Flower 6 or 8 inches long, 2 – 24, wide. Fruit 1 –  $1\frac{1}{2}$  inches long. Seed  $1\frac{1}{4}$  –  $1\frac{1}{2}$  lines long.

Subgen. 3. LEPIDOCEREUS. Caulis elongatus: fasciculi aculeorum steriles et florigeri similes: floris tubus brevior squamosus: phylla numerosissima: stigmata pallida: semina lævia: embryo hamatus.

29. *C. GIGANTEUS*, E. in Emory's Rep. 1848: erectus, elatus, parce erecto-ramosus, 18 – 21-costatus; aculeis 12 – 16 radialibus inæqualibus, centralibus sub-6 robustis basi bulbosis corneis basi nigris cæteros superantibus, infimo longiore deflexo; floribus subterminalibus albidis; bacca obovata demum 3 – 4-valvi.

From the Lower Gila north to Williams's River (better known

among western travellers as Bill Williams's Fork), and south into Sonora: fl. May-July; fr. July and August. — A now well-known plant to travellers and botanists, 30 – 50 feet high, 1 – 2 feet in diameter; central spines  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches long. The yellowish-white flower 3 – 4 inches long. Fruit 2 – 3 inches long, often pear-shaped, and opening with 3 or 4 irregular recurved valves.

30. C. THURBERI, E. in Sill. Journ. 1854: caulibus erectis vel adscendentibus pluribus elatioribus articulatis 13 – 14-costatis; aculeis 7 – 15 gracilibus fusco-atris valde inæqualibus; ovario tuboque imbricato-squamato; bacca globosa magna.

Sonora, west of the Sierra Madre: fl. June and July. — Stems 5 – 15 from one root, 10 – 15 feet high, 4 – 6 inches in diameter; spines slender, flexible, from 5 – 18 lines long. Flowers 3 inches long, white. Fruit like a large orange, of delicious flavor.

Subgen 4. PILOCEREUS. Caulis elatus: fasciculi aculeorum steriles a floriferis tenuioribus longioribus distincti: floris tubus brevis squamosus: phylla pauciora: stigmata pallida: semina lævia: embryō hamatus (in specie nostra!).

31. C. SCHOTTL, E. in B. C. R.: caulibus erectis vel adscendentibus pluribus elatioribus articulatis 4 – 7-costatis; areolis in articulis sterilibus remotis; aculeis brevibus robustis, radialibus 4 – 6, centrali unico; areolis in articulis floriferis confertis; aculeis 15 – 25 longioribus setaceis flexuosis e rubello cinereis; floribus carneis minoribus, tubo gracili decurvo; bacca parva.

Sonora, towards Santa Magdalena: fl. July. Stems 8 – 10 from the same base, often growing in dense clusters, 8 or 10 feet high, with 2 – 4 articulations, 4 or 5 inches in diameter. Spines of the sterile part of the plant 3 – 4 lines long, on the fertile joints 1 – 4 inches long, pendulous, forming a reddish-gray beard, in which the flower (not 2 inches long) is somewhat hidden. Seeds large: cotyledons hooked, exactly as in the last two species. This is evidently a *Pilocereus*, but with the seed of a true *Cereus*, thus reuniting the former with the latter.

## Trib. II. ROTATÆ, Miquel.

Aphyllæ seu foliosæ. Flores tubo abbreviato subrotati. Cotyledones facie versus hilum spectantes seminis lateri contrariæ (incumbentes).

## IV. OPUNTIA, Tourn.

Ovarium sepalis subulatis caducis axilla pulvilligeris instructum. Semina magna, compressa, discoidea, sæpe marginata, albida. Cotyledones foliaceæ, circa albumen curvatæ, plerumque incumbentes. — Plantæ articulatæ; articulis complanatis seu teretibus plus minus tuberculatis; foliis subulatis caducis axilla pulvillos setosos plerumque aculeiferos gerentibus; aculeis apice retrorsum hispidis.

## ANALYSIS.

- |                                                                             |                            |
|-----------------------------------------------------------------------------|----------------------------|
| I. Petala parva, subulata, suberecta.                                       | Subgen. 1. STENOPUNTIA.    |
| II. Petala lata, obovata seu obcordata.                                     |                            |
| 1. Articuli complanati: embryo circa albumen par-                           |                            |
| cum spiralter convolutus.                                                   | Subgen. 2. PLATOPUNTIA.    |
| A. Bacca succosa: margo seminum plerumque angustior ( <i>Sarcocarpeæ</i> ). |                            |
| a. Glabra.                                                                  |                            |
| * Bacca parva subglobosa.                                                   | § 1. <i>Microcarpeæ</i> .  |
| ** Articuli magni: aculei pauci compressi.                                  | § 2. <i>Grandes</i> .      |
| *** Articuli minores: aculei setiformes.                                    | § 3. <i>Setispinæ</i> .    |
| **** Articuli minores: aculei pauci, robusti, teretes.                      | § 4. <i>Vulgares</i> .     |
| b. Tubescentes.                                                             | § 5. <i>Pubescentes</i> .  |
| B. Bacca sicca: margo seminum plerumque latissimus.                         | § 6. <i>Xerocarpeæ</i> .   |
| 2. Articuli cylindracei: embryo circa albumen copiosius suborbicularis.     | Subgen. 3. CYLINDROPUNTIA. |
| A. Articuli abbreviate clavati.                                             | § 1. <i>Clavatæ</i> .      |
| B. Articuli cylindracei, elongati.                                          | § 2. <i>Cylindricæ</i> .   |

Subgen. 1. STENOPUNTIA, E. in B. C. R. Articuli complanati: flores parvi: petala subulata: stigmata pauca.

1. O. STENOPETALA, E. l. c.: prostrata; articulis magnis; aculeis 1 – 3 cum minoribus 1 – 3 ancipitibus deflexis atrofuscis; ovario pulvillis confertis stipato; sepalis petalisque subulatis suberectis; stylo inflato; stigmati simplici.

On the battle-field of Buena Vista, south of Saltillo. Nearly allied to the Mexican *O. grandis*, Hort. Angl., which has very similar flowers, but is an erect plant, with few and white spines, and 2 or 3 acute stigmata.

Subgen. 2. PLATOPUNTIA, E. l. c. Articuli complanati: flores magni: bacca pulposa vel rarius sicca: semina late marginata: embryoplusquam circularis circa albumen parcum spiraliter convolutus: cotyledones semper contrariæ.

§ 1. *Microcarpæ*: suberectæ: aculei plurimi, colorati: bacca parva subglobosa.

2. O. STRIGIL, E. in B. C. R.: suberecta, articulis ovatis orbiculatisve; pulvillis confertis; aculeis 5 – 8 radiantibus deflexis rufis apice flavis; bacca parva late umbilicata rubra; seminibus parvis anguste marginatis.

Between the Pecos and El Paso. — Plant 2 feet high; joints 4 – 5 inches long; spines an inch or less in length. Fruit 6 – 7 lines long.

§ 2. *Grandes*: erectæ seu procumbentes: articuli magni: aculei pauci, validi, compressi, plerumque colorati: bacca major vel magna, plerumque ovata.

\* *Subinermes*.

3. O. FICUS-INDICA, Mill: cultivated south of the Rio Grande, under the name Nopal Castellano.

\* \* *Flavispina*.

† *Erectæ*.

4. O. TUNA, Mill.: cultivated about the old missions in the southern parts of Upper California, under the name *Tuñá*. Specimens gathered at Beaufort, on the coast of South Carolina, (probably introduced,) may belong here.

5. O. ENGELMANNI, Salm: erecta, grandis; articulis obovatis; pulvillis remotis setas stramineas rigidas inæquales aculeosque 1 – 3 compressos stramineos basi rufos gerentibus; floris flavis intus rubelli ovario subgloboso; stigmatibus 8 – 10; bacca obovata late umbilicata; seminibus minoribus.

From the Canadian River to the mouth of the Rio Grande, and westward from the Gulf to Chihuahua and El Paso: fl. May and June. — Plant 4 – 6 feet high; joints a foot long or less; leaves subulate, 3 – 4 lines long; larger spines 1 – 1½ inches long. Flower 2½ – 3 inches in diameter. Fruit usually 2 inches long, 1½ in diameter, juicy, but of a somewhat nauseous taste. Seeds 1½ – 2 lines in diameter. A plant observed by Dr. Blackie on Bayou Bœuf, Western Louisiana, 5½ feet high, joints 9 inches long, reddish-yellow flowers, is probably this species.

*O. Lindheimeri*, E. Pl. Lindh., is partly this same plant, partly a hybrid form between it and perhaps *O. Rafinesquii*, with narrow clavate fruit.

*O. ENGELMANNI*, var.? CYCLODES, E. & B. in P. R. R.: articulis orbiculatis; aculeis validioribus subsingulis; bacca parva globosa; seminibus majoribus.

On the Upper Pecos, in New Mexico. Joints 6–7 inches, and fruit 1 or  $1\frac{1}{4}$  inches in diameter.

*O. DULCIS*, E. in B. C. R., is a doubtful plant, of which we have not material enough. It has been found near the middle course of the Rio Grande, near Presidio del Norte, &c. It is similar to *O. Engelmanni*, and may be a form of it; but it is lower, more spreading, with a similar but very sweet fruit, and small, regular seeds.

The following may be considered as a subspecies: —

*O. OCCIDENTALIS*, E. & B. in P. R. R.: erecta, patulo-ramosissima; articulis grandibus obovatis vel rhomboideis; pulvillis remotis setas graciles confertas et aculeos 1–3 validos compressos deflexos albidos basi obscuriores et inferiores paucos graciliores gerentibus; floris flavi intus rubelli ovario obovato; bacca obovata late umbilicata; seminibus majoribus.

On the western slope of the California mountains, near San Diego and Los Angeles: fl. June. — Plant 4 feet high, forming large thickets; the joints 9–12 inches long; pulvilli with very fine closely-set bristles; spines about one inch long. Apparently distinct from *O. Engelmanni* by its manner of growth, the very fine bristles, and the larger seeds.

There are also some indications of another form, growing on hills and plains near San Diego, California, and on the neighboring seabeach, with higher and more upright growth, and coarser bristles on the pulvilli, but which I cannot well distinguish from *O. Engelmanni*. I have seen no fruit or seed of it.

6. *O. CHLOROTICA*, E. & B. in P. R. R.: caule erecto aculeis flavis numerosissimis fasciculatis armato; articulis orbiculato-obovatis pallidis; pulvillis subremotis setas difformes confertas aculeosque 3–6 inæquales compressos stramineos gerentibus; floris flaviovario pulvillis confertis stipato; petalis spathulatis.

Western Colorado country, between New Mexico and California, from the San Francisco mountains to Mojave Creek. — Plant 4–6 feet high, forming large and sometimes spreading bushes; the trunk

covered with spines 1 – 2 inches long; joints 8 – 10 by 6 – 8 inches in length; spines  $\frac{1}{2}$  –  $1\frac{1}{2}$  inches long. Ovary with nearly 50 pulvilli, while the foregoing species have not more than 20.

†† *Procumbentes.*

7. *O. PROCUMBENS*, E. & B. l. c.: prostrata; articulis orbiculato-obovatis grandibus pallide viridibus; pulvillis remotis setas stramineas rigidas valde inæquales et aculeos 2 – 4 validos compressos angulatos stramineos basi obscuriores gerentibus.

San Francisco mountains to Cactus Pass, in Western New Mexico. Joints 9 – 13 inches long, always edgewise; pulvilli  $1\frac{1}{2}$  – 2 inches apart; spines 1 – 2 inches long. Similar to *O. Engelmanni*, but prostrate, with more distant pulvilli, and stouter spines. No flower or fruit seen.

8. *O. ANGUSTATA*, E. & B. l. c.: prostata vel adscendens; articulis elongato-obovatis versus basin angustatis; pulvillis remotis setas fulvas graciles aculeosque paucos (2 – 3) validos compressos stramineos seu albidos versus basin rufos deflexos gerentibus; bacca obovata tuberculata; seminibus magnis.

From Zuni, west of the Rio Grande, westward to the Cajon Pass, in the California mountains. — Joints 6 – 10 inches long, only 3 or 4 wide. Spines similar to those of the last species; bristles much more delicate. Fruit  $1\frac{1}{2}$  inches long; the umbilicus flat, but immersed. — Well distinguished by the shape of the joints.

\* \* \* *Fulvispinæ.*

9. *O. MACROCENTRA*, E. in B. C. R.: adscendens; articulis magnis suborbiculatis tenuibus; pulvillis subremotis setas graciles breves fulvas gerentibus, summis solum aculeos 1 – 2 prælongos subcompressos fusco-atros proferentibus; floris flavi ovario ovato; stigmatibus 8; seminibus majusculis.

Sand-hills on the Rio Grande near El Paso: fl. May. — Two or three feet high, with very striking round joints, 5 – 8 inches in diameter, and blackish spines as much as 2 or 3 inches long. Nearly allied to the next species.

10. *O. PHÆACANTHA*, E. in Pl. Fendl.: diffusa, adscendens; articulis obovatis crassis glaucescentibus; pulvillis subremotis setas graciles stramineas seu fuscatas longiores gerentibus, plerisque aculeos 2 – 5 plus minus compressos fuscis proferentibus; floris flavi ovario abbreviate; stigmatibus 8; bacca cuneata pyriformi; seminibus majusculis.



Var. *α*. NIGRICANS: aculeis brevioribus acute angulatis et nigricantibus.

Var. *β*. BRUNNEA: pulvillis remotioribus; aculeis longioribus obtuse angulatis brunneis sursum albidis.

Var. *γ*. MAJOR: suborbiculata; pulvillis remotis; aculeis brevioribus paucioribus pallidioribus.

New Mexico: fl. May. Var. *α*. is found on the Rio Grande near Santa Fé; *β*. in similar sandy locations near El Paso; and *γ*. in mountainous regions near Santa Fé. — Joints 4 – 6, or in *γ*. even 8, inches long; spines mostly 1 – 2 inches in length. Flower about 2 inches in diameter, with a short ovary. Fruit  $1\frac{1}{4}$  –  $1\frac{1}{2}$  inches long, slender, much contracted at base so as to appear almost stipitate.

O. MOJAVENSIS, E. & B. in P. R. R.: prostrata; articulis grandibus suborbiculatis; pulvillis remotis; setis fulvis; aculeis 3 – 6 validis infra fuscis.

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

11. O. CAMANCHICA, E. & B. in P. R. R.: prostrata; articulis adscendentibus majusculis suborbiculatis; pulvillis remotis plerisque armatis; setis stramineis fulvisve parvis; aculeis 1 – 3 compressis fuscis apice pallidioribus, superioribus elongatis suberectis, cæteris deflexis; bacca ovata late umbilicata; seminibus majusculis angulatis hilo excisis.

Llano Estacado, on the Upper Canadian River. A large, extensively spreading plant; the joints 6 – 7 inches long; spines  $1\frac{1}{2}$  – 2 or even 3 inches long. Fruit large, juicy. Seeds 2 – 3 lines in diameter, very irregular and deeply notched at the hilum.

12. O. TORTISPINA, E. & B. l. c.: prostrata; articulis adscendentibus majusculis suborbiculatis; pulvillis subremotis; setis stramineis seu fulvis; aculeis 3 – 5 majoribus angulatis sæpe tortis albidis cum 2 – 4 gracilioribus; bacca ovata late umbilicata; seminibus majusculis orbiculatis.

On the Camanche plains, east of the elevated plateau of the Llano Estacado. — Similar in size and habit to the last species, its western neighbor, with more numerous spines than any other of our *Opuntia* with juicy fruit. Seeds regular, and only very slightly notched at the hilum.

§ 3. *Setispinæ*: adscendentes: articuli plerumque minores: aculei pauci, teretes seu vix angulati, graciles, flexiles, pallidi: bacca minor.

13. *O. TENUISPINA*, E. in B. C. E.: articulis majusculis obovatis basiattenuatis læteviridibus; pulvillis subapproximatis setas graciles breves fulvas gerentibus plerisque armatis; aculeis 1 – 2 elongatis albidis cum 1 – 4 brevioribus inferioribus; floris flavi ovario clavato; petalis obovatis retusis; bacca oblonga profunde umbilicata; seminibus minoribus.

Sand-hills near El Paso: fl. May. — Joints 3 – 6 inches long, 2 – 4 wide; leaves very slender, hardly 2 lines long; upper spines suberect, or spreading,  $1\frac{1}{2}$  –  $2\frac{1}{2}$  inches long; flower  $2\frac{1}{2}$  – 3 inches in diameter; seeds less than 2 lines in diameter, very irregular. — Similar in many respects to *O. phæcantha*, which grows with it; but readily distinguished by the spines and fruit.

14. *O. SETISPINA*, E. in Salm, H. D.: articulis suborbiculatis parvis glaucis; pulvillis confertis setas flavidas gerentibus, omnibus armatis; aculeis 1 – 3 longioribus subangulatis et 3 – 7 brevioribus plus minus deflexis, omnibus gracillimis.

Pine woods in the mountains west of Chihuahua, *Dr. Wislizenus*. Joints not over 2 inches long; pulvilli only 3 – 4 lines apart; longer spines 1 –  $1\frac{1}{2}$  inches long, very slender, like bristles. Flower and fruit unknown.

15. *O. FILIPENDULA*, E. in B. C. E.: glauca; radicibus nodoso-incrassatis; articulis minoribus orbicularis seu obovatis seu oblanceolatis tenuibus; pulvillis approximatis setas virescenti-flavas graciles numerosas gerentibus armatis vel inermibus; aculeis, si adsunt, 1 – 2 elongatis subangulatis cum 1 – 2 minoribus, omnibus albidis; floris purpurascens ovario gracili; stigmatibus 5; seminibus minoribus tumidis.

Alluvial bottoms of the Rio Grande near El Paso, and eastward on the Pecos: fl. May and June. — The long knotted roots, the small bluish joints, with the very small leaves and very long bristles, together with the purple flower, and thick very narrowly margined seeds, distinguish this species from all others. Plant 6 – 12 inches high, joints  $1\frac{1}{2}$  – 3 inches long, 1 – 2 wide; pulvilli 4 – 6 lines apart; lower spines 1 – 2 inches long. Flower  $2\frac{1}{2}$  inches in diameter. Seed hardly 2 lines in diameter.

§ 4. *Vulgares*: procumbentes vel adscendentes: articuli plerumque minores: aculei validi, subteretes vel nulli, albidii vel obscuriores: bacca clavata.

16. *O. RAFINESQUII*, E. in P. R. R.: diffusa; radice fibrosa; articulis obovatis vel suborbiculatis perviridibus, foliis elongatis patulis; pulvillis subremotis setas graciles rufas gerentibus plerisque inermibus; aculeis paucis marginalibus validis rectis singulis erectis patulisve, uno alterove minore deflexo subinde adjecto, rufo variegatis; alabastro acuto; ovario clavato pulvillis 20 – 25 stipato; petalis 10 – 12; stigmatibus 7 – 8; bacca clavata.

Var. *MICROSPERMA*: subinermis: seminibus minoribus angustius marginatis.

Sterile, sandy, or rocky soil in the Mississippi valley, from Kentucky to Missouri, and from Minnesota southward: fl. May and June. — Joints 3 – 5 inches long; leaves 3 – 4 lines long; spines 9 – 12 lines long, sometimes entirely wanting. Flowers  $2\frac{1}{2}$  –  $3\frac{1}{2}$  inches in diameter, yellow, often with a red centre. Seed  $2\frac{1}{2}$  lines, or in the variety less than 2 lines in diameter. — This species had been confounded with the Eastern *O. vulgaris* by all our botanists, with the exception of Rafinesque, who pretended to distinguish three species, viz. *O. humifusa*, *O. cæspitosa*, and *O. mesacantha* (sometimes erroneously accredited to Nuttall), which cannot be made out, and which I have again united under their author's name. — The following is probably only a Southern variety of this species: —

*O. GRANDIFLORA*, E.: subadscendens; articulis majusculis; pulvillis remotis; setis tenuissimis; aculeis subnullis; floris grandis ovario elongato; petalis sub-10 latissimis; stigmatibus 5; bacca elongata clavata.

On the Brazos, Texas. — Joints often 5 – 6 inches long; pulvilli nearly an inch apart. Flowers  $4\frac{1}{2}$  – 5 inches in diameter, red in the centre; petals 2 inches long or more, and  $1\frac{1}{2}$  wide.

Dr. Bigelow collected on his tour from Arkansas to Santa Fé several forms, which, though somewhat distinct, are perhaps not entitled to be considered species. The true *O. Rafinesquii* does not seem to occur west of the western line of Missouri and Arkansas. The Western forms or subspecies are: —

*O. CYMOCHILA*, E. & B. in P. R. R.: diffusa; articulis orbiculatis; pulvillis subremotis stramineo- seu fulvo-setosis plerisque armatis; aculeis 1 – 3 robustioribus albidis basifulvis patentibus deflexisve, additis

sæpe 2 – 3 minoribus; stigmatibus 8; bacca obovata; seminibus undulato-marginatis majusculis.

Var.  $\beta$ . MONTANA: subinermis; stramineo-setosa.

Along the Canadian River east of the Llano Estacado, and on that plain. Var.  $\beta$ . near Albuquerque. — Joints  $2\frac{1}{2}$  – 3 inches in diameter, in  $\beta$ . larger; longer spines 1 – 2 inches long. Fruit short, pulpy, sweet. Seed  $2\frac{1}{2}$  lines in diameter, with a very sharp irregularly wavy or twisted border. — The var.  $\beta$ . seems to unite the common *O. Rafinesquii* with this form.

O. STENOCHILA, E. & B. l. c.: prostrata; articulis obovatis; pulvillis remotis stramineo-setosis, superioribus solum armatis; aculeis singulis albidis patulis, 1 – 2 minoribus deflexis sæpe adjectis; bacca obovata clavata; seminibus crassis anguste marginatis.

Zuni, Western New Mexico. — Joints 4 inches long and 3 wide; spines 1 –  $1\frac{1}{4}$  inches long. Fruit green or pale red, very juicy,  $1\frac{1}{2}$  or sometimes even  $2\frac{1}{2}$  inches long. Seeds quite peculiar, regular, much thicker in proportion than those of most other *Opuntia*, and with a very narrow edge. — Another form, with smaller and rounder joints, more spines, smaller fruit, but similar seeds, was found in the same neighborhood.

All the forms described above have fibrous roots. The following are principally characterized by their bulbous or tuberous roots, but can hardly be otherwise distinguished from the forms already described. Both are found westward of the range of *O. Rafinesquii* proper, and may be considered as subspecies, the peculiarities of which are readily propagated by seeds.

O. MACRORHIZA, E. in Pl. Lindh. part 1: prostrata, sæpe adscendens, radicibus tuberosis; articulis obovato-orbiculatis perviridibus; pulvillis subremotis rufo-setosis, superioribus solum armatis; aculeis singulis validissæpe variegatis patulis, 1 – 2 gracilioribus deflexis subinde additis; alabastro acuminata; petalis circiter 8 sulphureis basi miniatis; stigmatibus 5; bacca obovata basi clavata, umbilico lato; seminibus subregularibus compressis minoribus.

Sterile, rocky places on the Upper Guadalupe River, in Texas: fl. May and June. — Roots in young specimens fusiform, in old ones enlarged to fleshy tubers, sometimes 2 or 3 inches in diameter. Joints  $2\frac{1}{2}$  –  $3\frac{1}{2}$  inches long, the leaves and bristles the same as in *O. Rafinesquii*. Flowers 3 inches in diameter. Fruit green or pale purple, smaller and sweeter than that of *O. Rafinesquii*.

O. FUSIFORMIS, E. & B. l. c.: subprostrata; radicibus elongato-fusiformibus; articulis orbicularis; pulvillis setas elongatas virescentifuscas gerentibus, plerisque vel solum superioribus armatis; aculeis 2 – 3 gracilibus albidis deflexis seu patentibus; floribus minoribus; stigmatibus 8; bacca ovata; seminibus majusculis subregularibus.

Kansas and Nebraska, in the regions of the Cross-Timbers, from the Canadian to the Big Bend of the Missouri. — Roots elongated tubers  $\frac{1}{2}$  – 1 inch in diameter; joints about 3 – 4 inches long; spines an inch or a little more in length, slenderer and paler than in *O. Rafinesquii*. Flowers 2 –  $2\frac{1}{2}$  inches in diameter. Seed  $2\frac{3}{4}$  lines wide. This plant has been distributed by me under the name of *Opuntia bulbosa*.

17. O. FUSCO-ATRA, E. in P. R. R.: diffusa; articulis orbiculato-ovovatis tuberculatis; pulvillis subremotis magnis griseo-tomentosis, inferioribus solum inermibus; setis numerosis robustis longiusculis fuscis; aculeis subsingulis robustis fusco-atris suberectis, altero breviori deflexo sæpe adjecto; floris flavi ovario conico pulvillis 12 – 18 fulvo-villosos et fusco-setosos gerente; stigmatibus 5.

Sterile places in prairies, west of Houston, Texas: fl. May. — The stout brown, or above almost black spines, and the thick bunches of unusually stout brown bristles on the small joints, give this plant a very distinct appearance. Joints  $2\frac{1}{2}$  – 3 inches long; pulvilli 6 – 9 lines apart; bristles 2 – 3 lines long; spines 1 –  $1\frac{3}{4}$  inches long, the lower one, when present, about half as long, but hardly less stout. Flower nearly 3 inches in diameter; ovary an inch long, rather slender, its pulvilli covered with long grayish-brown wool, and the upper ones with a few bright-brown bristles.

18. O. VULGARIS, Mill.: diffusa, prostrata; radice fibrosa; articulis obovatis seu suborbiculatis crassis læte seu pallide viridibus plerumque inermibus; foliis ovatis cuspidatis fere adpressis; pulvillis subremotis parvis subimmersis setas paucas abbreviatas virescenti-stramineas gerentibus; aculeis rarissimis singulis robustis variegatis suberectis; alabastro subgloboso obtuso; ovario clavato pulvillis sub-10 stipato; petalis sub-8; stigmatibus 5; bacca obovata clavata; seminibus regularibus crassis crasse marginatis.

From the southeastern coast of Massachusetts to Georgia and Florida; apparently only in the low countries east and southeast of the Alleghany Mountains, generally not far from the sea-coast: fl. May and June. — Joints 2 – 4 inches long and 2 –  $2\frac{1}{2}$  in diameter, rather thick and fleshy. Leaves 2 –  $2\frac{1}{2}$  lines long, generally appressed, only in

very vigorous specimens more patulous: spines, when present, less than 1 inch long, but stout. Flower about 2 inches in diameter, pale yellow. Seed  $2\frac{1}{2}$  lines in diameter. It seems to be well distinguished from *O. Rafinesquii* (which grows only west of the Alleghanies) by the smaller size, paler color, small pulvilli, usually the absence of spines, the smaller flower, with all the parts less numerous, and especially by the short, thick, and more or less appressed leaves.

§ 5. *Pubescentes*: erectæ seu procumbentes: articuli pubescentes: folia minuta: aculei subnulli.

\* *Flavifloræ*.

19. *O. MICRODASYS*, Lehm.: erecto-patula; articulis oblongis obovatis seu orbiculatis pubescentibus læte viridibus; foliis minutis; pulvillis confertis inermibus lanam flavidam setasque numerosas gracillimas flavas gerentibus.

Only south of the lower Rio Grande, near Rinconada, etc. — Plant 2 – 4 feet high; joints 2 – 3 inches long,  $1\frac{1}{2}$  – 2 wide; pulvilli  $\frac{1}{4}$  –  $\frac{1}{3}$  of an inch apart.

20. *O. RUFIDA*, E. in B. C. R.: erecto-patula; articulis late-obovatis seu suborbiculatis pubescentibus; foliis longe acuminatis; pulvillis confertis setas rufidas graciles numerosissimas gerentibus inermibus; floris flavi ovario obovato pulvillis numerosis instructo; stigmatibus 7 in capitulum congestis.

Common about Presidio del Norte, on the Rio Grande: fl. May. — Stem 2 – 4 feet high, much branched; joints 3 – 6 inches long; leaves  $2\frac{1}{2}$ -lines long. Flower  $2\frac{1}{2}$  inches in diameter, with 40 – 50 pulvilli on the ovarium. — Apparently near *O. microdasys* and *O. puberula*; distinguished from the former by the rounded joints, larger leaves, and red-brown bristles; from the latter by the entire absence of spines, and of the purplish spot which in that species surrounds the pulvillus. Further investigations are necessary to decide about these closely allied forms, as about most species of this intricate genus.

\* \* *Rubriflora*.

21. *O. BASILARIS*, E. & B. l. c.: humilis; articulis obovatis seu triangularibus glaucescentibus pubescentibus e basi proliferis; foliis minutis; pulvillis subconfertis fulvo-villosis setas gracillimas demum numerosissimas fulvidas et subinde aculeolos setiformes caducos gerentibus; floris purpurei ovario obovato pulvillis plurimis instructo;

stigmatibus 8 in capitulum congestis; bacca obovata late umbilicata (sicca?); seminibus magnis crassis subregularibus.

On Williams's River, the Colorado, and the Mojave, and down to the Gila: fl. April and May. — Habit very different from any other of our *Opuntia*; the stout obovate or fan-shaped joints (5 – 8 inches long) originate from a common base, forming a sort of rosette. Leaves only one line long, 4 – 6 lines apart; pulvilli red-brown, somewhat immersed. Flower about 2½ inches in diameter; ovary with 40 – 60 pulvilli. Fruit apparently dry, thereby approaching the next section. Seed 3 lines in diameter, 2 lines thick.

Mr. Schott has observed, on the dividing ridge of the California mountains, west of the mouth of the Gila, and again in the Santa Cruz Valley, Sonora, a very similar but suberect species, 3 feet high, spineless, inclined to assume a purplish hue, which he seems to have confounded with *O. basilaris*. Can it be *O. rufida*, or is it an undescribed species?

§ 6. *Xerocarpeæ*: diffusæ: articuli suborbiculati vel tumidi: aculei plurimi: bacca sicca aculeolata: semina eburnea, magna, plerumque latissime marginata.

\* *Articuli compressi suborbiculati.*

22. *O. HYSTRICINA*, E. & B. l. c.: diffusa; articulis obovato-orbiculatis; pulvillis subconfertis setas pallidas rutilas veherentibus, omnibus armatis; aculeis 5 – 8 superioribus validis elongatis angulatis seu tortis patulis vel deflexis, inferioribus 5 – 7 gracilioribus radiantibus; bacca ovata aculeolata, umbilico planiusculo; seminibus maximis.

West of the Rio Grande, to the San Francisco mountains. — Joints 3 – 4 inches long; pulvilli 5 – 6 lines apart, unusually large; longer spines 1½ – 3 and even 4 inches long, brownish; lower radiating ones white, 4 – 9 lines long. Fruit an inch long; upper pulvilli with 4 – 6 bristly spines. Seeds 3½ lines in diameter, among the largest in this genus.

23. *O. MISSOURIENSIS*, DC. (*Cactus ferox*, *Nutt. Gen.*): prostrata; articulis obovatis vel suborbiculatis tuberculatis; foliis minutis; pulvillis subconfertis stramineo-setosis, omnibus armatis; aculeis 5 – 10 exterioribus radiantibus setiformibus albidis, 1 – 5 interioribus robustis albidis seurufescentibus; floris flavis intus aurantiacis ovario obovato vel subgloboso spinuloso; stigmatibus 5 – 10 viridibus; bacca spinosa, umbilico plano; seminibus magnis irregularibus.

Var. *α*. RUFISPINA, E. & B.: articulis orbicularis; aculeis interioribus 3 – 5 validis fuscis; bacca ovata.

Var. *β*. PLATYCARPA, E.: articulis obovato-orbiculatis; aculeis interioribus subsingulis validis fuscis; bacca depresso-globosa late umbilicata.

Var. *γ*. MICROSPERMA, E.: articulis aculeisque præcedentis; bacca ovata breviter aculeolata; seminibus minoribus anguste marginatis.

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

Var. *ε*. ALBISPINA, E. & B.: articulis late obovatis; aculeis 6 – 12 omnibus albis gracilioribus; bacca ovata.

Var. *ζ*. TRICHOPHORA, E. & B.: articulis ovatis; pulvillis confertis; aculeis 10 – 18 setiformibus (in articulis vetustis numerosioribus) capillaceis flexuosis; bacca ovata; seminibus maximis.

From the Upper Missouri to the Canadian; principally occupying the western plains, but also on the mountains towards Santa Fé and west of it. — The last-mentioned variety (which I would consider a distinct species, were it not for the var. *albispina*, which seems to unite it with the others) has been found only on the mountains near Albuquerque: all the other forms occur on the Upper Missouri, and *α*. and *ε*. also on the Canadian. Other and intermediate forms of this variable but nevertheless well-characterized species will no doubt be found in the wide territory inhabited by it. It flowers in May and June. — Joints 2 – 4, rarely 4 – 6 inches long, and 2 – 3½ inches wide, light green; leaves 1½ – 2 lines long; larger spines 1 – 1½, rarely 2 inches long, in *δ*. not more than 3 – 6 lines long. Flowers 2 – inches in diameter, with short green stigmata forming a compact head. Fruit 1 – 1¼ inches long, with shorter or longer spines, and a rather shallow umbilicus. Var. *β*. has a remarkably large flat fruit. Seed generally about 3 lines, but in *γ*. only 2 lines, in diameter.

24. O. SPHÆROCARPA, E. & B. l. c.: diffusa; articulis orbiculatis tuberculatis; pulvillis confertis stramineo-setosis plerisque inermibus, summis solum aculeos 1–2 deflexos patulosve majores gerentibus, adjectis sæpe 1 – 3 brevioribus; bacca globosa vix aculeolata; seminibus mediis.

Mountains near Albuquerque, New Mexico. — Joints 3 inches in diameter, strongly tuberculated; pulvilli 4 or 5 lines apart; spines 6 – 12 lines long, reddish-brown, often single or 2 or 3 together, with



or without smaller ones, which never occurs in any form of *O. Missouriensis*, where a large number of small setaceous spines is found, whether larger ones are present or not. Fruit 9 lines in diameter, with a small flat umbilicus. Seeds  $2\frac{1}{2}$  lines in diameter.

\* \* *Articuli tumidi ovati.*

25. O. ERINACEA, E. & B. l. c.: adscendens; articulis ovatis seu teretiusculis; pulvillis confertissimis omnibus armatis; aculeis 5 – 10 gracilibus rubellis, 3 – 5 elongatis; bacca ovata aculeolata; seminibus magnis subregularibus.

Near the Mojave, between the Colorado and the Californian mountains. — Joints 2 –  $2\frac{1}{2}$  inches long, 1 –  $1\frac{1}{2}$  broad, and  $\frac{1}{2}$  –  $\frac{3}{4}$  thick, sometimes almost cylindrical, densely covered with large white pulvilli, which are only 2 – 3 lines apart. Spines 6 – 14 or even 20 lines long, slender but stiff. Fruit an inch or more in length. Seeds nearly 3 lines in diameter.

26. O. ARENARIA, E. in B. C. R.: adscendens; articulis obovatis compressis seu teretiusculis tuberculatis; foliis minutis; pulvillis subconfertis pallide setosis; aculeis 1 – 4 robustioribus albidis fuscatisve, cum inferioribus brevioribus 2 – 6 albis; floris sulphurei ovario obovato; petalis emarginatis; stigmatibus 5; bacca oblonga spinulosa; umbilico infundibuliformi; seminibus magnis irregularibus.

Sandy bottoms of the Rio Grande near El Paso: fl. May. — Spreading 2 – 3 feet,  $\frac{1}{2}$  – 1 foot high; roots stout, creeping horizontally; joints  $1\frac{1}{2}$  – 3 inches long, 1 – 2 inches wide, and  $\frac{1}{2}$  –  $\frac{3}{4}$  thick, more strongly tuberculated than the allied species; leaves only a line long; pulvilli 3 – 5 lines apart, very bristly, especially on the old joints; upper spines 9 – 15 lines long. Flower 2 –  $2\frac{1}{2}$  inches in diameter. Fruit about an inch long. Seeds  $2\frac{1}{2}$  – 3 lines in diameter. This is the only one of our Cactaceæ on which the Cochenille has been found.

27. O. FRAGILIS, Haw. (Cactus fragilis, *Nutt.*): subdecumbens; articulis parvis ovatis subcompressis tumidis vel subglobosis vix tuberculatis nitide viridibus; foliis minutis; pulvillis subconfertis magnis albo-tomentosis, vix setulosis; aculeorum 1 – 4 robustiorum summo valido angulato fuscato porrecto, ceteris debilioribus pallidioribus patulis seu radiantibus; aculeis inferioribus 2 – 6 gracilibus albis radiantibus; floribus minoribus; bacca ovata vix spinulosa, umbilico infundibuliformi; seminibus paucis magnis subregularibus.

Fertile prairies, or sterile places, on the Upper Missouri and Yellowstone, to the mountains and south to Santa Fé. — Size and shape of the joints variable; fruit-bearing joints compressed,  $1\frac{1}{2}$  – 2 inches long,  $1 - 1\frac{1}{4}$  wide, and  $\frac{1}{2} - \frac{3}{4}$  thick; others smaller and more tumid. Leaves a line long, hardly longer than the large pulvilli, red. Pulvilli 4 – 6 lines apart, bristles very few, short, whitish, on the old joints a little more numerous, coarser, dirty yellow. Lower radiating spines 2 – 4 lines long; central spines 6 – 10 lines long, the other interior spines 3 – 8 lines long, often similar to the smaller lower spines. Fruit rather fleshy through the winter, getting dry in spring, nearly an inch long, with 20 – 25 pulvilli, of which only the upper ones bear a few short spines. Seeds few, usually only 5 or 6 in each fruit, 3 lines in diameter, with a wide and thick obtuse corky margin. — Often sterile, but abundantly propagated by the fragile joints.

28. O. BRACHYARTHRA, E. & B. l. c.: adscendens; articulis ovatis orbiculatisve tumidis sæpe subglobosis tuberculatis; pulvillis confertis parce setulosis; aculeis 3 – 5 validioribus 1 – 2 fuscatis patulis vel suberectis, cæteris deflexis; floris parvi ovario subgloboso pulvillos 12 – 15 vix aculeolatos gerente; stigmatibus 5.

Inscription Rock near Zuni. — The short and tumid joints (10 – 15 lines long) resemble the joints of a finger; the pulvilli 2 – 4 lines apart, even in the oldest parts of the plant with very few bristles; longer spines 9 – 12 lines long, terete. Ovary less than half an inch long. Flower apparently an inch in diameter. — Perhaps too near *O. fragilis*; but in the absence of good flowers and fruit, it is impossible to say whether it does not belong to even a different section, perhaps to the *Glomeratæ*, Salm.

Subgen. 3. CYLINDROPUNTIA, E. in B. C. R. Articuli cylindracei: flores magni vel parvi: bacca plerumque sicca: semina immarginata seu vix marginata: embryo circa albumen copiosius subcircularis; cotyledones contrariæ seu obliquæ, subinde parallelæ.

§ 1. *Clavatæ*: prostatae: articuli breves, clavati, adscendentes, textura lignosa laxè reticulata: flores flavi majusculi: bacca sicca, pulvillis numerosis setosissimis stipata, floris rudimentis persistentibus coronata.

29. O. CLAVATA, E. in Wisl. Rep.: articulis breviter clavatis læte viridibus; tuberculis ovatis; foliis subulatis minutis; aculeis albidis

scabrellis, interioribus 4 – 7 complanatis, inferioribus deflexis latioribus supra striatis subtus carinatis, superiore triangulato erecto; aculeis exterioribus 8 – 10 gracilioribus undique radiantibus; baccæ pulvillis setosissimis; seminibus rostratis.

Santa Fé and Albuquerque, on the plateaux: fl. in June and July. — Dense spreading masses, with joints  $1\frac{1}{2}$  – 2 inches long; tubercles 6 – 8 lines long; larger spines 6 – 15 lines long, and the broadest one  $\frac{3}{4}$  –  $1\frac{1}{2}$  lines wide. Flower 2 inches in diameter. Fruit yellow,  $1\frac{1}{2}$  –  $1\frac{3}{4}$  inches long, an inch in diameter, covered with 30 – 50 large pulvilli. Seed  $2\frac{1}{2}$  – 3 lines in the longest diameter. Cotyledons mostly oblique, or, as in most other *Opuntia*, incumbent. (The expression is not etymologically correct, but I use it to designate the direction of the face of the cotyledons towards the radicle.)

30. O. PARRYI, E. in Sillim. Journ. 1852: prostrata; articulis ovatis basi clavatis; tuberculis oblongo-elongatis; setis paucis; aculeis angulatis scabris rubellis demum cinereis, interioribus sub-4 validioribus compressis, exterioribus 4 – 8 divergentibus, extimis 6 – 10 gracilibus radiantibus; bacca ovata pulvillis sub-40 setosissimis stipata; seminibus erostratis.

On the Mojave, west of the great Colorado. — Joints  $2\frac{1}{2}$  – 3 or 4 inches long, attenuated below and somewhat so above; tubercles 9 lines long; inner spines 12 – 16 lines long, and the larger ones somewhat flattened, but less than a line wide; exterior spines 3 – 8 lines long, in two series. Fruit  $1\frac{1}{2}$  inches long. Seeds about 2 lines in diameter. — The original specimens of Dr. Parry were found farther south, near San Felipe. He describes the joints as 4 – 8 inches long, with shorter whitish spines or tubercles 6 – 12 lines long, and the flower as greenish-yellow. The Mojave plant is nearly allied to the last species, but may be distinguished by the shape of the joints, the narrower, darker-colored, more numerous spines, and the smaller and more regular seeds.

31. O. EMORYI, E. in B. C. R.: articulis cylindricis basi clavatis glaucis; tuberculis oblongo-linearibus elongatis; setis paucis; aculeis plurimis rufis, interioribus 5 – 9 validioribus triangulatis, compressis, exterioribus 10 – 20 pluriseriatis undique radiantibus; floribus flavis extus rubellis; bacca pulvillis 35 – 50 setosissimos inferiores aculeolatos gerentibus; seminibus valde inæqualibus irregularibus.

Arid soil, from El Paso through Sonora to the desert of the Colorado: fl. August and September. — The stoutest species of this sec-

tion. Joints 4 - 6 inches long, curved, 1 - 1½ inches in diameter; tubercles 1 - 1½ inches long; longest spines 1½ - 2½ inches long, ¾ - 1 line wide; the exterior spines gradually smaller, and less angular. Fruit 2 - 2½ inches long, partly armed with spines 4 - 8 lines long. Seeds from 2¼ to 3¼ lines in diameter. Cotyledons oblique or accumbent.

32. *O. SCHOTTII*, E. l. c.: articulis clavatis; tuberculis elongatis; pulvillis pauci-setosis; aculeis rubellis scaberrimis, interioribus sub-4 cruciatis, superiore triangulato, cæteris supra planis subtus convexis, latioribus; exterioribus 8 - 10 radiantibus gracilibus; bacca ovata pulvillos 35 - 40 pauci-setosos gerente; seminibus rostratis.

On the arid hills near the mouth of the San Pedro and Pecos, Western Texas. — Distinguished by the broad and very rough spines, which are dirty red, the larger ones with a white margin, and by the smaller number of bristles both on the pulvilli of the joints and of the fruit, where they are mostly turned upwards. Joints 2 inches long; tubercles 8 - 9 lines long; spines 1½ - 2 inches long; the radiating ones only 4 - 9 lines long. Seeds 2 lines in diameter. Cotyledons oblique.

Dr. Gregg has collected a similar plant near San Luis Potosi; which at present I know not how to distinguish from *O. Schottii*. The spines are stout, perhaps less rough, and narrower, 12 - 15 in number; some of them borne on the upper margin of the pulvillus, which I have never seen in *O. Schottii*. Tubercles an inch long.

33. *O. GRAHAMI*, E. l. c.: radicibus fusiformibus; articulis clavatis; tuberculis oblongis; foliis ovatis cuspidatis; setis demum plurimis; aculeis gracilibus rubellis, interioribus 4 - 7 teretiusculis angulatisve, exterioribus 4 - 6 brevibus; bacca pulvillos sub-30 setosissimos gerente; seminibus erostratis.

Sandy bottoms of the Rio Grande near El Paso: fl. June. — Joints 1½ - 2 inches long; tubercles 6 - 7 lines long; leaves thicker and in proportion shorter than in most other species, nearly 2 lines long. Fruit similar to that of *O. clavata*. Seed 2½ lines in diameter or more. Cotyledons regularly incumbent.

34. *O. BULBISPINA*, E. l. c.: radicibus fusiformibus; articulis parvis ovatis sæpe ex apice proliferis fragilibus; tuberculis ovatis brevibus; pulvillis parce setosis; aculeis teretiusculis scabrellis basi bulbosis, interioribus 4 cruciatis, inferiore longiore, exterioribus 8 - 12 radiantibus.

Saltillo, Mexico. — Spreading masses with joints an inch long or less; tubercles 4 – 6 lines long; interior spines 4 – 6, exterior ones  $1\frac{1}{2}$  – 3 lines long. Apparently near the South American *O. pusilla*, Salm., and perhaps belonging to the *Opuntia glomerata*, rather than here. Fruit unknown.

§ 2. *Cylindricæ*: ascendentes vel erectæ: articuli longiores, ovato-cylindrici seu elongati: textura lignosa compacta, tubum reticulatum vel truncum compactum formans: flores magni seu parvi, purpurei vel raro flavi: bacca sicca vel subcarnosa, floris rudimenta plerumque deficiens, aculeata seu inermis.

\* *Polyacanthæ*: lignum plerumque reticulato-tubulosum; articuli crassiores distincte tuberculati: aculei plures seu plurimi: flores plerumque rubri: semina immarginata.

† *Humiliores*: diffuse ramosas: articuli subclavati: flores plerumque flavidi: baccæ siccæ, aculeatæ.

35. O. DAVISII, E. & B. in P. R. Rep.: caule dense lignoso ramossissimo divaricato; articulis junioribus erectis elongatis basi attenuatis; tuberculis oblongo-linearibus; aculeis interioribus 4 – 7 subtriangularibus rufis vagina straminea laxa indusiatis divergentibus; aculeis inferioribus 5 – 6 gracilibus; bacca ovata pulvillis sub-25 aculeigeris stipata.

On the Llano Estacado, near the Upper Canadian River; common. — Spreading and somewhat procumbent, about 18 inches high; the only one in this section with dense wood. Joints 4 – 6 inches long, rather slender; tubercles 7 – 8 lines long; interior spines 1 –  $1\frac{1}{2}$  inches in length; lower ones 3 – 6 lines long. Fruits (all sterile, and perhaps not properly developed) an inch or more in length.

36. O. ECHINOCARPA, E. & B. l. c.: erectiuscula; ramis numerosis patentissimis; articulis ovatis basi clavatis; tuberculis ovatis confertis; aculeis majoribus sub-4 albidis stramineo-vaginatibus, 8 – 16 minoribus undique radiantibus; flore flavo (?); bacca globosa depressa seu hemisphæricate profundeque umbilicata pulvillis sub-40 aculeatissimis stipata; seminibus late commissuratis.

Var. *β*. MAJOR: elatior; articulis elongatis; aculeis longioribus laxius vaginatis paucioribus; baccis globosis pulvillos pauciores (25) gerentibus.

In the valley of the Lower Colorado; *β*. in Sonora. — Var. *α*. is a

low shrub, 6 – 18 inches high; joints 1 –  $2\frac{1}{2}$  inches long; tubercles 4 – 5 lines long; spines not over an inch in length. Flower apparently yellow, about  $1\frac{1}{2}$  inches in diameter and somewhat persistent on the fruit. Fruit very shallow, saucer-shaped, with few large seeds. Var.  $\beta$ . is 4 or 5 feet high; joints 8 – 10 inches long; interior spines 1 –  $1\frac{3}{4}$  inches long. Fruit globose or even ovate, with 25 pulvilli. Seeds the same in both.

37. O. SERPENTINA, E. in Sill. Journ. 1852: erectiuscula seu subprostrata; articulis elongatis cylindricis; tuberculis ovatis; aculeis 7 – 9 albido- seu rufido-vaginat; flore flavo extus rubello; bacca subhemisphærica late et profunde umbilicata villosa aculeatissima.

Near the sea-coast about San Diego, California. — Sometimes 4 – 5 feet high, but often prostrate; joints 6 – 12 inches long; spines less than one inch long. Flower cup-shaped,  $1\frac{1}{4}$  inch wide. Fruit apparently like that of the last species, but “long woolly” and with fewer pulvilli, also often crowned with the persistent flower. Seed unknown; said to be large. — Closely allied to the foregoing species. Can this be Nuttall’s *Cactus Californicus* (Cereus, Torr. & Gr. Fl.), with cylindric branches, yellow flower, and spiny fruit?

†† *Deciduaæ*: arborescentes: articuli tumidi, perfragiles: tubercula depressa: flores purpurei: baccæ sæpissime steriles, proliferæ.

38. O. PROLIFERA, E. l. c.: ramis divaricatis; articulis ovatis seu ovato-cylindricis perviridibus versus ramorum apicem congestis; tuberculis obovato-oblongis prominulis; aculeis 8 – 10 obscuris stramineo- seu rufo-vaginat, singulo centrali, ceteris patulis; flore rubro; bacca ovata aculeolata plerumque sterili prolifera.

On arid hills about San Diego, California, forming extensive thickets. — Stems 2 – 4, and sometimes even 6 – 7, inches in diameter, 3 – 10 feet high; joints 3 – 6 inches long and  $1\frac{1}{2}$  – 2 in diameter; tubercles about 6 lines long; spines 6 – 14 lines long, the lower ones shorter. Flowers red, salver-form,  $1\frac{1}{2}$  inches in diameter.

39. O. FULGIDA, E. in B. C. R.: ramis divaricatis; articulis ovatis seu ovato-cylindricis glaucescentibus versus ramorum apicem congestis; tuberculis ovato-oblongis prominulis; aculeis 5 – 9 subæqualibus laxè vaginat, undique stellato-porrectis; flore purpureo parvo; bacca ovata inermi vix tuberculata; seminibus parvis rostratis.

Mountains of Western Sonora: fl. July and August. — Plant 5 – 12 feet high; joints 3 – 8 inches long; tubercles rather elongated, 6 – 7

lines long; spines 1 –  $1\frac{1}{4}$  inches long, hiding the whole plant with their lustrous sheaths. Flower about one inch or less in diameter. Fruit fleshy, 1 –  $1\frac{1}{4}$  inches long, usually sterile. Seeds smaller than in any other *Opuntia* examined, 1 –  $1\frac{1}{2}$  lines long.

40. *O. BIGELOVII*, E. in P. R. R.: ramis erectis adscendentibusve; articulis ovato-cylindricis pallido virescentibus congestis; tuberculis subhemisphæricis depressis confertis; aculeis 6 – 10 robustioribus et totidem gracilioribus inferioribus; ovario tuberculato; bacca tuberculata subinde (sterili?) aculeolata; seminibus parvis.

On Williams's River, of the Californian Colorado. — Stem 3 – 4 inches thick and 10 – 12 feet high; the branches forming a dense contracted head, with joints 2 – 6 inches long; tubercles 3 – 4 lines long; larger spines about an inch long, smaller ones 4 – 7 lines long.

The three foregoing species represent this subsection west of the California mountains, and east of them both south of the Gila and north of it, and seem to be well distinguished from one another by the characters indicated.

††† *Cristata*: frutescentes vel arborescentes: articuli cylindrici: tubercula plerumque cristata prominula: flores purpurei: baccaë inermes seu rarius aculeatæ.

41. *O. WHIPPLEI*, E. & B. in P. R. R.: caule erecto seu rarius subprocumbente divaricato-ramoso; articulis cylindricis; tuberculis ovatisconfertis; aculeis brevibus cinereo-seustramineo-vaginatiss, 1 – 4 majoribus, 2 – 8 brevioribus deflexis vel radiantibus; flore rubro; bacca subglobosa tuberculata flava inermi; seminibus regularibus.

Var. *α*. LÆVIOR: humilior, aculeis paucis deflexis.

Var. *β*. SPINOSIOR: elatior, aculeis plurimis radiantibus.

From Zuni westward to Williams's River (*α*.), and south of the Gila (*β*.): fl. in June. — The first state is from a few inches to 3 – 6 feet high; the second forms small trees 8 – 10 feet high. Joints  $\frac{1}{2}$  –  $\frac{3}{4}$  inch in diameter; tubercles about 5 lines long; spines very variable, between 3 and 9 lines long. Flower (of var. *β*.)  $1\frac{1}{4}$  –  $1\frac{1}{2}$  inches in diameter. Fruit about an inch long.

42. *O. ARBORESCENS*, E. in Wisl. Rep. (*O. stellata*, Salm.): arborescens; ramis verticillatis horizontalibus vel pendulis; articulis verticillatis cylindricis; tuberculis cristatis prominentibus; aculeis 8 – 30 stellato-divaricatis; flore purpureo magno; bacca subhemisphærica tuberculato-cristata flava inermi; seminibus regularibus.

From north and east of Santa Fé and the Llano Estacado, to Zuni; extending southward deep into Mexico: fl. May-July. — Northward 5 – 6, south 10 – 20 or more, feet high; easily characterized by the horizontal and verticillate branches, etc.

43. *O. ACANTHOCARPA*, E. & B. in P. R. R.: arborescens; ramis alternis adscendentibus; articulis cylindricis; tuberculis elongatis; aculeis 8 – 25 stellato-divaricatis; bacca subglobosa tuberculata aculeata; seminibus multangulatis.

Mountains of Cactus Pass, between Santa Fé and the Western Colorado. — Stems 5 – 6 feet high; branches few, alternate, and separating from the stem at an acute angle. Joints (as in the preceding) 4 – 6 or 8 inches long, about 1 inch in diameter; tubercles 9 – 10 lines long; interior spines 1 – 1¼ inches, exterior ones 4 – 10 lines, long. Spines of fruit on the depressed tubercles 3 – 6 lines long. Seeds large, unlike those of any other *Opuntia* seen by me.

44. *O. MAMILLATA*, A. Schott in litt., B. C. R.: arborescens, divaricato-ramosissima; articulis crassis abbreviatis perviridibus; tuberculis tumidis; aculeis 4 – 6 brevibus plerisque deflexis; flore parvo purpureo; bacca obovata inermi; seminibus parvis.

Sonora, on the Sierra Babuquibari, in fertile soil: fl. July and August. — Stems 5 – 6 feet high; joints 3 – 4 inches long, 14 inches in diameter; the swelling tubercles very prominent; spines 3 – 9 lines long, sometimes almost wanting. Flowers an inch or less in diameter.

45. *O. THURBERI*, E. in B. C. R.: frutescens, erecta; articulis cylindricis gracilibus elongato-tuberculatis; aculeis 3 – 5 brevibus divergento-deflexis; flore miniato.

Bacuachi, Sonora: fl. June. — Much more slender than any species yet enumerated in this subgenus. Joints ½ inch in diameter; tubercles 9 lines long; spines 3 – 8 lines long, the lowest one the stoutest. Flower 1½ inches in diameter.

\* \* *Monacanthæ*: lignum densum: articuli graciliores obscure tuberculati: aculei singuli: flores flavi seu rubri; semina plus minus marginata.

46. *O. WRIGHTII*, E. l. c.: frutescens, erecta; articulis cylindricis gracilibus elongato-subtuberculatis; aculeis subsingulis porrectis vel subdeflexis; flore miniato.

On steep mountain-sides, from the Limpio to the Pecos, and in Northern Mexico: fl. June and July. — Shrub 2 – 4 feet high, 1 – 1½



inches thick. Joints 4 lines in diameter; tubercles depressed, 7 – 9 lines long; spines 8 – 10 lines long. Flower about 1 – 1¼ inches in diameter.

47. *O. ARBUSCULA*, E. l. c.: arborescens, erecta, capitato-ramosissima; articulis læte viridibus elongato-subtuberculatis; aculeis subsingulis porrectis vel subdeflexis; flore flavo-virescente.

On the Lower Gila, near Maricopa village: fl. June. — A truly arborescent form, with a solid trunk of 4 or 5 inches in diameter, 7 – 8 feet high; joints 2 – 3 inches long, about 4 lines in diameter; tubercles indistinct, about 6 lines long; spine 9 – 12 lines long, often with 1 or 2 smaller ones under it. Flower 1½ inches in diameter.

48. *O. VAGINATA*, E. in Wisl. Rep. (partim): frutescens, erecta; ramis erectiusculis; articulis subtuberculatis; aculeis subsingulis; bacca obovata tuberculata coccinea.

Albuquerque, New Mexico, and southward. — Shrub 3 – 5 feet high, 1 – 1½ inches thick; joints 3 – 4 lines in diameter; tubercles rather distinct, 6 – 9 lines long. Fruit 8 – 9 lines long. Seed about 2 lines in diameter. Perhaps a stout form of the next species.

49. *O. FRUTESCENS*, E. in Pl. Lindh. 1845: frutescens, erecta; ramis erectiusculis; articulis teretibus; aculeis subsingulis; flore parvo virescente; bacca obovata haud tuberculata coccinea.

Var. *α*. *LONGISPINA*: articulis nascentibus stipitatis; aculeis validioribus longioribus laxè vaginatis.

Var. *β*. *BREVISPINATA*: articulis nascentibus sessilibus; aculeis gracilioribus brevioribus arcte vaginatis.

From the Colorado of Texas to Matamoras and Saltillo, westward to Sonora and the Californian Colorado: fl. June to August. — Var. *α*. is the usual Western form; *β*. occurs only in Texas and Eastern Mexico. — Shrub 3 – 5 feet high, stem 1 – 1½ inches thick; joints 2 – 3 lines in diameter; indistinct tubercles 3 – 5 lines long; spines in *α*. 1 – 2 inches, in *β*. 4 – 6 lines, long. Flower 7 – 9 lines in diameter. Fruit 5 – 9 lines long. Seeds few, usually 1½ lines in diameter.

50. *O. TESSELLATA* (*O. ramosissima*, E. in *Sill. Journ.* 1852): frutescens, erecta seu diffusa, divaricato-ramosissima; articulis gracilibus tessellato-tuberculatis cæsiis; tuberculis 5 – 6 angulatis planis inermibus seu aculeum elongatum paucosque minutos gerentibus; flore purpurascente parva; bacca setosissima sicca.

Valley of the Lower Colorado from Sonora to the California moun-

tains: fl. May to September. — Stems 2 – 6 feet high, at the base 1 – 3 inches thick; joints. 3 – 3½ lines in diameter, ashy gray; the singular flattened and angular tubercles 2½ – 3 lines long; spines 1½ – 2 inches long, crowded together at the upper end of each year's growth, very loosely sheathed. Flower purple, half an inch in diameter. Fruit 9 – 10 lines long, covered with reddish-brown bristles. Seed 2 lines or less in diameter.

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\*.\* The material for the present study of our *Cactaceæ* is not as full as would have been desirable in the examination of so difficult a family. Hence it may sometimes have happened, that what I have endeavored to distinguish as species are forms which properly belong together; or I may have combined as one species incomplete specimens of quite distinct plants. The fear of confusing heterogeneous plants under one name, and the desire to indicate to future explorers all the different forms known to me, combined to induce me to proceed as I have done.

For those who naturally may be horrified at the idea of 117 species of *Cactaceæ* in a territory where, a few years ago, scarcely half a dozen were known, I will indicate how the mass of material may be comprehended under fewer types.

Of *Mamillariæ* the species 1 – 9 are quite distinct, and can in no manner be united; 10 – 12 might perhaps be considered as forms of a single species; 13 – 17 are all very distinct; 18 and 19, 20 – 23, 25 and 26, 27 and 28, may possibly be forms of only four types, instead of 10, as I have enumerated them, thus referring my 30 species to 22 types.

In the genus *Echinocactus* the following species might be united: 1 and 2, 7 and 8, 9 and 10, 12 and 13, 14 and 15, — leaving 15 instead of 20 types.

The following species of *Cereus* will perhaps bear reduction: Nos. 1 and 2, 3 and 4, 5 – 7, 10 and 11, 12 – 14, 16 and 17, 18 – 22 (though some of them, of which I do not even know the flowers, may prove to belong even to different sections!), 23 and 24, — thus reducing my 31 species to 18 types.

*Opuntia* is a still more difficult genus, and mistakes are here most easily made. Many of them are as yet very incompletely known; and without being able to compare a great number of living specimens

in their native state and in all stages of development, it can hardly be expected that any one should know beforehand what constitutes the specific characters in these plants. I have tried to unite the forms which seemed to justify such a proceeding (see, e. g. *O. Rafinesquii*, here made to comprise quite a suite of forms as subspecies). Still it may be thought that a greater reduction was yet desirable; but with our present data this would involve great danger of jumbling heterogeneous materials together. Nos. 5 and 7 (of which latter neither flower nor fruit is known) can perhaps be united; also 9 and 10, 11 and 12, 13 and 14, 16 and 17, 19 and 20, 22 – 24, 25 – 28, 29 and 30, 31 – 33, 35 – 37, 38 – 40, and 48 and 49, — leaving 31 types, 29 of which are indigenous to our territory, and two cultivated.

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*Geography of the Cactus Region of the United, States.*

The localities where our Cacti grow are so little known to those who have not made the geography of the West a particular study, or are familiar with the publications of our Western explorers, that it seems necessary to add a few explanatory remarks.

Texas, as at present organized, is bounded southeasterly by the Gulf of Mexico, into which the following rivers mentioned in the foregoing pages empty, following the order from east to west: the Brazos, the Colorado with the Llano, the Guadalupe with the Pierdenales and San Antonio, the Nueces, and the Rio Grande. The latter forms the southern and southwestern boundary as high up as El Paso. On it are the towns of Matamoras (not far from its mouth), Mier, Laredo; and higher up, Presidio del Rio Grande; then Fort Duncan or Eagle Pass (southwest of which is Santa Rosa, in the State of Coahuila); next comes the mouth of the San Pedro or Devil's River (a small river or rather torrent running southward), and not far from it the mouth of the Pecos or Puerco, which rises at the north-northwest in the upper parts of New Mexico. Between the mouth of the Pecos and El Paso we notice only Presidio del Norte, San Elizario, and a "cañon" below the latter. The valley of the Limpio, a little more to the northward between the Pecos and El Paso, is a remarkable locality; probably because there porphyritic rocks take the place of the cretaceous formation of the more eastern districts.

Chihuahua is the well-known capital of the Mexican State of the same name, south of El Paso.

The Canadian River is a southern tributary of the Arkansas, running eastwardly very nearly under the 35th degree of latitude, and bounding on the north the elevated plains known as the *Llano Estacado*, in the northwestern parts of Texas and the adjoining regions of New Mexico.

The Upper Rio Grande runs through New Mexico from north to south; the capital, Santa Fé, is not far from the river, in lat.  $35\frac{1}{2}^{\circ}$ ; and the town of Albuquerque is a little below. Doñana is a small place on the river, above El Paso. El Paso itself, where the Rio Grande breaks through the mountain ranges, changing its heretofore southern to a southeastern course, is the central point of our Cactus region, partly from its geographical position, and partly because many of our explorers have made it the centre of their operations.

The present southwestern boundary of the United States runs from El Paso irregularly westward through the former Mexican State of Sonora, to the Colorado "of the West," or "of California," which comes from the South Pass in the Rocky Mountains, and runs southwestward and southwardly. Its principal tributaries rise in the east; those most important to us are the Little Colorado or Colorado Chiquito, under the 35th and 36th degree of latitude; Bill Williams's Fork, or Williams's River, as it is lately styled, further south; and in lat.  $33^{\circ}$  the Gila River, which rises near the "Coppermines," northwest of El Paso.

Proceeding from Santa Fé westward, we find the Indian town of Zuni, on the head-waters of the Little Colorado; then the San Francisco mountains; the Cactus Pass, at the head of Williams's River, and this stream itself. All this territory is at present included in the political organization of New Mexico, though uninhabited by whites.

West of the Colorado, in lat.  $35^{\circ}$ , is the Mojave or Mohave River, rising in the Sierra Nevada near the Cajon Pass; lower down, opposite the mouth of the Gila, the country is a sandy desert extending westward nearly to San Felipe, on the eastern slope of the California mountains in the same latitude. On the western sea-coast the town of San Diego is the only interesting point for the plants under review.

*Geographical Distribution of the Cactaceæ in the Territory of the United States.*

As to the geographical distribution of the Cactaceæ, our territory may properly be divided into eight regions, viz.: —

1. THE ATLANTIC REGION; which has only a single *Opuntia*, and that peculiar to it. Along the Southern coast some West Indian species may yet be expected.

2. THE MISSISSIPPI REGION, including the Western States, produces another *Opuntia*, which, in different distinct forms, extends into the 3d, 4th, and 5th regions.

3. THE MISSOURI REGION; namely, the Northwestern or Upper Missouri Territory to the Rocky Mountains. It furnishes

Two *Mamillariæ* of the subgenus *Coryphantha*, both extending into the 4th and 5th region; and

Three *Opuntia*, one of which only is peculiar.

4. THE TEXAN REGION; namely, the eastern and inhabited parts of Texas, westward to the San Pedro, and northward including the territory south of the Arkansas River. This region produces

Five *Mamillariæ*, two of them peculiar to this district;

Three *Echinocacti*, none of which are found in any other of our regions; \*

Six *Cerei* (five *Echinocerei* and one *Eucereus*), all of them peculiar to this district; and

Six *Opuntia*, of which only three are restricted to it; among them is only a single cylindric *Opuntia*.

This region contains therefore altogether twenty species, fourteen of which are peculiar to it.

5. THE NEW-MEXICAN REGION; namely, Western, uninhabited, mountainous Texas, and Eastern New Mexico to the eastern headwaters of the Colorado of California. This region is our richest Cactus district. It has furnished sixty-five species, fifty-five of which are peculiar to it, viz.: —

Nineteen *Mamillariæ* (eight *Eumamillariæ*, ten *Coryphanthæ*, and one *Anhalonium*), of which sixteen are peculiar;

Nine *Echinocacti*, all of them belonging to this district only;

Sixteen *Cerei* (fifteen *Echinocerei*, fourteen of which are peculiar, and one *Eucereus*, common also to other regions); and

Twenty-two *Opuntia*; of these twelve are flat-jointed, four clavate, and five cylindrical ones: seventeen of these species are peculiar.

6. THE GILA REGION, comprising the whole valley of the Colorado

\* Always excepting Mexico itself, south of the Rio Grande, into which many, if not most, of our species extend.

south of lat. 36°, and the country of the Gila, its large southern tributary. This has thus far furnished thirty-six Cactaceæ, viz.:—

Five *Mamillariæ*, three of them peculiar species;

Six *Echinocacti*, none of them found elsewhere;

Seven *Cerei*, representatives of each of our four subgenera, and five of them peculiar;

Eighteen *Opuntia*, of which six (all peculiar) belong to the *Platopuntia*, two to the clavate and ten to the cylindric *Cylindropuntia*; one of the former and nine of the latter peculiar.

7. THE CALIFORNIAN REGION, namely, California west of the Sierra Nevada, and comprising the southwestern part of the present State of California, produces six Cactaceæ, five of which are peculiar. They are,—

One *Mamillaria*;

One *Echinocactus*;

One *Cereus* of the section *Eucereus*; and

Three *Opuntia*; one of them a *Platopuntia*, probably only a form of a more eastern species, and two peculiar *Cylindropuntia*.

8. THE NORTHWESTERN REGION, comprising the northern parts of the State of California, the Territories of Utah, Oregon, and Washington. This region has so far furnished only a single *Opuntia* (from Eastern Oregon), common also to the Missouri Region. — Mr. Geyer, in his account of his expedition to Oregon in 1843, mentions two *Mamillariæ*; and a "*Melocactus*" (?), which latter he has not seen himself, nor are there any known specimens in existence.

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#### CORRECTIONS AND ADDITIONS.

P. 267. *Mamillariascolumoides* has been collected by Mr. Wright, on the Pecos, in Western Texas.

P. 273. 9th line from top, dele "1" after "fuscatis."

P. 278. 5th line from top, for "parallelæ" read "contrariæ."

P. 286. *Cereus Berlandieri* is very near *C. pentalophus*, DC, but Prince Salm, who has cultivated both side by side, considers them well distinguished.

P. 300. *Opuntia Missouriensis* has been sent from Clear Water, on the Kooskooskie, in Oregon, by the Rev. Mr. Spalding.

texture on cooling is highly crystalline and porous. Although the iron in this state is as pure chemically as any bar-iron, its mechanical state does not assimilate it to malleable iron, and the ingots rarely present the compactness of cast-iron of the coarser qualities. A careful examination of the specimens suggests the conclusion, that much of the character of fluidity is also due to the presence of the engaged carbonic oxide, which, like any gas disengaging from a dough-like semi-solid, causes it to flow.

“This mechanical constitution of the pure iron removes the difficulty which every iron-master must have conceived to exist, in the descriptions of the new method heretofore published, and it will be seen that the effects produced in the old and new process are strikingly similar; while the fuel in the one case is iron, in the other the ordinary coke or coal. In removing the iron from the furnace, the puddler depends on forming a rude porous aggregate, while Mr. Bessemer, by a refined mechanical agitation, converts the whole into a semi-solid, crystalline mass, full of gas-bubbles, which flows from an inverted vessel, and takes the forms of the moulds.”

Mr. Charles Jackson expressed a doubt as to the practical value of the new process, and adduced the significant fact, that it had not in the least affected the price of iron in the market, nor the value of iron-works.

Dr. Hayes rejoined, that he had presented to the Academy only the interesting chemical points, avoiding the economical bearing of the discovery. He was, however, prepared to discuss this fact, in view of its importance to the English, rather than to the American manufacturer.

Professor Gray presented, in the name of Dr. Engelmann, the following

*“Corrections and Additions to the Synopsis of the Cactaceæ of the United States.*

“On p. 279, the var. *minor* of *Cereus dasyacanthus* should be cancelled, and after *C. longisetus*, p. 280, the following added: —

“9½. C. RÆTTERI, E. in B. C. R.: ovato-cylindricus, 10 – 12 costatus; areolis ovato-orbiculatis; aculeis e basi bulbosa subulatis-rubellis apice obscuris exterioribus 10 – 15, interioribus 2 – 5 robustioribus

sub-brevioribus; floribus subterminalibus magnis purpureis; bacca subglobosâ; seminibus tuberculatis.

"El Paso, southward to the Sandhills; fl. April. — Stem 5–6 inches high; spines 4–8 lines long; flower  $2\frac{1}{2}$ –3 inches long. Similar to *C. dasyacanthus*, from which it is distinguished by the fewer ribs, fewer and stouter spines, purple flowers, smaller fruit, and larger seed. This species is intermediate between the *Pectinati* and *Decalophi*.

"After *Opuntia setispina*, p. 294: —

"O. PES CORVI, Le Conte, Mss.: articulis parvis teretiusculis; pulvillis subconfertis setas paucas breves graciles flavidulas gerentibus plerisque armatis; aculeis binis ternisve gracilibus sæpe basi compressis tortisque; flore flavo minore.

"Sandy coast of Georgia, *Major Le Conte*, and Florida, *Dr. Chapman*. — Joints not much over an inch long, and half as thick. Spines 1– $1\frac{1}{2}$  inches long, straight and slender. Flower  $1\frac{1}{2}$  inches in diameter. Ovary only with 5 areolæ; stigmas 5. — In the shape of the joints this curious little species resembles *O. fragilis*, but in other respects it seems intermediate between *O. vulgaris* and *O. tenuispina*."

Professor Agassiz addressed the Academy on the general characters of Orders in the classification of the animal kingdom. Orders, he said, are natural groups characterized by complication of structure. There are groups, however, constituting orders, which do not come under this definition; hence he concludes that the different classes of the animal kingdom do not all admit of the same divisions. Professor Agassiz illustrated his views by the different orders of Echinoderms. In conclusion, he remarked, that orders are of different kinds, some synthetic, some prophetic, others graduated.

After nomination by the Council, —

Laurens P. Hickok, D. D., President of Union College, Schenectady, was elected an Associate Fellow in the Section of Philosophy and Jurisprudence.

Dr. George B. Wood and Dr. Isaac Hays, both of Philadelphia, were elected Associate Fellows in the Section of Medicine and Surgery.





30th CONGRESS, }  
1st Session. }

SENATE.

{ EXECUTIVE,  
{ No. 7.

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# REPORT

UPON THE

## COLORADO RIVER OF THE WEST,

EXPLORED IN 1857 AND 1858 BY

LIEUTENANT JOSEPH C. IVES,

CORPS OF TOPOGRAPHICAL ENGINEERS,

UNDER THE DIRECTION OF THE OFFICE OF EXPLORATIONS AND SURVEYS,

A. A. HUMPHREYS, CAPTAIN TOPOGRAPHICAL ENGINEERS, IN CHARGE.

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BY ORDER OF THE  
SECRETARY OF WAR.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1861.

EXPLORATIONS AND SURVEYS. WAR DEPARTMENT.

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COLORADO EXPLORING EXPEDITION, LIEUTENANT J. C. IVES, TOPOGRAPHICAL ENGINEERS.

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B O T A N Y .

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BY PROFESSORS GRAY, TORREY, THURBER, AND DR ENGELMANN.

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WASHINGTON, D. C.  
1860.

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ENOOTHERA (CHYLISMA) BREVIPES, *Gray in Torr. Bot. Whipple.*, p. 86. Common all along the Colorado in February and March.

ENOOTHERA (CHYLISMA) CLAVÆFORMIS, *Torr. in Frem. Rep. & Bot. Whipple. l. c.* Common on gravel hills, &c., upper part of the Colorado, in February and March.

ENOOTHERA (SPHÆROSTIGMA) GAURÆFLORA, *Torr. & Gray, Fl. 1*, p. 510. Riverside mountain, on Colorado.

These specimens, like one of Schott's from the Gila, are complete, and allow the cauline leaves, &c., to be described. The petals are pale yellow, tinged with pink outside.

ENOOTHERA DENTATA, *Cav.; Torr. & Gray, Fl. 1*, p. 510. Riverside mountain, on Colorado, January 28.

ENOOTHERA CHAMÆNERIOIDES, *Gray, Pl. Wright. 2*, p. 58. Fort Defiance. New Mexico; May 23. Early; small specimens.

ENOOTHERA CHEIRANTHIFOLIA, *Horvem.; Torr. & Gray, l. c.* San Diego, California; November 10.

ZAUSCHNERIA CALIFORNICA, *Presl. Rel. Hoenk. 2, t. 52.* San Diego and San Luis Obispo; November.

#### LOASACEÆ.

EUCNIDE BARTONIOIDES, *Zucc.; Gray, Pl. Lindh. 2, p. 192.* On ledges of rocks, head of Mojave valley. "Setæ irritating the skin like nettles."

MENTZELIA ALBICAULIS, *Torr. & Gray, Fl. 1, p. 534.* On gravelly surfaces, &c., along the Colorado. Common. Mojave valley; March 23.

MENTZELIA (BARTONIA) LÆVICAULIS, *Torr. & Gray, l. c.* *Bartonia lævicaulis, Dougl. in Hook. Fl., t. 69.* Riverside mountain; January 25.

#### CUCURBITACEÆ.

MEGARHIRA CALIFORNICA, *Torr. in .* Riverside mountain, and on the Colorado, to Black Cañon; March; in flower.

CUCURBITA PERENNIS, *Gray, Pl. Lind. 2, p. 193.* On Colorado everywhere, and thence to Rio Grande.

CUCURBITA DIGITATA, *Gray, Pl. Wright. 2, p. 60.* Along Lower Colorado.

#### CACTACEÆ. By Dr. Geo. Engelmann.

MAMILLARIA GRAHAMI, *Engelm. in Mex. Bound. Rep. II, p. 7, tab. 6, figs. 1-8; Synops. Cact. in Proc. Americ. Acad. Arts and Sciences, III, p. 6.* Common along the Colorado; in flower April 7; fruit of last year just ripe. In the M. B. Rep. the fruit is erroneously called a *small oval berry, probably green*. The specimens then at command had shrivelled and discolored fruit. Those now before me show that the berry is elongated, clavate, scarlet, three-quarters or even one inch long, with or without the remains of the flower. The seeds are absolutely the same as those of the El Paso plant.

MAMILLARIA PHELLOSPERMA, *Englm. l. c., p. 6, t. 7; Syn. Cact. p. 6.* Common with the last, and easily confounded with it by the casual observer; apparently more abundant westward, while the former prevails more eastward; generally simple, sometimes many-headed. Some of Dr. Newberry's specimens closely resemble the figure in M. B. R.; others have fewer, (30-35,) shorter, and stiffer spines, almost in three series, the 8-12 interior ones stout and purplish brown. One of the specimens before me has, in each bunch, three divergent, hooked, central spines.

ECHINOCACTUS WHIPPLEI, *Engelm. & Bigelow in Pacif. R. R. Rep. IV, Cactaceæ of Lieut. Whipple's Exped., p. 28, t. 1; Syn. Cact., p. 15.* In sandy soil on the Little Colorado, often half buried in sand, in the same region where Dr. Bigelow discovered this pretty species in 1853; in flower in the middle of May.

The specimens have thirteen compressed, interrupted ribs; the floriferous is contiguous to the spiniferous areola, not separated from it by the cylindric glands present in several allied species. After flowering the floriferous areola forms a groove two-thirds down the upper side of the tubercle, (or prominent part of the rib,) or even almost to its base. Number of radial spines, 7 to 11. The description of the flower, wanting heretofore, may be given thus:

Floribus versus apicem congestis virescenti-flavis pollicaribus; ovario sepalis squamiformibus paucis (2–5) orbiculatis seu reniformibus munito; sepalis tubi 10–15 inferioribus ovatis, superioribus oblongis obtusis; petalis sub 8 oblongis mucronatis; infimo tubi parte intus nudo; filamentis tenuissimis numerosis; stylo exerto sursum clavato apice infundibuliformi in stigmata 5 brevissima erecta seu conniventia diviso.

The flowers are one inch long, greenish red, externally tinged with brown red; stigma green. The fruit remains unknown as yet; the large seed has been figured in the work mentioned.

ECHINOCACTUS LECONTEI, *Engelm. in M. B. R. II, p. 23, t. 27, & P. R. R. l. c., p. 28, t. 2, f. 3–5; Syn. Cact., p. 18.* In the Colorado valley; in flower in April. Specimens of 3–5 inches diameter have below eight, and upwards thirteen ribs; those of 9–12 inches show 19–21 ribs. The lowest bunches (those developed probably in the 3d or 4th year) have eight radial and one central spine, all annulated. The central one is curved, not hooked; one, or even three, of the lower radial ones are often hooked. The fully developed bunches consist of four central spines, the upper and lower one of which is quite flat, five or seven lower radial ones, never hooked, three upper ones, and 6–12 slender, bristly, radial spines. The ovary is covered with about thirty sepaloid scales, in the specimens examined, in  $\frac{4}{11}$  or  $\frac{5}{13}$  arrangement.

ECHINOCACTUS? Young specimens, 3–5 inches high, of another evidently large species, were collected, with thirteen ribs — four central and five lower, stouter, and 3–6 upper slender radial spines, all annulated and curved. The plants, showing no indication of floriferous areolæ, must be undeveloped; they may possibly be young ones of *E. polycephalus*, or belong to species yet unknown to us.

ECHINOCACTUS VIRIDESCENS, *Nutt. in Torr. and Gray, Fl. I, p. 554. Engelm. in M. B. R. II, p. 24, t. 29; Syn. Cact., p. 19.* San Diego, California. 25–30 scales on yellow fruit. Seed as described in M. B. R., but the pits are much closer together than in fig. 6. c! The hooked acute cotyledons are bent over a rather copious albumen; similar to those of *E. Wislizeni*, t. 25, f. 4. e.

CEREUS FENDLERI, *Engelm. in Plant. Fendl. in Mem. Am. Acad. 1848, p. 51, M. B. R. II, p. 33, t. 51–53; Syn. Cact., p. 25.* Coveras, New Mexico, and from Laguna to Santa Fé; fl. April.

CEREUS PHOENICEUS.—*Engelm. P. R. R. l. c., p. 34, t. 4, f. 1; Syn. Cact., p. 28; Echinocereus coccineus, Engelm. in Wisliz. Rep. N. Mex. note 9.*

This is *Mamillaria aggregata*, Emory's Report, 1848, and the "Aggregated Cactus" of the explorers of the western parts of New Mexico and the Gila regions. It grows in large dense masses, often 100 or 200 heads from a single base, the whole often of the shape and size of a bushel basket, generally on apparently naked rocks; in the proper season densely covered with beautiful crimson flowers. It was found from Camp 64 to Camp 78 (Yampai valley to Partridge creek) in flower in April. The flowers collected are less than 2 inches long, much more densely covered with bristle-bearing sepals than the next species, and with only 5 stigmata; the naked space in the base of the tube is nearly four lines long. The fruit and seed of this common plant, which has now been known to science for twelve years, still remains unknown, and living plants are as yet extremely scarce.

CEREUS CONOIDEUS, *Engelm. & Bigelow, l. c., p. 35, t. 4, f. 4–5; Syn. Cact., p. 28.* Camp 96. (Oryabe gardens, Moqui country.)

Flowering in May. So nearly allied to the last that we considered it a form or sub-species of it. Dr. Newberry has now obtained the flowers. His specimen has fewer spines than Dr. Bigelow's original ones; 8 or 9 radial ones, about 1 inch long, and 1 or 2 central angulate ones,  $1\frac{1}{2}$ –2 inches long; all whitish and somewhat translucent. They resemble the spines of *C. enneacanthus*, but the flowers are vastly different, being open day and night, and not diurnal, as those of the species just mentioned.

Floribus magnis diametro transversali duplo longioribus coccineis; ovario parvo squamis sepaloideis 8–12 triangulatis in axilla lanam albam et aculeolos 3–5 graciles gerentibus munito; tubo sensim ampliato sepalis fere 20 lanceolatis aculeigeris instructo; sepalis superioribus sub 8 oblongis obtusis; petalis 10–13 spatulatis obtusis; staminibus numerosissimis et stigmatibus sub 9 vix exsertis petala subæquantibus.

The flowers are  $3\frac{1}{2}$ –4 inches long and  $1\frac{1}{2}$ –2 inches in diameter; the slender spines in the axills of the upper sepals are 6–8 lines in length, the stigmas, as in the whole subgenus *Echinocereus*, velvety green.

OPUNTIA BASILARIS, *Engelm. & Bigelow, l. c., p. 43, t. 13, f. 1–5, t. 23, f. 14; Syn. Cact., p. 42.*

Abundant on the Colorado from Fort Yuma to the Great canon, and one of the most common species in the Colorado valley and desert. Dr. Newberry confirms the description before given of the peculiar growth of this species; a large number of joints of different shape obovate, obcordate, emarginate, or elongate, and almost oblanceolate, issue from nearly the same base, and are covered in spring (March and April) with a profusion of rose-colored or purplish flowers, often 150 on one plant. The ovary is described as somewhat tuberculate but sometimes almost smooth. The fruit is dry when ripe; seed large and thick, as in the figure above cited.

OPUNTIA HYSTRICINA, *E. & B. l. c., p. 54, t. 15, f. 5–7, t. 23, p. 15; Syn. Cact., p. 43.* Common from the Colorado to the Rio Grande. The form collected by Dr. Newberry, and named in his notes "*hairy-spined Opuntia*," has fewer, shorter, and usually straighter spines than the specimens figured and described in Lieut. Whipple's report; the larger ones are also angular and erect, and by these characters distinguished from the nearly allied *Opuntia Missouriensis*. However, Mr. Fendler's specimens from Santa Fé, (the flowers of which were inadvertently distributed with No. 276, *O. phæacantha*, but are easily distinguished by the spinulose ovary,) seem to be intermediate between the two, and may make it necessary to unite them.

Dr. Newberry's specimens have 1–5 larger spines,  $1-1\frac{3}{4}$  inches long, nearly erect, and about 5 smaller deflexed ones below, with a few very small ones above. Flower nearly two inches in diameter, ovary with 20–25 tomentose pulvilli, each with a short slender leaf, (sepal,) less than one line long, and 5–12 bristly spines of very different lengths: the interior sepals are obovate cuspidate petals, obcordate, orange yellow; 5 erect green stigmata, forming a compact head.

OPUNTIA ECHINOCARPA, *E. & B. l. c., p. 40, t. 18, f. 5–10, t. 24, f. 8; M. B. Rep. II, p. 56. Syn. Cact., p. 49.* In the Mojave valley, and common on the Colorado; begins to flower end of March. The specimens obtained are low, with many short branches, much of the habit of the clavate *Opuntia*, but distinguished from them by the sheathed spines and the reticulated wood peculiar to the cylindroid *Opuntia*. The ovary is 6–8 lines long, with about 20 pulvilli bearing thick ovate leaves, abruptly narrowed into a subulate point, 1–2 lines long, and in their axills in a white tomentum, 6 or 8 sheathed spines, the large ones 6–8 lines long. The greenish yellow flower when fully open is  $1\frac{1}{2}$  inches wide; petals spatulate, rounded or emarginate, denticulate, the exterior ones mucronate; stigmata 5–6, large and thick, and apparently yellow.

OPUNTIA ARBORESCENS, *Engelm. in Wislizen. Rep. N. Mex. note 5, M. B. Rep. II, p. 58, t. 75, f. 16–17; P. R. Rep. IV., t. 17, f. 5–6, t. 18, f. 4, t. 24, f. 12; Syn. Cact., p. 51.* Common in "Western New Mexico.

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WITH PLATES ILLUSTRATING PAPERS.

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and on houses, but are very common, not to say universal, in our gardens and vineyards. in some seasons more so than in others. It is said that vineyards further north, e. g. in Northern Illinois, are free from these pests.

Whether other diseases assist in the destruction of the grape, as wine-growers will have it, he cannot, from his own experience, determine. He has never seen the *Erysiphe*, which is so destructive to the gooseberry, and to vines in grapevies, on grapes cultivated in the open ground.

Dr. Hilgard presented a series of mounted specimens of Algae.

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October 7, 1861.

The President, Dr. ENGELMANN, in the chair.

Six members present.

A letter was read from A. F. Bandelier, Oct. 4, 1861, communicating meteorological observations for September, at Highland, Ill.

The Proc. Boston Soc. Nat. Hist., May–August, 1861, was received as a donation to the library.

Dr. Shumard presented a small piece of meteoric iron from Denton Co., Texas.

Dr. Engelmann communicated the results of his investigations on the nature of the pulp of the Cactus fruit, illustrated by many drawings. Zuccarini, than whom none better understood the morphology, as well as the systematic characters of the Cactaceæ, had already in the year 1845 (Plant, nov., fasc. 5, pag. 34) expressed the opinion that in Cactaceæ, as well as in Cucurbitaceæ, the *funiculi* assisted in forming the pulp of the fruit. Schleiden (Grundzüge, ed. 3, p. 408) ascribes the pulp of Mamillaria to an *arillus*, dissolving into single juicy cells. Gasparrini, in his extended but rather odd description of the Opuntia fruit, (Osservazioni, 1853, p. 20.) also considers the pulp as a peculiar sort of an arillus. I had long since come to the conclusion, especially after examining the somewhat dry fruits of *Cereus cespitosus* and *Echinocactus setispinus*, that the *funiculi* alone constitute the pulp, and in Cact. Mex. Bound., T. 20, fig. 12, I had figured the enlarged funiculi of the latter plant.

The Cactus fruit is usually succulent; only some Echinocacti and some Opuntia are known to bear dry fruits. The succulent fruit consists of the fleshy walls of the fruit itself, originating from the carpel and the adhering calyx, (or part of the stem, as Zuccarini will have it,) coalescing and forming a homogeneous mass, and of the juicy pulp, in which latter the seeds are imbedded. In some species the parenchyma of the walls, in others the mass of the pulp, prevails. *The pulp is always the product of the funiculus or its appendages.* The funiculus, even at the flowering period, bears on its inner side a beard of transparent fibres, 0.01–0.10 line in length; the fruit maturing, these fibres are enlarged, and the whole cellular tissue of the funiculus becomes, as it were, hypertrophic, every cell swelling up, filling with a sweetish, mostly red-colored juice; at last the cells in most species separate from one another, and leave the seeds floating in the pulp attached only to the slender spiral vessels. The mass of the funiculi and their proportion to the mass of the seed is very different in different species; in *Lepismium Myosurus* it constitutes only  $\frac{1}{4}$  or  $\frac{1}{5}$  of the seed; in *Mamillaria Nuttallii* it bears, perhaps, a still smaller proportion; while in other Mamillariæ, e. g. *M. polythele* and



*M. pusilla*, it is 2–4 times as large as the seed. In the large edible fruits of *Cerei*, such as *C. triangularis*, *C. grandiflorus*, *C. giganteus*, etc., it constitutes by far the largest part of the fruit. The cells are globular, oval, or variously compressed; in some species I find them extremely small, 0.01–0.03 l. long, while in others they are 0.1–0.2 and even 0.3 l. long.

The genus *Opuntia* apparently differs in having the whole seed covered with juicy cells, which, in size and quantity, vastly predominate over the cells of the rather insignificant funiculus proper. But the whole bony coating of the seed being but an arillary enlargement of the funiculus, (Cact. Mex. Bound., p. 70,) this peculiar case entirely falls into the analogy of the other *Cactaceæ*. The real difference is caused by the nature of the arillus, which, getting extremely hard, leaves the cells of the epidermis only to grow out, and finally to form the pulp of the fruit. Soon after fecundation these cells gradually become elongated, cylindrical, and disconnected among one another, rising perpendicularly from the surface of the seed; they are shorter, of nearly equal length, and perfectly straight, on the faces of the young seed, and longer, hair-like, and twisting in different directions on and near the rim. In *O. glaucophylla*, which I take to be a mere variety of *O. Ficus Indica*, I find them at their first appearance on a seed of less than one line in diameter only about 0.004 l. long and wide; on the rim they soon grow to twice the diameter and ten times the length, till at maturity the larger ones are 0.3–0.5 l. long. These cells, at first simple and cylindrical, become at last jointed and clavate, the terminal cells being many times larger than the basal ones, thus properly filling the interstices between the seeds. During winter, the fruit and seeds having reached their full growth, these cells contain a colorless, viscous, insipid fluid; in the following spring, when the fruit has assumed a deep purple colour, and attained full maturity, they contain a sweetish, purple liquid, and soon separate, forming what is properly called the pulp. The single cells are mostly oval or oblong, 0.02–0.20 l. in length. I find the same structure in *O. Engelmanni*, which, however, ripens its fruit, with us, in autumn, and it undoubtedly obtains in all *Opuntia* with large and juicy fruit.

In *O. Rafinesquii*, and probably in all species with less juicy fruit, the cells on the face of the seed are not developed, only those on the rim producing the pulp, which in this species as well as in *O. vulgaris* and *O. Pes Corvi*, remains, even at full maturity, insipid and viscous and of pale red colour. In this condition the fruit adheres to the plant, without any change, until it falls off in the following spring.

In *O. Brasiliensis* and *O. monacantha*, these epidermis-cells are greatly elongated, forming, in fact, a matted, tough beard, 2–3 lines long, analogous to that of the unripe cottonseed; each hair consists of several slender joints, 0.01–0.02 l. in diameter, the terminal one often thickly clavate or otherwise variously inflated. I have found them thus in the unripe fruit late in autumn; how they may change at maturity I have been unable to ascertain.

No such development of the epidermis-cells seems to take place in the *Opuntia* with dry fruit, such as *O. Missouriensis*, *O. clavata*, etc.; the seed, consequently, has a whiter, polished, ivory-like surface, while that of the juicy *Opuntia* fruits is dull and almost rough, and not so white.

The cells of the parenchyma of the fruit, as well as those of the bony seed-coat, are full of aggregations of crystals; those of the funiculus proper contain fewer and smaller clusters; but in the pulp itself I have never seen them; neither could I discover any in the parenchyma, or in the pulp of the fruits of *Mamillaria*.

Dr. J. S. Newberry, of Cleveland, O., and Prof. Chas. T. Jackson, of Boston, Mass., were elected Corresponding Members.



ADDITIONS TO THE CACTUS-FLORA of the Territory of the United States. By GEORGE ENGELMANN, M.D.

Since my *Synopsis of the Cactaceæ of the United States\** was published, Dr. J. S. Newberry, attached to Lieut. Ives' Expedition to the Colorado River, 1857-'58, has elucidated more fully the natural history of several species, heretofore only imperfectly known.† In the same year, 1858, and the following one, my brother, Henry Engelmann, Geologist to the Expedition sent under Capt. Jas. H. Simpson, U. S. Topog. Eng., to explore the best emigrant routes through the interior of Utah, discovered in that interesting country a number of new forms, which were placed in my hands for examination. My report on them, illustrated by several plates from the hands of our skillful artist, Mr. P. Røetter, was in due time sent to the department; but the necessities of the country not permitting the official publication, I have received permission to communicate the substance of my investigations.

1. MAMILLARIA VIVIPABA, *Haw. Engel. Syn. Cact.*, p. 13. In the South Pass, and on Sweetwater River, no specimens of this wide-spread species have turned up from the other side of the great mountain chain.

2. ECHINOCACTUS SIMPSONI, *spec, nov.*: e basi turbinata simplex, subglobosus seu depressus, mamilliferus; tuberculis laxis ovatis oblique truncatis axilla nudis; areolis ovatis seu ovato-lanceolatis, nascentibus albo-villosissimis mox nudatis; aculeis exterioribus sub-20 tenuibus rigidis rectis albidis, interioribus 8-10 erecto-patulis robustioribus paulo longioribus obscuris; areola florifera sub tuberculi apice aculeis contigua circulari; floribus in vertice dissitis minoribus; sepalis ovarii paucis et tubi brevis inferioribus orbiculatis crenulatis, superioribus ovatis obtusis, petalis oblongis cuspidatis e virescente roseis, stigmatibus 5-7 brevibus in capitulum globosum compactis; bacca parva sicca umbilico latissimo truncata flore marcescente demum deciduo coronata; seminibus paucis magnis oblique obovatis minute tuberculatis.

Var.  $\beta$ . MINOR: tota planta, tuberculis, aculeis, seminibus minoribus.

Butte Valley, in the Utah Desert, and Kobe Valley, farther west; var.  $\beta$ . in Colorado Territory, e. g. in coarse gravel or in crevices of rocks, abundant near Mount Vernon, at the base of the mountains, *Parry, Hull & Harbour*; fl. in May, fr. in July and August. With the Now Mexican *E. papyracan-*

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\* Proceeding Amer. Acad. Arts & Sciences, Vol. III., p. 259-314; p. 344-346, Nov. 1856.

† See my account in Lieut. Ives' Colorado River Expl. Exped., Washington, 1861, Botany, p. 12-14.

thus,\* the Mexican *E. horripilus*, Lem., and perhaps the South American *E. Odierii*, Lem., and *E. Cummingii*, Salm, this species forms a small section of Echinocacti with the appearance of Mamillariæ, named by Prince Salm, (Hort. Dyck., 1849, p. 34.) *Theloidei*. Through the *Coryphanthæ* they are nearly allied to Mamillaria, while our species at least, (the fructification of the others not being known,) by its dry fruit, its black tuberculated seeds, and especially the large and curved embryo and the presence of an albumen, proves itself a true Echinocactus, very closely connected with the regularly ribbed *E. intertextus*, Eng. Cact., Mex. Bound, t. 34. The similarity in all essential organs of these two species is such that no system ought to separate them, proving again of how little essential importance among Cactaceæ the external form must be regarded; another striking example, among many, is the rat-tail *Cereus tuberosus*, and its globular or oval allies, *C. cæspitosus*, etc.

Full grown specimens are 3–5 inches high and 3–4 inches in diameter; dark green tubercles, loosely arranged in  $\frac{1}{21}$  or  $\frac{13}{34}$  order, 8 and 13 spirals being most prominent; tubercles 6–8 lines long, at base 6–7 l. wide in the vertical and 4–5 l. in the transverse diameter, fruit-bearing ones rather shorter and stouter; areolæ 3–4 l. long; external spines 4–6 l. long, whitish, with the addition of several bristles at the upper end of the areola; central spines 5–7 l. long, yellow, reddish, deep brown, or even black, upwards. Flowers 8–10 l. long, and of nearly the same diameter, with a short and wide tube, externally greenish purple, petals yellowish-green verging to pale purple; the short stamens arise from the whole inner surface of the tube, leaving only a very small nectariferous space in its base; funiculus very short, stout and straight, and not curved over the micropyle, as I have found it in almost all other cactus flowers examined. Fruit 3–3½ l. long, about the same in width, with 1–3 small calycine scales towards its flat top, each with 1 or 2 small spines in its axil; it usually bursts irregularly on the side, and, falling off, leaves its base adhering to the areola, as is the case in other dry-fruited Echinocacti; e. g. *E. horizonthalonius*. Seeds 1½ l. long in the longest diameter, covered with minute closely set tubercles, with a large oval subbasilar hilum, and an embryo strongly curved around a small albumen. The plant germinates with

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\* *Mamillaria papyracantha*, Eng. Pl. Fendl., p. 49; Syn. Cact., p. 8. A closer examination of the dry specimen obtained by Mr. Fendler near Santa Fé proves that the floral areola joins the spiniferous one on the top of the small nascent tubercles, making the plant an Echinocactus, according to the views at present prevalent. It is singular that Fendler's single specimen has remained, thus far, the only one ever obtained of this well marked species.

erect pointed cotyledons, and when a few weeks old begins to develop its then pubescent spines.

Var.  $\beta$ . with smaller tubercles in  $\frac{8}{21}$  or  $\frac{13}{34}$ , or even  $\frac{21}{54}$  order, closely set, bearing smaller but often more numerous spines, (20–28 ext., 6–7 int.) may be confounded with the simple mountain form of *Mam. vivipara*, from which, when not in flower or fruit, only a close examination can distinguish it.

3. ECHINOCACTUS PUBISPINUS, *spec. nov.*: parvus turbina-tus; costis 13 subobliquis compressis interruptis; areolis orbiculatis; aculeis breviusculis velutinis demum nudatis albidis apice adustis, radialibus inferioribus lateralibusque 5–8 brevioribus, superioribus 1–2 robustioribus rectis curvatis seu hamatis, centrali deficiente seu singulo robustiore longiore arrecto sursum hamato.

Pleasant Valley, near Salt Lake Desert, found in May without flower or fruit, but exhibiting in the vestiges of the small supraspinal floriferous areolæ the character of the genus. Perhaps the smallest species of the genus, 2 inches high, 1–1 $\frac{1}{4}$  in diameter; ribs formed by compressed confluent tubercles; areolæ 4–6 lines apart; radial spines 1–4 l. long, more densely pubescent, or even tomentose, than I have seen them in any other Cactus; on the lower areola; 5 or 6, on the upper ones 9–12; here and there a single central spine makes its appearance, 5–6 l. long, stouter, and always strongly hooked.

4. ECHINOCACTUS WHIPPLEI, *Engelm. & Bigelow, Cact. Whipp. p. 28, t. 1; Syn. Cact., p. 15; Ives' Exped. Bot., p. 12.* Var. SPINOSIOR: aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, summis 2 sæpe elongatis latioribus curvatis; centralibus 4, summo longo plano flexuoso, cæteris paulo brevioribus obscuris, solo infimo seu omnibus hamatis.

Desert Valley, west of Camp Floyd, Utah, with the remnants of flowers and fruit, and with seeds hid between the spines, exactly like the seeds figured in the plate cited above; embryo curved about  $\frac{3}{4}$  around a large albumen; stigmas 6–7. The locality is about 5 degrees north of the place where Dr. Bigelow, and afterwards Dr. Newberry, found the plant.

5. CEREUS VIRIDIFLORUS, *Engelm.*; evidently the most northern Cereus, found as far north as the Laramie region, and not rare in Colorado, where it occurs 1–3 inches high, mostly with 13 ribs, and with the greatest variability in the color of the radial spines, and in the presence of the 1–2 central ones.

6. CEREUS ENGELMANNI, *Parry*: in the Salt Lake Desert, far to the northwest of the country where it was originally discovered; always characterized by the cruciate central spines.

7. OPUNTIA SPHÆROCARPA, *Eng. & Big.* var.? UTAHIENSIS: diffusa; articulis orbiculato-obovatis crassis, junioribus

sæpe globoso-obovatis vis tuberculatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis, aculeis nullis seu parvulis seu rarius singulo longiore recto robusto albido; floribus sulphureis; sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late obovatis emarginatis; stigmatibus 8 brevibus erectis; bacca obovata areolis sub-25 stipata; seminibus irregulariter compressis anguste marginatis.

In the Pass, west of Steptoe Valley, in the Utah basin; in flower and fruit at the end of July. Joints 2–3 inches long, and of nearly the same diameter; areolæ 6–8 lines apart; leaves smaller than in any other of our species, except *O. basilaris* scarcely 1 line long; bristles few on young, none on old joints, about  $\frac{1}{2}$  l. long; stouter spines, when present,  $\frac{3}{4}$ –1 inch long. Flowers 3 inches in diameter, pale or sulphur-yellow; fruit 1 inch long, half as thick, with a very deep umbilicus and with a few bristles, or here and there a minute spine on the areolæ — in the specimens before me apparently fleshy, but perhaps dry at full maturity; seeds very irregular, 2 l. or in the longest diameter  $2\frac{1}{2}$  l. wide. Loth to increase the number of illy defined species, I provisionally attach this to the New Mexican *O. sphærocarpa*, of which, however, leaves and flowers are as yet unknown, and the fruit is rather different.

8. *OPUNTIA HYSTRICINA*, Eng. & Big., is evidently a western representative, or may be a western form, of *O. Missouriensis*. (See Bot., Ives' Exp., p. 14.) It was collected in the present Territory of Nevada, between Walker and Carson Rivers. Flowers  $2\frac{1}{2}$ –3 inches wide, larger than in Dr. Newberry's specimen; stigmas 8–10, short, erect.

9. *OPUNTIA MISSOURIENSIS*, De C., itself is not rare in the deserts between Salt Lake Valley and Rush Valley. Var. *ALBISPINA*, approaching to var. *trichophora*, was found on Smith Creek, Lookout Mountains; flower 3– $3\frac{1}{2}$  inches in diameter; ovary with 20 or 25 scarcely spiny areolæ; 5 very short erect stigmas.

10. *OPUNTIA FRAGILIS*, Haw. Suppl., p. 82; *Cactus fragilis*, Nutt., gen. I, p. 200. Fort Kearney to the North Platte country, in flower in June and July. This, I believe, is the first time, since Nuttall's discovery in 1813, that the flowers of this species were collected. Travellers report the plant very common on the sterile prairies at the foot of the Rocky Mountains, but rarely found in flower, and still more rarely in fruit; it seems to propagate principally by the extremely brittle joints, which even the wind is apt to break off and carry about. I have had for many years specimens in cultivation, brought by Dr. Hayden, but have never been able to obtain flowers. Nuttall says the flowers are solitary and small; in the specimen before me they are nearly 2 inches in

diameter, pale yellow; ovary 8–9 l. long, with 13–15 areolæ, densely covered with white wool, the upper ones with a few white spines; lower sepals broadly oval, with a short cusp; petals 5 obovate, roundish, crenulate; style longer than stamens; stigmas 5, short, cuspidate, erect.

11. *OPUNTIA PULCHELLA*, *spec. nov.*: parvula, diffusa; articulis obovato-clavatis leviter tuberculatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum, cæteros brevissimos radiantes gerentibus; floribus purpurei ovario areolis 13–15 albo-villosissimis et aculeoligeris dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus cuneato-spatulatis; petalis 8 obovatis obtusis; stylo cylindrico exserto, stigmatibus 5 linearibus suberectis.

Sandy deserts on Walker River, Nevada; fl. in June. This is one of the smallest and prettiest species of the genus and belongs to the section *Clavatae* (Syn. Cact., p. 46); it is readily distinguished from its allies by the small joints and purple flowers. Joints 1–1¼ inches long; leaves scarcely 1 line long; flower bright purplish red or deep rose red, 1¼–1½ inches in diameter; ovary 4–5 l. long, beset with white bristly spines, 15–25 on each areola; style not ventricose in the lower half, as is visual in this genus;\* stigmas slender, pale yellow.

From other sources I am enabled to give the following further Additions and Corrections to my former publications:

Many *Eumamillariæ* (Syn. Cact., p. 4) have an “*ovarium exsertum*,” not only the large flowered *Longimammæ*, which, approach closely to *Corypantha*, deviate in this respect from the assumed character of the subgenus, but in a great many other species I find the same peculiarity; so that I am inclined to restrict the ovarium immersion to that natural subdivision, the *Lactescentes*, already recognized by Zuccarini; probably all those with limpid juice have an exsert ovary.

*Mamillaria barbata*, Eng. This species is easily propagated by seed, and is apt to flower already in the second year. The first flowers in spring (May) appear in the axils of the last, innermost tubercles of the last year, and are, therefore, almost central; the later ones seem to be developed from the axils of the first tubercles of the same spring! Flowers 9–10 l. long, of the same diameter; tube constricted above the exsert oval ovary; 12–13 exterior green sepals, lanceolate, cuspidate, fimbriate, 8 interior ones, reddish, longer, lance-linear,

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\* Another deviation from the usual form I observe in the style of *O. coccinellifera*; from a very narrow and short base it is suddenly dilated 5 or 6 times its diameter, and then gradually contracts upwards.



slightly ciliate; 18–21 petals, rose red, with a deeper colored streak, lance-linear, shorter and narrower than the inner sepals, entire; stamens not half as long as petals, with oval anthers; style much longer than stamens, with 5–6 short, greenish yellow suberect stigmas.

*Mamillaria bicolor*, Lehm., is not a Texan plant, as has been stated, inadvertently, in Synops. p. 7. Dr. Poselger found it on another Rio Grande, between Tampico and Real del Monte, Mex.

*Mamillaria papyracantha*, Eng., is an Echinocactus, as stated above.

*Mamillaria recurvispina*, Eng., in Cact. Mex. Bound., p. 12; Syn. p. 10. As there is already a species named thus by Vriese, (see Walp. Rep. 2, p. 801.) I now name the Arizona species *M. recurvata*. *M. recurva*, Lehm., is a form of *M. macracantha*, D.C., fide Salm.

*Cereus variabilis*, thus named in Cact. Mex. Bound., p. 40 t. 60, f. 5–6, and in Synops. p. 31, is not Pfeiffer's plant, figured in Abbild. 2, t. 15, but seems to be, as regards fruit and seeds, identical with a species obtained by Dr. Poselger near Tampico, and decided by him to be *C. princeps*, Hort. Würzb. ex-Pfeiff. Enum. p. 108. Plants from the Rio Grande have repeatedly bloomed here at the late Mr. Grieve's, and as the flower has never been described, I here supply the omission. Fruit and seed, obtained near Matamoras, have been described and figured in Mex. Bound. Cact. l. c.

Flores ad apicem caulis ramorumve pauci magni albi nocturni; ovario ovato areolis aculeolatis 25–30 stipato; tubo elongato cylindrico sursum sensim ampliato areolis 10–20 vix squamigeris, inferioribus aculeolatis munito; sepalis superioribus 20–25 lanceolatis patulis reflexisvo; petalis 40–50 pluriseriatis lineari-lanceolatis patentissimis; staminibus superiori tubi parti gradatim adnatis; stigmatibus 12–13 in capitulum clavato-obovatum coarctatis pallide virescentibus.

In bloom from July to September, flower 7–8 inches long, 5½–6 inches wide; tube 4–5 inches long; lower sepals near the well defined upper edge of the tube reddish green, 3–9 lines, upper ones petaloid, 9–18 l. long; petals 2 inches long, and about 4 l. wide; lower part of tube for 2 or 2½ inches, with a naked, nectariferous surface; the upper part, 2½–3 inches, densely beset with stamens of about equal length, so that the mass of the anthers form a deep funnel, corresponding to the shape of the upper part of the tube; the outer series of stamens forms a regular crown, but is not separated from the inner lower ones by a naked belt, such as is found in many species; nor are the filaments declined, and, so to say, fasciculated. This is interesting, as it weakens the value of this arrangement of stamens as a generic or subgeneric character; nevertheless, it is one of the few general charac-



ters left us, to be used in the arrangement of the very large number of species of this protean genus, to which several lately established genera have to be reduced. The following disposition is suggested:

1. *Cerei flore regulari, plerumque brevior; staminibus tubo gradatim adnatis.*

*Echinocereus*, Eng.

*Acanthocereus*.

*Lepidocereus*, Eng.

*Pilocereus*, Lem.

2. *Cerei flore sæpe obliquo, plerumque longiore; corona staminum exteriorum erectorum a cæteris gradatim adnatis plus minus declinatis discreta.*

*Echinopsis*, Zucc.

*Eucereus*.

*Phyllocactus*, Link.

*Disisocactus*, Lindl.

Under the name *Acanthocereus* I comprise the species of this division with spiny fruit, but not belonging to *Echinocereus*; it is probable that *Pfeiffera*, Salm, is only a diminutive form of *Acanthocereus*. *Lepidocereus*, to which many tropical species must be referred, and also a few which lately have been classed with *Pilocereus*, is distinguished from the latter by the uniformity of the fertile and sterile branches and areolæ, while in *Pilocereus* the fertile areolæ are closer together and densely beset with bristly spines or long wool. *Eucereus*, in a more restricted sense than Miquel has used it in his *Genera*, or 9 in the *Synopsis*, would comprise the largest number of *Cerei* of the second division, of very different external shape, and would probably have to be again subdivided when we get to know more of the fructification of the different species. Neither *Echinopsis* nor *Phyllocactus* do in their flowers differ from *Eucereus*, and *Disisocactus* is but a depauperate *Phyllocactus*, with scarcely more than the crown of stamens left, a few single ones representing the great mass of inner stamens of the allied sections. I am as yet undecided whether *Epiphyllum*, as restricted by Prince Salm, has also to be united with *Cereus* or not; the fasciculated declined stamens spring from the whole tube; the exterior ones form no crown, but the innermost ones are separated from the rest, and form, with their confluent bases, a kind of vault, which is arched over the base of the tube. I have had no opportunity to examine fruit and seed.

I am not sure whether the true *Cereus variabilis* is also found on the Lower Rio Grande. A specimen in Mr. Gæbel's horticultural establishment, said to come from that region, has repeatedly flowered and borne fruit; the flowers opened in Slay, and the fruit ripened after 10 or 11 months; flower 9 inches long, white, open only at night; ovary angular, with

5 or 6 triangular scales, but no spines; long tube with about 8 scales; crown of exterior stamens distant from the others 8 or 9 lines; about 10 filiform spreading stigmas; fruit irregularly oval, about 2 inches long, naked, deep violet purple, at last bursting and dropping seeds and pulp; seed quite different from that of the last species, very obliquely obovate, almost curved from a narrow base, with an orbicular hilum, 0.9 l. long, smooth, shining, with a few irregular dots.

Through the kindness of Dr. A. W. Chapman, of Apalachicola, Florida, I have received living specimens and fruit of the little southeastern sea coast *Opuntia*, so that I can now complete and correct the description of this very distinct species.

*Opuntia Pes Corvi*, Le Conte in herb.; Engelm. App. to Syn. Cact. in Proc. Am. Acad. A. & S. 3, p. 846; Chapm. South. Flora, p. 145: læte viridis, diffusa; articulis parvis ovatis seu obovatis tumidis sæpius teretiusculus fragilibus; pulvillis pulvinatis; foliis ovatis cuspidatis incurvis; areolis junioribus albo-tomentosis setas parcas brevissimus pallidas et plerisque aculeos 1-3 rectos rigidos sæpe basi compressos tortosque obscuros gerentibus, infimis inermibus; floribus minoribus flavis; ovario obovato pulvillis perpauca fusco-villosis stipato; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub-5 obovatis spatulatis obtusis; stigmatibus 4-5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulpa viscosa baccæ sæpe floris rudimentis coronatæ nidulantibus.

Barren sands along the coast of Georgia and Florida. Joints 1-3 inches long, obovate, tumid, or narrower and sub-cylindric, usually many of them growing in the same season, one from the top of the last one, till they at last become prostrate, and 1 or 2 feet long; pulvilli somewhat prominent, 4, 6, or even 8 lines apart; leaves  $2\frac{1}{2}$ - $3\frac{1}{2}$  l. long; spines 1- $1\frac{1}{2}$  inches long, very straight, when in threes, divergent. Flowers  $1\frac{1}{2}$ - $1\frac{3}{4}$  inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary  $\frac{1}{2}$  inch long, with only 2 or 3 areolæ on its surface, and 3-5 on its upper edge. Fruit obovate, 6-7 l. long, rose-purple, with a shallow umbilicus, areolæ almost obliterated; seeds 2 l. in diameter, 1-3, rarely as many as 5, in one fruit. Evidently near *O. vulgaris*, from which the shape and armature of the joints sufficiently distinguishes it; far removed from *O. fragilis*, with which, at first glance, the tumidity and fragility of the joints would seem to connect it.



UNITED STATES GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL.  
CLARENCE KING, GEOLOGIST-IN-CHARGE.

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**B O T A N Y.**

BY

**SERENO WATSON,**

AIDED BY

**PROF. DANIEL C. EATON, AND OTHERS.**

SUBMITTED TO THE CHIEF OF ENGINEERS AND PUBLISHED BY ORDER OF THE SECRETARY OF WAR  
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long and 6" in diameter; petals a light sulphur-yellow, fading with age, open during the day. *M. ornata*, with "white" flowers and bracteated calyx-tube, was not met with. Stansbury's plant, so named, is *levicaulis*. From New Mexico and Colorado to California and Washington Territory. On dry foothills from the Washoe Mountains to Salt Lake; 4,500–6,000 feet altitude; June–September. (432.)

## CACTACEÆ.

BY DR. GEORGE ENGELMANN.

MAMILLARIA<sup>1</sup> (EUMAMILLARIA) GRAHAMI, Eng. Globose or oval, usually simple, 1–3' high; on the short oval close-set tubercles are numerous thin but rigid whitish spines, 3–6" long, the outer 15–30 in a single series and straight, surrounding a stouter and longer hooked brown one; flowers small, nearly 1' wide, reddish; berry oval, green, with black pitted seeds.—Rocky localities in Southern New Mexico, Arizona and the adjoining parts of Utah.

MAMILLARIA PHELLOSPERMA, Eng. Resembling the last, rather larger, more oblong or cylindrical; tubercles longer and less crowded; spines more numerous, the outer 40–60 in two series, the exterior bristle-like, the inner more robust, with 3–4 brown central spines, of which one or more are hooked; flowers similar; berry club-shaped, scarlet; seed globose, with a larger spongy brown appendage.—Gravelly soil in Southern Utah and Arizona, rarer than the last.

MAMILLARIA (CORYPHANTHA) VIVIPARA, Haw., Var. Simple, oval, the almost terete tubercles bearing fascicles of 5–8 reddish-brown spines surrounded by 15–20 grayish ones in a single series, all straight and very rigid, the latter 5–8", the former even 10" long; flowers purple, often 2' or more in diameter, with numerous lance-subulate petals and fringed sepals; berry oval, green; seed pitted, light-brown.—Near St. George, Southern Utah, (J. E. Johnson.) Larger than the often cæspitose forms of the eastern slopes and

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<sup>1</sup> MAMILLARIA, Haw. Sepals and petals united beyond the naked ovary into a short tube. Berry juicy, oval or club-shaped. Seeds brown or black; embryo straight, without albumen; cotyledons very short, globose.—Low globose or oval plants, simple or branched, covered with spine-bearing tubercles; flowers rising from the axils of the tubercles, usually small, about as wide as long, opening in sunshine only. Comprising two sections:—

§ EUMAMILLARIA, ENG. Flowers from the axils of the older (never grooved) tubercles, usually small.

§ CORYPHANTHA, ENG. Tubercles grooved on the upper surface; flowers usually large, from the axils of the youngest often scarcely developed tubercles.

plains. Another simple form, but scarcely half as large, occurs in Colorado and possibly in Eastern Utah.

MAMILLARIA NUTTALLII, Eng. Smaller, globose, simple or sometimes cæspitose, with fewer (10–20) weaker ash-colored spines; flowers yellow, 1–2' broad; berries scarlet, subglobose; seeds few, black, globose, pitted.—Common on the eastern slopes of the mountains of Colorado and perhaps to be found in Eastern Utah.

ECHINOCACTUS<sup>1</sup> SIMPSONI, Eng. Simple, globose or depressed, with ovate tubercles like a *Mamillaria*, bearing about 20 outer ash-colored spines and 5–10 stouter darker inner ones, all straight and rigid; flowers from the top of the just developing tubercles, small, 9–12" broad, yellowish-green to purplish; scales on the ovary very few; berry small, dry, with few black tuberculated seeds.—Butte and Kobe Valleys, Utah, (H. Engelmann;) frequent on the eastern slopes of the Rocky Mountains, Colorado; flowering in April and May. [Found on the Havallah, Battle and Toyabe Mountains, and above Thousand Spring Valley, Nevada, only on high rocky ridges; 7–8,000 feet altitude; July, in flower. Heads 2–5' in diameter, often clustered, the fleshy interior frequently colored, s. w.] A small variety, resembling forms of *M. vivipara* in habit, but the tubercles grooveless and fruiting at top, has spines 4–6" long, the inner scarcely different; a larger form has much larger tubercles and spines, often 12–14" long, the inner ones bright reddish-brown. (433.)

ECHINOCACTUS WHIPPLEI, Eng. & Big. Middle-sized, globose or oval, with 13 interrupted ribs; outer spines 7–11, mostly ivory-white, the lowest darkish, the upper much longer, flat and often curved; central spines 4, the upper broader, longer, white, the others brown, the lowest hooked; flowers greenish-red, with few (2–5) sepals on the ovary, 9–15" long, not quite so wide; seeds few, large, tuberculate.—Heads 3–5' high; spines 3–20" long. On the lower Colorado, (Bigelow, Newberry;) in Desert Valley, west of Sevier Lake, Utah, (H. Engelmann;) the latter with more radial spines and often with more than one hooked.

ECHINOCACTUS POLYANCISTRUS, Eng. & Big. Medium-sized, oval, with

<sup>1</sup> ECHINOCACTUS, LINK & OTTO. Sepals and petals united beyond the sepal-bearing ovary into a short tube. Berry globose or oval, juicy or dry, covered with scales and sometimes with wool. Seeds brown or black; embryo usually curved over a small albumen; cotyledons short, foliaceous, parallel to the sides of the seed.—Globose or oval, mostly simple, generally many-ribbed with bunches of spines on the ribs, rarely tuberculated; flowers near the top, just above and close to the spines of the same season, usually large, as wide as long, open only in sunshine.

13–17 interrupted ribs; outer spines 20 or more, white, the uppermost broader and longer; central spines 5–10, upper one broadest, longest, white, curved, the others brown, terete, mostly hooked; flowers yellow, large,  $2-2\frac{1}{2}$ ' long and wide, with about 8 fringed sepals on the ovary; seeds as in the last.—Head-waters of the Mohave (Bigelow) to the sage-plains of Western Nevada, (Gabb;) the southern form 4–10' high, with longer spines, (the longest 3–5';) the northern but 3–4' high, with spines rarely more than 2', the radial ones but  $\frac{1}{4}$ –1' long.

*ECHINOCACTUS PUBISPINUS*, Eng. Small, (only 2' high,) oval, with 13 compressed sinuate ribs; outer spines 6–10, bristle-like, 1–4" long, the uppermost longest, often curved or hooked, with or without a stouter hooked central one, all usually densely pubescent.—Flower and fruit unknown. Found by H. Engelmann in Pleasant Valley near Salt Lake Desert.

*ECHINOCACTUS JOHNSONI*, Parry MSS. Medium-sized, (4–6' high,) oval, with 17–21 low rounded interrupted close-set often oblique ribs, densely covered with stoutish reddish-gray spines; the outer 10–14,  $\frac{1}{2}$ – $1\frac{1}{4}$ ' long, the upper longest; the central 4, stouter, recurved,  $1\frac{1}{2}$ ' long; flowers large,  $2-2\frac{1}{4}$ ' long and wide, purple or pink, with numerous reniform sepals on the ovary and tube, and ovate obtuse petals; seeds reticulate-pitted.—Discovered about St. George in Southern Utah by J. E. Johnson, whose zeal for the development of the natural history and resources of his region is commemorated in the name of the species.

*ECHINOCACTUS POLYCEPHALUS*, Eng. and Big. Usually with several heads, often over a foot high, with few very stout annulated curved spines and very early flowers, the base of which, as well as the fruit, is enveloped in dense cotton.—From the Mohave region, and may be looked for in Southern Nevada.

*CEREUS*<sup>1</sup> *ENGELMANNI*, Parry. Heads several, 4–12' high, cylindric or ovate, with 11–13 ribs, bearing bunches of about 13 pale acicular radiating

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<sup>1</sup> *CEREUS*, Haw. Sepals and petals united above the sepal-bearing ovary into a short or usually long tube. Berry juicy, globose or oval, beset with scales (sometimes rather indistinct) or spines. Seeds brown or black; embryo straight or usually curved, without albumen; cotyledons short or foliaceous, commonly contrary to the sides of the seed.—Globose or oval, or mostly cylindric or columnar, few- or many-ribbed, usually branched, bearing bunches of spines on the ribs; flowers lateral, just above and close to the spines of previous seasons, usually large, fully open in sunlight or at night or, rarely, permanently.

The above species belong to § *ECHINOCEREUS*, Eng.:—Heads commonly many, low, oval or cylindric; flowers short, mostly as wide as long; ovary covered with bunches of spines; stigmas green; seeds small, tuberculated; cotyledons short, straight.



spines, 3–6" long, and about 4 darker (yellow, brown or black) stout and angular, straight or curved, central ones, 1–3' long; flowers very numerous, large, ( $2\frac{1}{2}$ ' broad or more,) purple, diurnal.—From Salt Lake Desert (H. Engelmann) to Silver Peak in the Sierras, (Gabb,) and southward to Southern Utah (Johnson) and the Mohave country (Bigelow.)

*CEREUS VIRIDIFLORUS*, Eng. With very short pectinate pale and reddish-brown spines and small green flowers.—Common in Colorado, and may be found in Utah.

*OPUNTIA*<sup>1</sup> (*PLATOPUNTIA*) *BASILARIS*, Eng. & Big. Low; joints 5–8' long, obovate or triangular, proliferous from their base, pubescent, unarmed, but beset with numerous dense fascicles of short brownish bristles, as is also the ovary; flowers large,  $2\frac{1}{2}$ ' in diameter, purple; fruit dry, with large and thick seeds.—Nevada, in the Silver Peak region south of Walker's Lake, (Gabb,) and southward.

*OPUNTIA SPHÆROCARPA*, Eng. & Big., Var. (?) *UTAHENSIS*, Eng. Prostrate; joints small, orbicular-ovate, 2–3' long and nearly as wide, thick; spines in the axils of the minute subulate leaves, few and mostly weak or solitary or none, with few and very short bristles; flowers 3' in diameter, pale-yellow; fruit oval, almost spineless, at last dry.—In the pass west of Steptoe Valley, Utah, (H. Engelmann.)

*OPUNTIA MISSOURIENSIS*, DC. Prostrate; joints medium-sized, obovate or almost orbicular, tuberculate; leaves minute, subulate, all bearing in their axils 5–10 radiating or deflexed spines, 1–2' long, often with a few erect darker ones; flower large, 3' broad, yellow; ovary and dry fruit spiny.—Quite variable, especially in the stoutness and color of the spines. From the Upper Missouri to the Canadian and New Mexico, and throughout the Salt Lake Basin. [Found in Salt Lake Valley and the Wahsatch; 4,200–6,500 feet altitude; July, in flower. Joints sometimes 6' long and 4' broad, w.] (434.)

Var. [With smaller creeping joints, the numerous fascicles of short stout spines strongly reflexed. Above Wahsatch Station in the Wahsatch Mountains; 7,000 feet altitude, w.] (435.)

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<sup>1</sup> *OPUNTIA*, TOURN. Sepals and petals united beyond the sepal-bearing ovary into a very short cup. Berry pulpy or dry. Seeds large, whitish, bony, flat, mostly irregular. Embryo curved around the albumen; cotyledons foliaceous, usually contrary to the sides of the seed.—Jointed, the joints broad and flat, or clavate or cylindrical, bearing bunches of barbed spines and bristles in the axils of small terete deciduous leaves, and from their middle rather large flowers, opening only in sunshine and much wider than long. The above species belong to the two sections:—

§ *PLATOPUNTIA*, Eng. Joints flattened; embryo somewhat spiral.

§ *CYLINDROPUNTIA*, Eng. Joints clavate or cylindrical; embryo nearly circular.



OPUNTIA HYSTRICINA, Eng. & Big. Very similar to the preceding and probably only a form of it, with longer and more numerous gray or reddish spines, longer yellow bristles, and usually smaller flowers.—New Mexico; between Walker and Carson Rivers, (H. Engelmann,) and Owen's Valley, (Gabb,) Nevada. [Found abundantly in Monitor and Thousand Spring Valleys, Nevada; 5–6,000 feet altitude; July, in flower; September, in fruit. Flowers either purple or sulphur-yellow, scarcely smaller, w.] (436.)

OPUNTIA RUTILA, Nutt. Similar to *O. Missouriensis*; joints often larger, 3' by 4', covered with closely set bunches of mostly radiating and deflexed spines, the larger ones flattened and often twisted; flowers rose-red; ovary and dry berry spiny.—From Fillmore to St. George, Utah, (Dr. Palmer; J. E. Johnson;) a rediscovery of Nuttall's long-lost plant, who found it near the Green River in Southern Wyoming.

OPUNTIA ERINACEA, Eng. & Big. *Pac. R. R. Surv.* 4. 47, t. 13. Diffuse, ascending; joints thick, ovate, 2–2½' long, or sometimes elongated and almost cylindrical, densely covered with clusters of 3–5 radiating spines, slender, ½–1½' long, very rigid, reddish-gray, with 2–4 smaller ones below; berry ovate, 1¼' long, with crowded clusters of 12–20 mostly deflexed spines, 3–6" long.—Near Mohave Creek, Southern California, (Bigelow.) [A specimen in Herb. Gray., collected by Dr. Bloomer near Virginia City, Nevada, (not seen by Dr. Engelmann,) may belong to this species, w.]

OPUNTIA FRAGILIS, Nutt. Joints small, ovate, compressed or tumid or even terete, 1–1½' long, fragile; larger spines 4, cruciate, mostly yellowish brown, with 4–6 smaller white radiating ones below; bristles few; flowers smaller, yellow; fruit smaller, with 20–28 clusters of bristles, only the upper ones with a few short spines; seeds few, regular.—On the Upper Missouri and Yellowstone, southward probably to New Mexico. [Found at the west base of the Wahsatch in Jordan Valley. Specimens not seen by Dr. Engelmann, but doubtless of this species, w.] (437.)

OPUNTIA (CYLINDROPUNTIA) PULCHELLA, Eng. Low, 3–10' high, spreading; joints small, slender, 1–3' long, 6" thick, clavate, tuberculated, with bunches of straight radiating spines 6–18" long, from white to nearly black, one or more of the inner longer ones flattened; flowers purple, 1½' or less in diameter; ovary and dry berry bearing numerous flexible not barbed bristles.—Near Walker's River, Nevada, (H. Engelmann, Gabb.) [Frequent in the valleys of Western Nevada from the Trinity Mountains to Monitor Valley;

4–5,000 feet altitude; May–August. A very showy species, with sometimes 50 flowers upon a single plant; main stem erect, becoming 9" in thickness and occasionally showing 25 annual rings, w.] (438.)

OPUNTIA ARBORESCENS, Eng. 3–5° high or more, with horizontal branches, cylindric strongly tuberculated joints, numerous sheathed spines, large purple flowers, and tuberculated unarmed fruit.—New Mexico and Arizona, and probably farther northward.

OPUNTIA ACANTHOCARPA, Eng. & Big. Similar to the last; rather more slender and with more erect branches, smaller copper-colored flowers and rather even spiny, fruit.—Arizona, and probably Southern Utah.

OPUNTIA FRUTESCENS, Eng. 2–4° high, with slender terete joints 3" in thickness, very small yellow flowers and scarlet berries.—From Texas to Southeastern California, and probably farther northward.

#### FICOIDEÆ.

SESUVIUM PORTULACASTRUM, L., Var. Leaves spatulate-obovate and obtuse, as in *S. pentandrum*. Florida to New Jersey. Growing in alkaline soil, Truckee Meadows and at the Hot Springs near Meigs's Station, Nevada; 4,500 feet altitude; May–July. (439.)

#### UMBELLIFERÆ.

OROGENIA<sup>1</sup> LINEARIFOLIA. Stem leafless, rising but an inch or two above the ground and very slender; leaves 2–3, upon filiform petioles, equaling the stem; leaflets 1–2' long and 1" wide, petiolulate, obtuse; umbels with 2–3 rays, 1–4' long; umbellets 3–5-flowered; flowers nearly sessile; involucre none; involucels of a few (1–3) linear leaflets exceeding the rays; fruit 1½–2" long, oblong, subcompressed; tubers small, rounded, 3–5" in diameter.—Damp shaded ridge of the Wahsatch, north of Parley's Park; 7,500 feet altitude; June 28, in fruit. Near to *Erigenia*, both in habit and characters. PLATE XIV. Fig. 1. Plant; natural size. Fig. 2. Carpel; enlarged four diameters. Fig. 3. Cross-section of same; enlarged eight diameters. (440.)

<sup>1</sup>OROGENIA. Calyx-teeth minute. Stylopodia somewhat elevated. Fruit ovoid, but slightly compressed laterally and with a commissure but little narrowed; carpels dorsally compressed, slightly incurved; the 3 dorsal ribs filiform, the lateral thickened, corky and involute; vittæ obscure, 3 in each interval, and 2–4 in the commissure. Carpophore (?) adnate to the carpels and forming a thick corky midrib dividing the hollowed face of the commissure longitudinally. Seed somewhat concave.—Dwarf, scarcely caulescent, glabrous. Root tuberous. Leaves radical, 1–2-ternate; segments entire, linear. Umbel subcompound, with few very short unequal rays.



ENGINEER DEPARTMENT, IT. S. ARMY.

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REPORT

OF

EXPLORATIONS

ACROSS THE

GREAT BASIN OF THE TERRITORY OF UTAH

FOR A

DIRECT WAGON-ROUTE FROM CAMP FLOYD TO GENOA, IN CARSON VALLEY,

IN 1859,

BY

CAPTAIN J. H. SIMPSON,

CORPS OF TOPOGRAPHICAL ENGINEERS, U. S. ARMY,  
[NOW COLONEL OF ENGINEERS, BVT. BRIG. GEN., U. S. A.]

MADE

BY AUTHORITY OF THE SECRETARY OF WAR, AND UNDER INSTRUCTIONS FROM BVT. BRIG. GEN. A. S. JOHNSTON,  
U. S. ARMY, COMMANDING THE DEPARTMENT OF UTAH.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1876.

## APPENDIX M.

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SAINT LOUIS, *December* 31, 1860.

DEAR SIR: Want of time has prevented me fully to elaborate the very rich botanical material brought together, under your orders, by my brother, Henry Engelmann, the geologist and meteorologist of your expedition.

I herewith inclose to you an account of a few species, which seem to have a particular, and principally a practical, interest.

I expect to continue my investigations, and hope to submit them, through you, to the scientific public at a future period.

Very respectfully, &c.,

GEORGE ENGELMANN.

Capt. J. H. SIMPSON,

*Topographical Engineers, U. S. A., Commanding Expedition.*

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### ROSACEÆ.

CERCOCARPUS LEDIFOLIUS, *Nuttall in Torrey and Gray's Fl. N. Am.* 1, p. 427; and in his continuation of *Michaux's Sylva*, 2, p. 28, t. 51; *Hooker, i. c. pl. t.* 324; *Mountain-Mahogany* of the inhabitants of Utah.

This small evergreen tree is so well described by Nuttall in both works mentioned that not much remains to be added. His figure, however, is not a very faithful representation. He says that it grows much like a peach-tree, at most 15 feet high, and that the trunk is sometimes as much as a foot in diameter. On the expedition, it was found to grow rarely as a tree, but usually branching from the base, or several stems from one root; its height was from 8–15 feet, and the stems seen had the thickness of 3–6, or, at most, 10 inches. The bark is light gray, tough, smoothish, with superficial longitudinal wrinkles and short transverse scars. The wood is hard, heavy, very close-grained, light reddish-brown, with white sap; medullary rays very numerous, but extremely fine, scarcely visible with the naked eye; the wood is similar to cherry-wood, but harder and heavier. A specimen before me has a diameter of 16 lines, 14 lines of which are wood, showing 24 annual rings, so that each ring has a thickness of not much more than  $\frac{1}{4}$  line. The shoots, or longer branches, have a white, smooth bark, with joints or internodes of about 1 inch in length. The leaves, however, are usually



crowded at the end of lateral branchlets, a few lines to 1 or 1½ inches in length closely covered with circular scars. Leaves very thick and leathery, persistent, lanceolate, acute at both ends, entire and revolute at the margin, with a thick midrib, prominent on the lower surface, 9–14 lines long, 2½–3½ lines wide, on a petiole 1½–2 lines long, to the lower part of which adhere lanceolate, brown, scarious stipules. When young, the branchlets as well as the leaves are covered all over with short, curly hair; when older, the leaves become glabrous and glossy on the upper surface, the lower remaining hairy and assuming a rusty color. The sessile flowers are produced in June from the axils of the uppermost leaves of the preceding year's growth, either single or 2 or 3 together; short scarious bracts envelop the base of the cylindrical woolly calyx-tube, which is 3 lines long; its 5-lobed, white limb, 3–4 lines in diameter, is very woolly externally, and less so internally, and bears about 20 or 25 naked, slender filaments, with reniform anthers ½ line in diameter. Immediately after flowering, the silky-feathery style becomes elongated, and carries up with it the detached limb of the calyx; at maturity, the style becomes a twisted, feathery tail of about 2 inches in length; the inconspicuous, linear, hairy fruit itself is about 4 lines long, and remains hid in the persistent, calyx-tube; at its top and base I observe a beard of very curious, stiff, white bristles, less than a line in length, thicker in the middle, and tapering toward both extremities. The fruit seems to be somewhat persistent, as I find it in specimens collected in spring before the flowering-season. About the time of flowering, the young leaves begin to develop at the end of the branchlets, leaving the flowers between them and the leaves of the year before. I generally find 4 or 5 leaves of the same year's growth at the end of each branchlet; they probably fall off when about 15 or 18 months old.

This fine tree, discovered by Nuttall on Bear River, north of the Salt Lake, and near "Thornberg's Ravine" in the Rocky Mountains, was found by the expedition on the Lookout Mountains and other mountain-chains of the basin.

#### CACTACEÆ.

The geographical limits of the area of this curious American family have been considerably enlarged by this expedition, proving the presence of at least 7 species in the Utah Basin between the thirty-eighth and fortieth parallels, viz: 2 *Echinocacti*, 1 *Cereus*, and 4 *Opuntia*æ. Several species known before have been found in new localities, and 3 new and very distinct species have been discovered, 2 *Echinocacti* and 1 *Opuntia*.

*MAMILLARIA VIVIPARA*, *Haworth, Suppl. p. 72; Torrey & Gray, Fl. N. Am. 2, p. 554; Engelm. Synops. Cact. p. 13; Cactus viviparus, Nuttall, Gen. 1, p. 295.*

Was collected in the South Pass and on Sweetwater River. It extends from here to the mountains of Colorado and New Mexico, but its most characteristic forms are peculiar to the more elevated plains, where it assumes that cespitose, spreading appearance, from which it has received its name. The mountain form usually makes larger heads, but remains single or branches out very sparingly. Its large purple flowers, with numerous lance-linear, long acuminate, bristle-pointed petals, and its leather-brown pitted seeds, readily distinguish it from allied species.

*ECHINOCACTUS SIMPSONI* (*spec; nov.\**) simplex, subglobosus sen depressus, basi turbinatus, mamilliferus; radicibus fasciculatis; tuberculis laxis ovatis apice oblique truncatis axilla nudis, junioribus leviter compressis basi deorsum productis, vetustioribus obcompressis basi dilatatis; areolis ovatis seu ovato-lanceolatis, nascentibus albo-villosissimis mox nudatis; aculeis exterioribus sub 20 radiantibus tenuibus rigidis rectis albidis, additis supra aculeis 2–5 setaceis brevibus, interioribus 8–10 robustioribus obscuris erecto-patulis, areola florifera sub tuberculi apice areolæ aculeigeræ contigua circulari; floribus in vertice dissitis minoribus; ovario abbreviato squamis sepaloideis triangulatis paucissimis (1–3) instructo; sepalis tubi brevis late infundibuliformis orbiculatis seu ovatis obtusis membranaceo-marginatis crenulatis fimbriatis, sepalis superioribus 10–12 ovatis obtusis integriusculis, petalis 12–13 oblongis apice crenulatis cuspidatis ex virescente roseis; stigmatibus 5–7 brevibus erectis, bacca parva viridi sicca umbilico latissimo truncata squamis paucis subinde aculeiferis instructa flore marcescente demum deciduo coronata irregulariter basi seu latere dehiscente; seminibus magnis obovatis obliquis minute tuberculatis, hilo magno ovato subbasilari, embryone circa albumen parcum fere circumvoluto hamato.

Var.  $\beta$  MINOR: tota planta, tuberculis, aculeis, floribus seminibusque minoribus.

Butte Valley in the Utah Desert, and Kobe Valley farther west; fl. in April and May, fr. in June and July. Var.  $\beta$  comes from the mountains of Colorado. This and the New Mexican *Echinocactus papyracanthus*, † the Mexican *Ech. horripilus*, Lem., and perhaps the South American *Ech. Odierii*, Lem., and *Ech. Cummingii*, Salm, and probably one or two others, form the small group of *Echinocacti*, with the appearance of *Mamillaria* (*Theloidei*, *tuberculis spiraliter dispositis distinctis*, Salm, Cact. Hort. Dyck 1849, cult. p. 34). They constitute the closest and most imperceptible transition to *Mamillaria* subgen. *Coryphantha*, Synops. Cact., p. 8, which bear the flowers in the axils of the nascent tubercles, the flower-bearing and the spine-bearing areolæ being connected by a woolly groove. In *M. macromeris*, Engelmann, they come from the middle of the tubercle (Cact. Mex. Boundary, t. 15, f. 4), and in the *Theloidei* they advance to the top of the tubercle close to the spines, thus assuming the position which the flowers regularly occupy in the genus *Echinocactus* (see Cact. Mex. Bound, t. 20, f. 2; t. 21; t. 25, f. 1; t. 27, f. 1; t. 28, f. 2). ‡

The ovary is also almost naked, like that of *Mamillaria* generally, or has only a few scales, like that of *M. macromeris*. On the other hand, the dry fruit, such as is often found in *Echinocactus*, but never in *Mamillaria*, the tuberculated black seeds, and especially the large and curved embryo, and the presence of an albumen, do not permit a separation from *Echinocactus*.

This species is further interesting because it again strikingly proves that the

\* An extract of this description was published in the Transactions of the Saint Louis Academy of Sciences, vol. 2, p. 197 (1863).

† The plant I formerly described as *Mamillaria papyracantha*, Plant. Fendl., p. 49; Synops. Cact., p. 8, proves to belong to this section of *Echinocactus*. A closer examination of Mr. Fendler's original specimen shows that the floral areola joins the spiniferous one at the apex of the small nascent tubercles. Thus far Mr. Fendler's specimen, found near Santa Fé, has remained the only one ever obtained of this pretty species.

‡ *Echinocactus brevihamatus*, Engelm., forms an exception. In this species, the flowers are situated exactly as in *Coryphantha*, at the base of the tubercle, and connected with the distinct spiniferous areola by a woolly groove, (see Cact. Mex. Bound, t. 19, fs. 2 and 3).

general appearance, the habitus, of a cactus plant, not necessarily indicates its real affinities. Not only is it a true *Echinocactus*, notwithstanding every appearance of a *Mamillaria*, but it is, moreover, closely allied in all its essential characters to the very compact *Ech. intertextus*, Engelm., C. Bound, p. 27, t. 34, in which all traces of tubercles are lost in the straight ribs. It has the same small flowers and the same small dry fruit, containing few large seeds, of similar structure, though not entirely the same arrangement of the spines.

Full-grown specimens of our plant are 3–5 inches high and 3–4 inches in diameter, of dark-green color; tubercles loosely arranged in  $\frac{8}{21}$  or  $\frac{13}{34}$  order, 8 and 13 spirals being most prominent. They are 6–8 lines long, at base somewhat quadrangular, 6–7 lines wide in the vertical and 4–5 lines in the transverse diameter, becoming sub-cylindric upward; areola: 3–4 lines long, a little more than half as wide. The fruit-bearing tubercles are rather stouter and shorter. Exterior spines 4–6 lines long, whitish; interior ones spreading, stouter, and a little longer (5–7 lines long), yellowish and upward deep brown or black; no truly central spine. In the very young plant, the spines, 18–20 in number and only 1–1½ lines in length, are all radiating, closely fitting with their compressed bulbous bases on a linear areola, resembling in shape and arrangement those of *Cereus cespitosus*. Soon afterward the areola becomes wider, and 6 or 8 short, stout, brown interior spines make their appearance, divergent like the original ones. Next the ordinary arrangement, as described above, takes place.

It seems that quite early in spring the young tubercles on the vertex of the plant begin to form, exhibiting their densely woolly tops, and soon afterward, long before any spines make their appearance, the tips of the smooth brown flower-buds come out. The flowers are 8–10 lines long and of nearly the same diameter, externally greenish-purple, petals yellowish-green or verging to pale purple. The short stamens arise from the whole surface of the tube, leaving only a very small nectariferous space in its base. The fruit is about 3 or 3½ lines long and almost as wide, borne on a very large circular areola, surrounded by a woolly margin (see t. 2, f. 1). It bears toward its top 1–3 scales, sometimes with 1 or 2 small spines in their axils. The fruit usually opens by an irregular lateral slit; falling off, its base remains attached to the areola, as is the case in many (or all? or only all the dry-fruited?) *Echinocacti*, thus producing a basal opening (see t. 2, f. 5). Seeds 1½ lines long in the longest diameter, covered with minute close-set tubercles. The young seedling shows erect, pointed cotyledons, and, when a few weeks old, begins to develop its pubescent spines.

Var.  $\beta$  has been received this fall from the Colorado gold-region;\* the smallest specimens were 1 inch in diameter, globose, the small tubercles in  $\frac{8}{21}$  order, spines 1½–2 lines long, often curved; sometimes 1–3 darker stouter ones in the center. The larger specimens are almost of the size of those of Utah, but often depressed at top; tubercles arranged in  $\frac{13}{34}$  or even  $\frac{21}{54}$  order, spines only 4–5 lines long, 20–28 external and 6 or 7 internal ones.

This species has been named in honor of the gallant commander of the expedition.

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\* It here grows and thrives probably at a higher elevation than any other northern Cactus, occupying e. g. the gravelly moraines of the Glacial period of Clear Creek Valley, between 8,000 and 9,000 feet altitude, and in the southern part of the Territory, the Sangre de Cristo Pass, 10,000 feet high (January, 1876).



Plate 1. *Echinocactus Simpsoni* as it appears in early spring; on the vertex a young growth of tubercles is visible, their tops covered with wool.

Plate 2. Details of the same.

Fig. 1. Four tubercles from near the vertex, one shows the broad scar where the fruit has fallen off, another one is just developing its spines, exhibiting their points above the thick wool.

Fig. 2. A detached tubercule bearing a ripe fruit.

Figs. 3 and 4. Flowers with the upper part of the tubercule and its young spines.

Figs. 5 and 6. The fruit magnified three times; fig. 5 showing the basal opening, fig. 6 the broad umbilicus.

Fig. 7. A scale of this fruit, more magnified, with two axillary spines.

Figs. 8–12. Seed: fig. 8 natural size, the others eight times magnified; fig. 9 lateral, fig. 10 dorsal, fig. 11 basal view; fig. 12 part of the surface, highly magnified.

Fig. 13. Embryo, enveloped in the inner seed-coat, including also the albumen; magnified.

Fig. 14. Lateral, fig. 15 frontal view of the embryo, magnified.

Fig. 16. Seedling, a few weeks old, magnified.

Fig. 17. Tubercles of the smaller variety from Colorado, in every state of development.

*ECHINOCACTUS PUBISPINUS* (*spec. nov.*)\* *parvulus, turbinatus, costis 13 subobliquis compressis interruptis tuberculatis; areolis orbicularis, aculeis brevibus, rectis seu sæpe curvatis albidis apice adustis velutinis demum nudatis; radialibus superioribus 1–2 robustioribus, longioribus rectis curvatis seu hamatis, ceteris 5–8 brevioribus; aculeo centrali deficiente seu singulo robustiore longiore arrecto sursum hamato; flore?; fructu?*.

Pleasant Valley, near the Salt Lake Desert, found May 9 without flower or fruit. Plant 2 inches high, 1 or 1¼ in diameter; compressed tubercles 4–6 lines distant from one another, confluent in 13 ribs, radial spines 1–4 lines long, white pubescent or almost tomentose, more so than I have observed it in any other cactus; on the lower areolæ, I find only 5–6 spines, the upper ones a little longer and stouter than the balance; farther upward, the number increases to 10, one or more of the upper ones becoming still stouter and often hooked; at last here and there a single central spine makes its appearance, 5–6 lines long, the strong hook always turned inward or upward. At first, only the dusky point of the spine is naked; with age, the whole coating seems to wear off. In another specimen, I find the spines 8–12 in number, a little longer, more slender, all radiating. The small suprascapular areola proves this plant to be an *Echinocactus*; it probably belongs, together with the next, to the section *Hamati*, *Synops. Cact.* p. 15.

*ECHINOCACTUS WHIPPLEI*, *Engelm. & Bigelow, Pacif. R. Rep. IV, Cact. p. 28, t. 1, Syn. Cact. p. 15.* *Var. SPINOSIOR: globosus; costis 13 compressis interruptis; aculeis radialibus 9–11, inferioribus sæpe obscurioribus, reliquis longioribus niveis, 2 superioribus sæpe*

\* This description has been published in *Trans. Acad. St. Louis*, vol. 2, p. 199 (1863). It is rather strange that neither this nor the above-mentioned *E. papyracanthus* has ever been found again (January, 1876).

elongatis complanatis curvatis; centralibus 4, summo elongato complanato pergamentaceo flexuoso albo, 3 reliquis paullo brevioribus obscuris omnibus seu solum infimo hamatis; floribus minoribus; ovario squamis sepaloideis 5 oblongis munito; sepalis tubilinearibus margine membranaceis integris mucronulatis, petalis angustis oblongis; stigmatibus 6–1 brevibus in capitulum globosum congestis; bacca ovata parce squamata floris rudimentis persistentibus coronata.

The species was originally discovered on the Little Colorado by Dr. Bigelow, and was found afterward on the same stream by Dr. Newberry; the variety here described was met with more than 5 degrees farther north, in Desert Valley, west of Camp Floyd; remains of fruit, with the withered flowers attached, and some seeds, were found concealed between the spines from which the description has been drawn.\* Globe heads 3 inches in diameter, radial spines  $\frac{1}{2}$ – $1\frac{1}{2}$  inches long, central ones  $1\frac{1}{2}$ –2 inches in length; flowers, if I may judge from the withered remains, about 1 inch long; ovary small, bearing about 5 membranaceous scales, the lower triangular, the upper oblong-linear, almost entire, and never cordate or auriculate at base, as they appear in most of the allied species; sepals of tube also narrow, linear, or oblong-linear, 2–5 or 6 lines long,  $\frac{1}{2}$ –1 line wide, stigmas about  $\frac{1}{2}$  line long. Fruit apparently an oval berry,  $\frac{1}{2}$  inch long; seed just as it is described and figured in Whipple's Cactaceæ; the tubercles on the seed-coat are extremely minute and distant from one another, each forming a central protuberance on the otherwise flat surface of an angular cell of two or three times the diameter of the tubercle itself; embryo curved about  $\frac{3}{4}$  around a rather copious albumen.

CEREUS VIRIDIFLORUS, *Engelm. in Wislitz. Mem. note 8, sub Echinocereo; Cact. Mex. Bound. t. 36; Synops. Cact. p. 22.*

This is evidently the northernmost *Cereus*, extending to the Upper Platte; it is abundant in Colorado. These northern specimens are 1–3 inches high, 13-ribbed, and show the greatest variability in the color of the radial spines; in some bunches, they are all red, in others white, in others again the colors are distributed without much regularity; sometimes the upper and lower spines are white and the lateral ones red, or a few or even a single one above and below are red and all the rest white; or the lower ones are red and the upper ones white, and all these variations sometimes occur on the same specimen. I mention this to show how little reliance can be placed on the colors or the distribution of the colors of the spines. Central spines wanting or 1 or 2 projecting horizontally, straight or curved upward, white or tipped with purple or all purple, 6–9 lines in length.

CEREUS ENGELMANNI, *Parry in Sillim. Journ. n. ser. 14, p. 338; Engelm. Cact. Bound. p. 36, t. 57; Synops. Cact. p. 27.*

Deserts west of the Salt Lake, without flower or fruit. Specimen entirely similar to the one figured in the Cactaceæ of the Boundary. The species seems to extend from the Salt Lake region southwestwardly to Arizona and the Mohave country.

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\* The botanist of Dr. Hayden's Expedition of 1875, Mr. Brandegee, found it abundantly in Southwestern Colorado (January, 1876).

OPUNTIA SPHÆROCARPA, *Engelm. and Bigelow, Pac. R. Rep. IV, Cact. p. 47, t. 13, fs. 6–7; Syn. Cact. p. 44.* Var.? UTAHENSIS: diffusa, læte-virens, articulis orbiculato-obovatis, crassis, junioribus sæpe globoso-obovatis; areolis subapproximatis; foliis minutis subulatis divaricatis; setis brevissimis paucis stramineis; aculeis nullis seu parvulis nunc singulo longiore recto robusto albido; floribus sulphureis, ovario obovato areolis fusco-tomentosis sub-25 instructo, sepalis exterioribus transversis obcordatis cuspidatis; petalis 8 late-obovatis emarginatis; stylo vix supra stamina exserto; stigmatibus 8 brevibus erectis; bacca obovata areolis plurimis tomentosus stipata; seminibus numerosis irregulariter compressis anguste marginatis.

Pass west of Steptoe Valley, in the western mountains of the Basin, found July 19 in flower and fruit. Joints 2–3 inches long and of almost the same diameter; often over  $\frac{1}{2}$  inch in thickness, sometimes almost terete or rather egg-shaped; areolæ 6 or 8 lines apart; leaves very slender and acute, scarcely 1 line long, smaller than in any other of our species except *O. basilaris*, also a western form from the Lower Colorado. Bristles few, and even in old joints scarcely more than  $\frac{1}{2}$  line long; spines none, or on the upper areolæ a few short ones, with here and there a stouter one  $\frac{3}{4}$ –1 inch in length. Flowers nearly 3 inches in diameter, pale or sulphur-yellow, when fading, reddish; fruit about 1 inch long and half as wide, with a deep umbilicus, and with 20–25 areolæ, which sometimes show a few bristles or a minute spine; seeds very irregular, 2, or, in the largest diameter, sometimes  $2\frac{1}{2}$  lines wide.

Unwilling to increase the number of illy-defined species in this most difficult genus, I attach this plant to the only species known to me to which it possibly can be compared, *O. sphærocarpa* from New Mexico, though its fruit is not spherical, has not a shallow umbilicus, and is, at least in the specimen before me, not dry; the latter would be an insuperable distinction, if we might not suspect, what in fact is often the case, that the fruit later in the season would become dry and brittle. The leaves, which heretofore have been entirely too much neglected as a diagnostic character in this genus, and the flowers of the original *O. sphærocarpa*, are unknown thus far.

OPUNTIA TORTISPINA, *Engelm. & Bigelow, l. c. p. 41, t. 8, fs. 2–3; Syn. Cact. p. 37.*

Forks of the Platte; in flower in July. The specimens being very incomplete, I am not quite sure that this is the same species as that of Captain Whipple's Expedition; the joints appear to be somewhat smaller, the areolæ closer together, and the spines shorter (1–1 $\frac{1}{2}$  inches) and rather weaker; it may possibly prove to be an extreme form of *O. Rafinesquii*, the area of which extends to the Rocky Mountains. Leaves subulate, 2 lines long; flowers  $2\frac{1}{3}$ –3 inches in diameter, sulphur-yellow; ovary long (1–1 $\frac{1}{2}$  inches), with 20–30 areolæ, with light-brown wool and short bright-brown bristles; exterior sepals obovate, lance-cuspidate; petals 6–8, broadly obovate, obtuse, crenulate; stigmas 6–8, short, erect, as long as the stamens.

OPUNTIA HYSTRICINA, *Engelm. & Bigelow, l. c. p. 44, t. 15, fs. 5–7; Syn. Cact. p. 43.*

A flowering specimen, collected in June between Walker and Carson Rivers, is exactly like one found by Dr. Bigelow on the Colorado Chiquito; it has slenderer and straighter spines than the one figured in Whipple's Report, and approaches somewhat to *O. erinacea*, E. & B., of the Mohave region, in which I now recognize the long-lost

*O. rutila*, Nutt. in Torr. & Gray Flor. 1, p. 555. Joints 5 inches long, half as wide, obovate; leaves  $1\frac{1}{2}$  lines long; areolæ closely set with long straw-colored bristles; lower ones with few and short white spines, upper ones with numerous grayish-red spines,  $1\frac{1}{2}$ –2 inches in length. Flowers pale straw-colored,  $2\frac{1}{2}$ –3 in diameter; ovary 1 inch long, with 20–30 white woolly aculeolate areolæ; exterior sepals oblanceolate, squarrose, or recurved at the elongated tip; petals obovate, obtuse, crenulate; style with 8 or 10 short erect stigmas, longer than the stamens. The squarrose tips of the sepals are particularly conspicuous on the bud.

OPUNTIA MISSOURIENSIS, *De Cand. Prod.* 3, p. 472; *Torr. & Gray, Fl.* 1, p. 555 (*in part*); *Cactus ferox*, *Nutt. Gen.* 1, p. 296.

From the deserts of Salt Lake Valley to Rush Valley; specimens without flower or fruit. Joints small (2–3 inches long), broadly obovate or circular; areolæ closely set; spines numerous, stiff, stout, angular, white, mostly deflexed.

OPUNTIA MISSOURIENSIS, var. ALBISPINA, *Engelm. & Bigelow, l. c.* p. 46; *t.* 14, *fs.* 8–10; *Syn. Cact.* p. 44.

Smith Creek, Lookout Mountains, in Western Utah; flowering in July. By their slender flexuous spines, the specimens approach to var. *trichophora*. Flowers  $3$ – $3\frac{1}{2}$  inches in diameter, bright golden-yellow; ovary 1 inch long, with 20 or 25 areolæ, scarcely spiny; exterior sepals obovate, cuspidate; petals about 8, obtuse, crenulate; style shorter than the stamens; stigmas about 5, very short, erect. Some flowers have elongated and very spiny ovaries, evidently abortive.

OPUNTIA FRAGILIS, *Haworth, Suppl.* p. 82; *Torr. & Gray, Fl.* 1, p. 555; *Synops. Cact.* p. 45; *Cactus fragilis*, *Nutt. Gen.* 1, p. 296.

Fort Kearny to the North Platte country; in flower in June and July. This is, I believe, the first time that the flowers of this species were collected since Nuttall's discovery of it in 1813. Travelers report that the plant is very frequently seen in the sterile prairies east of the Rocky Mountains, but that it is rare to find them in flower and rarer still in fruit. Since many years I have the plant in cultivation from specimens brought down by Dr. Hayden, but have not been able to get it to flower. Nuttall only informs us that the flowers are solitary and small. In the specimen before me, they are yellow, scarcely 2 inches in diameter; ovary 8–9 lines long; the 13–15 areolæ are densely covered with thick white wool; the upper ones bear a few white spines; lower sepals broadly oval, with a short cusp; petals 5, obovate, rounded, crenulate; style longer than the stamens; stigmas 5, short, erect, cuspidate.\*

\* Through the kindness of Dr. A. W. Chapman, of Apalachicola, Fla., I have received living specimens and fruit of *O. Pes Corvi*, so that I can now complete the description of this very distinct southern species.

OPUNTIA PES CORVI, *Le Conte in herb. Engelm.; Append. to Synops. Cact. in Proceed. Am. Acad. Arts & Sc.* 3, p. 346; *Chapman, Fl. South. U. S.* p. 145: diffusa, læte viridis; articulis parvis ovatis seu obovatis tumidis sæpius teretiusculis concatenatis fragilibus; pulvillis subdistantibus pulvinatis; foliis teretiusculis ovatis cuspidatis incurvis; areolis junioribus albo-tomentosis setas parcas brevissimas pallidas et plerisque aculeos 1–3 rectos rigidos sæpe basi compressos tortosve obscuros gerentibus, infimis inermibus; floribus flavis minoribus; ovario obovato pulvillos perpaucos fusco-villosos gerente; sepalis exterioribus ovato-lanceolatis, interioribus obovatis cuspidatis; petalis sub-5 obovatis spatulatis obtusis; stylo stamina æquante, stigmatibus 4–5 erectis; seminibus paucissimis anguste obtuseque marginatis in pulpa viscosa baccæ parvæ rubræ sæpe floris rudimentis coronatæ nidulantibus.

Barren sandy places along the coast of Georgia and Florida. Joints 1–3 inches long, obovate tumid, or narrower



*OPUNTIA PULCHELLA* (*spec. nov.*):\* *parvula cæspitosa diffusa; articulis parvis obovato-clavatis; foliis minutis e basi ovata subulatis; areolis confertis, superioribus aculeos albidos rectos, singulum longiorem complanatum porrectum seu deflexum alios brevissimos radiantibus; floris purpurei ovario areolis 13–15 convexis albo villosissimis et longe setosis dense stipato; sepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus spatulatis; petalis sub-8 obovatis obtusis, stylo cylindrico exserto, stigmatibus 5 linearibus suberectis; bacca sicca setosissima, seminibus crassis rhapshe lata plana notatis.*

Sandy deserts on Walker River; † fl. in June.

This is one of the smallest, as it is one of the prettiest, species of this genus. It belongs to the small section of *Clavatae* (Synops. Cact. p. 46) of the cylindric *Opuntiae*, but is distinct from all those known to me by its small joints and purple flowers; all the others have, so far as I know, yellow flowers. Joints 1–1¼ inches long, 4–6 lines thick, very slightly tuberculated; leaves scarcely one line long; areolæ crowded, white woolly; larger central spine on the upper areola; 4–6 lines long, flat, and somewhat rough above, convex below; smaller ones 4–6 or 10, radiating, ½–1½ lines long; flowers crowded, of a beautiful bright purplish-red or deep rose-red color, 1¼–1½ inches in diameter; ovary 4–5 lines long, beset with white capillary spines, 3–5 lines long, 15–20 on each areola; style not ventricose, as is usual in the genus, but cylindric; stigmas slender, pale yellow; berry clavate, at last dry, about 1 inch long, well marked by the conspicuous white-woolly areolæ and their numerous purplish-brown, flexible, hair-like bristles, 4–6 or 7 lines long. These bristles are entirely destitute of the minute barbs which otherwise invariably characterize spines and bristles of *Opuntiae*. The thick round seeds, 2 lines in diameter, are well distinguished by a broad rhapshe, much wider than I have seen it in any other clavate *Opuntia*.

Plate 3, Fig. 1. Part of a plant of *Opuntia pulchella*, showing a flower-bud and two flowers, natural size.

Figs. 2–4. Bunches of spines, 4 times the natural size.

Fig. 5. Section of a larger spine, more magnified.

Fig. 6. A leaf from an ovary with the axillary woolly and bristly areola, 4 times natural size.

Fig. 7. A fruit.

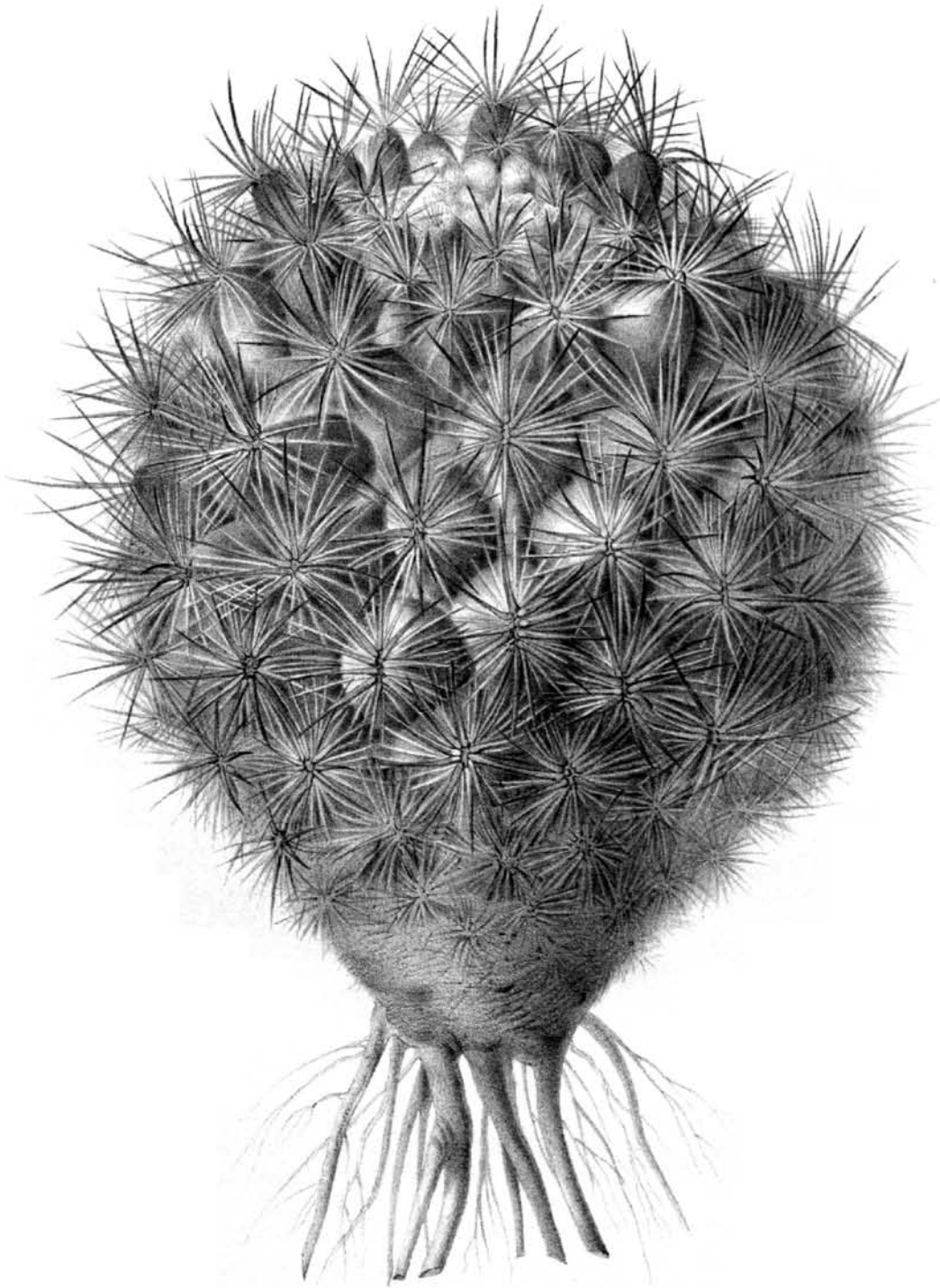
Figs. 8–9. Seed, 4 times magnified; fig. 9 showing the broad rhapshe.

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and cylindric, fresh or dark green, usually growing one on top of the other, forming chains of 1 or 2 feet long, at last prostrate; joints fragile, separating as readily as in *O. fragilis*; tumid pulvilli 4–6 or even 8 lines apart; leaves 2½–3½ or 4 lines long, incurved; spines 1–1½ inches long, very straight, when in threes divergent like the “crowsfoot” used against cavalry, whence the name given by the military gentlemen who discovered this species. Flowers 14–11 inches in diameter; sepals and petals less numerous and narrower than in any allied species; ovary about ½ inch long, with only 2 or 3 areolæ on the surface and 3–5 on the upper margin. Fruit obovate, 6–7 lines long, rose-purple, with a shallow umbilicus, often crowned with the blackened remains of the flower; areolæ almost obliterated; red pulp very glutinous, including 1–3 or at most 5 seeds, which are regularly shaped, lenticular, with a narrow but thick and very obtuse rim. By its pulpy fruit, this species is widely removed from *O. fragilis*, to which its tumid and fragile joints seem to ally it, nor can it be confounded with any other species, though allied to *O. vulgaris* and *O. Rafinesquii*.

\* An account of this species was given in the Transactions of the St. Louis Acad. 2, p. 201 (1863).

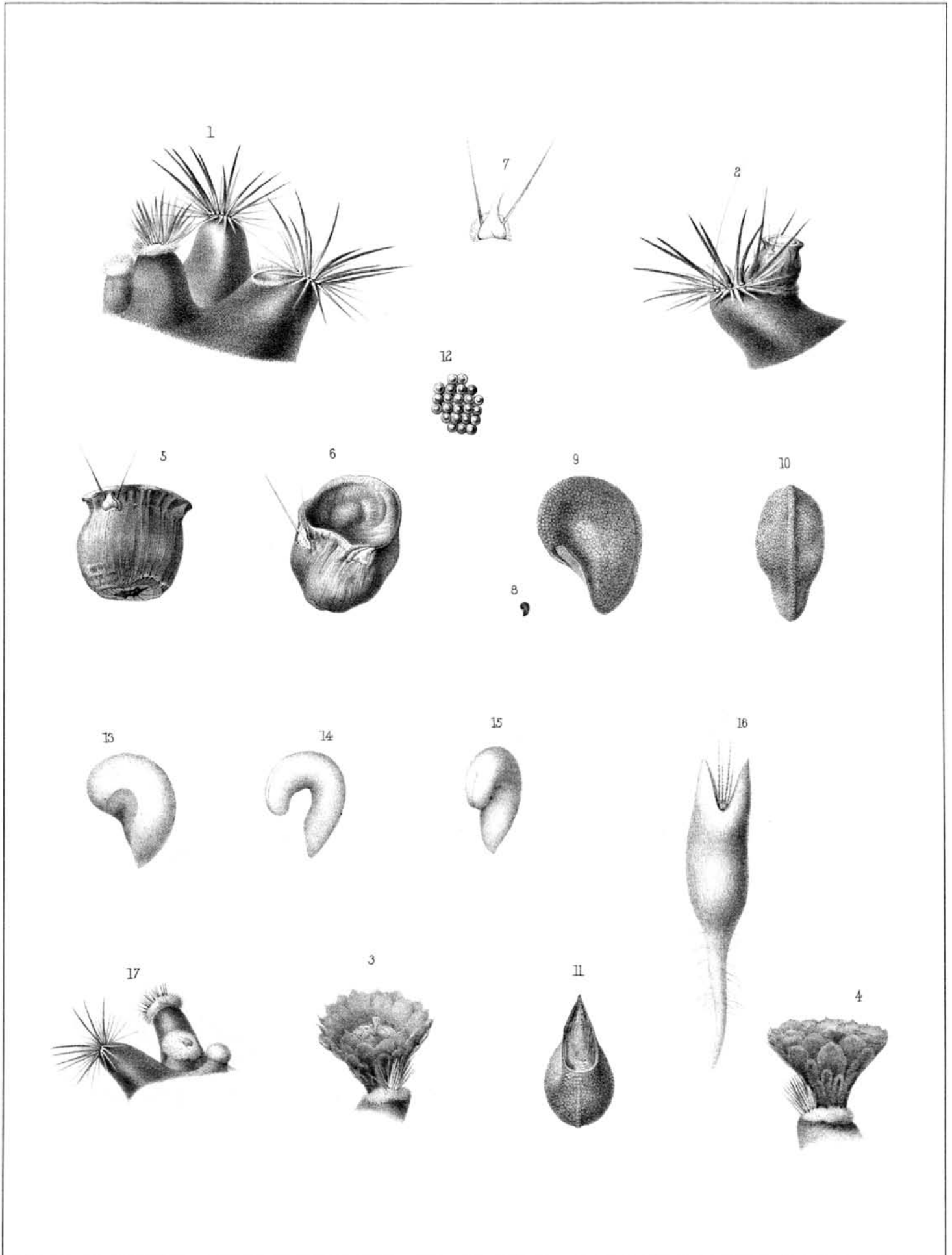
† This pretty species was afterward collected, 1867, “among the sage brushes” of Nevada, by Mr. William Gabb and in the following year by Mr. S. Watson “frequent in the valleys of Western Nevada from the Trinity Mountains to Monitor Valley, 4–5,000 feet alt.”



E. Roetter del.

T. Snelair & Son. lith. Phila.

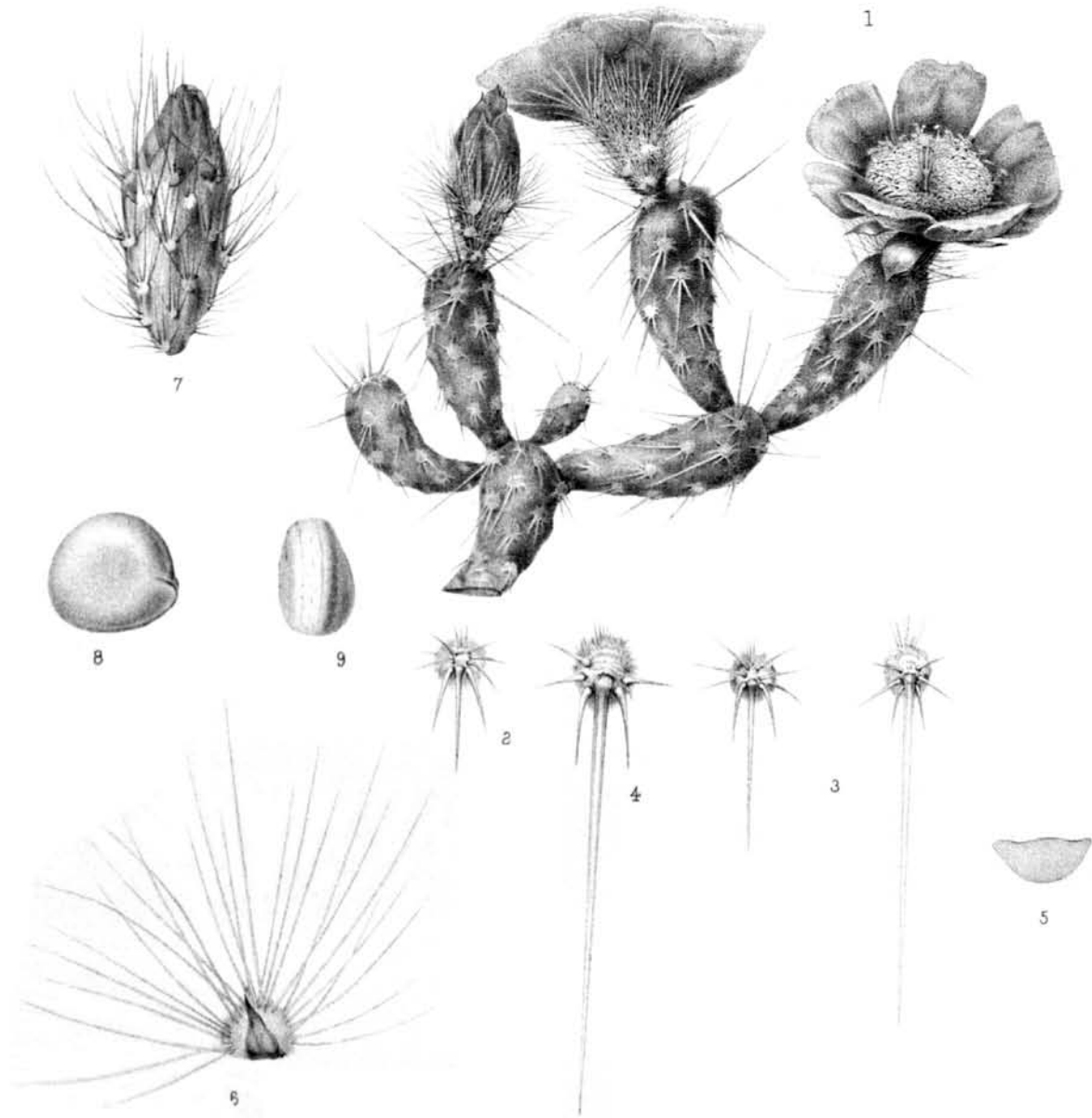
ECHINOCACTUS SIMPSONI ENGELM.



F. Roetter del.

T. Sinclair & Son. Lith. Phila.

ECHINOCACTUS SIMPSONI ENGELM.



*OPUNTIA PULCHELLA*, ENGELM.





ENGINEER DEPARTMENT, U. S. ARMY.

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REPORT

UPON

UNITED STATES GEOGRAPHICAL SURVEYS

WEST OF THE ONE HUNDREDTH MERIDIAN,

IN CHARGE OF

FIRST LIEUT. GEO. M. WHEELER,

CORPS OF ENGINEERS, U. S. ARMY,

UNDER THE DIRECTION OF

BRIG. GEN. A. A. HUMPHREYS,

CHIEF OF ENGINEERS, U. S. ARMY.

PUBLISHED BY AUTHORITY OF THE HONORABLE THE SECRETARY OF WAR,

IN ACCORDANCE WITH ACTS OF CONGRESS OF JUNE 23, 1874, AND FEBRUARY 15, 1875.

IN SEVEN VOLUMES, ACCOMPANIED BY ONE TOPOGRAPHICAL AND ONE  
GEOLOGICAL ATLAS.

VOL. VI.—BOTANY.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1878.

branches prostrate, running 10–20 feet." Segments of the upper leaves 2–4" wide and 3' long; lower leaves wider and shorter, somewhat lobed. Corolla yellow, 3' long, funnel-shaped.—Arizona (441). Fruit 3' in diameter, green, with white, longitudinal stripes.

### CACTEÆ.

BY DR. GEORGE ENGELMANN.

MAMILLARIA (CORYPHANTHA) VIVIPARA, Haworth, Engelm. in Watson's Bot. King's Expl. 117.—A common plant on the Western plains from the Missouri to Texas, extending in the mountain regions as far west as Arizona and South Utah, the large, deep rose-colored or purple flowers, with fringed sepals and lance-linear, acuminate petals, green, oval berries, with light brown, pitted seeds, readily distinguish the species. The form of the plains is lower and often densely cespitose-spreading; the mountain plant is often simple and larger. The largest form, which comes from Arizona, I had at one time distinguished as *M. Arizonica*, but must now consider it as only a gigantic *vivipara*, 3–5' high, 4' in diameter, with spines often over 1' long on rather broad and spreading tubercles. Rothrock, 1874, (203), is a smaller form, from Camp Apache, Ariz.

MAMILLARIA (CORYPHANTHA) CHLORANTHA, n. sp.—Similar to the last, but with broader yellow petals; stems oval to cylindrical, 3' wide, sometimes 8–9' high; tubercles compressed from above; 20–25 outer spines gray, almost in 2 series; 6–8 or 9 inner ones stouter,  $\frac{1}{2}$ –1' long, reddish or brownish only at the tip; flowers yellowish or greenish-yellow, crowded on the top of the plant,  $1\frac{1}{2}$ ' long and wide, often 1–2 small, fringed sepals on the ovary (which also occasionally is seen in *vivipara*); sepals lanceolate, fringed; petals lanceolate or linear-lanceolate, acute, denticulate; 7–9 whitish stigmas, erect-spreading.—Southern Utah, east of Saint George, Dr. Parry. I. E. Johnson.

ECHINOCACTUS WISLIZENI, Engelm.—Very large, often over 3° high and half as much in diameter; at first globose, then ovate to cylindrical,

and many-seeded. Seeds ovate or oblong. Stems annual, roots perennial, often procumbent and rooting. Leaves cordate at base and lobed. Tendrils 2-mauy-cleft. Flowers large, yellow. Fruit often very large.—BENTHAM & HOOKER.

with 21–25 rather sharp ribs; the large linear-oblong areolæ (very woolly when young) bear three kinds of spines, first, 4 very stout, annulated, reddish ones,  $1\frac{1}{2}$ – $2\frac{1}{2}$ ' long, the 3 upper ones straight, the lower one hooked; second, 3–5 lower and usually 3 uppermost spines, slender, but straight, stiff, and annulated, of reddish color; third, 12–20 whitish, bristle-like, flexuous, lateral spines: flowers 2– $2\frac{1}{2}$ ' long,  $1\frac{1}{2}$ ' wide, yellow, outside greenish with purple-brown; ovary and fruit imbricately covered with numerous (50–60) cordate or reniform crenulate sepals; sepals of tube oblong, ciliate; petals broadly linear, crenate, bristle-pointed; style deeply divided into 12–18 linear stigmas; seeds 1" long or over, reticulate or shallow-pitted.—Southern New Mexico.

Var. LE CONTEI. (*E. Le Contei*, Engelm.)—At last clavate from a slender base; lower central spine more flattened, curved or twisted, but not hooked; flower rather smaller and with fewer parts.—This is the Western form, from South Utah and Arizona to and beyond the Colorado River. Dr. Rothrock collected, at Camp Bowie, Ariz., a peculiar form (492), which may represent another variety, *decipiens*: globose, 1° in diameter; spines shorter and fewer, no straight spines above the 4 central ones, none longer than 1– $1\frac{1}{2}$  inches; 10–15 thin flexuous spines on side and upper end of areolæ; only 20–25 sepals on ovary.

ECHINOCACTUS POLYCEPHALUS, Engelm. & Bigel. (see Watson in Bot. King's Expl. 117).—From the Mojave region to Southwestern Utah. The numerous spiny-bristly sepals, and the linear, acute, yellow petals almost hidden in a dense cottony wool.

ECHINOCACTUS WHIPPLEI, Engelm. & Bigel; Watson, *l. c.* 116.—On the Lower Colorado River and northward into Utah.

CEREUS (ECHINOCEREUS) ENGELMANNI, Parry; Watson, *l. c.* 117.—Throughout Arizona and into Utah and Southern California. Flower purple, open only in mid-day sunshine.—Camp Bowie (1002), Mrs. Major Sumner. Flower only. May be this or an allied species.

CEREUS (ECHINOCEREUS) PHŒNICEUS, Engelm.—Globose or oval heads, 2–3' high, about 2' in diameter, several to a great many (sometimes over 100) from one base, 8–11-ribbed; 8–15 slender, but straight, stiff, and very brittle spines in each bunch,  $\frac{1}{2}$ – $1\frac{1}{2}$ ' long, 1–3 of them more central and

a little stouter; deep red flowers,  $1\frac{1}{2}$ – $2\frac{1}{2}$ ' long, half as wide, open equally day and night, spatulate, rather stiff petals, rounded at tip.—From West Texas to Southern Colorado and Arizona, as far west as the San Francisco Mountains, Bigelow, and from Fort Whipple, Palmer.

CEREUS (ECHINOCEREUS) TRIGLOCHIDIATUS, Engelm.—Few (2–5) globose or oval heads, 2–4' high,  $2-2\frac{1}{2}$  thick, 6–7-ribbed; areolæ more distant than in the last; spines fewer, only 3–6, flattened or angular, usually curved, about 1' long; flowers same as in last.—New Mexico, Santa Fé, 1874, Rothrock (39). *C. gonacanthus*, Engel. & Bigel., which extends from New Mexico to the Arkansas River and westward to Zuñi, and is characterized by its stouter, longer, and more numerous spines, may belong to this species; and perhaps both, with numerous other so-called species, which vary only in the number of the ribs, the number or form of the spines, and the closeness of the spine-bunches, but have all similar flowers, may have to be considered as forms of one polymorphous type (*C. phœniceus*).

OPUNTIA (PLATOPUNTIA) BASILARIS, Engelm. & Bigel.—A low plant, with broadly obovate, often retuse or fan-shaped joints, branching mostly from the base, pubescent, as well as the fruit; areolæ very close, without spines, but densely covered with short, yellowish-brown bristles; flowers large, rose-purple; fruit dry, subglobose, with rather few, large and thick seeds.—Southeastern California to Arizona. Distinct from all other species of this region by its mode of growth, its pubescence, the absence of spines proper, and the very large ( $3\frac{1}{2}$ –5" wide) seeds. The large purple flowers, which in the season completely cover the plant, make a beautiful show.

OPUNTIA (PLATOPUNTIA) MISSOURIENSIS, DC.—Santa Fé, N. Mex., 1874, Rothrock (6). Common from the plains of the Missouri into the mountains. A low, very spiny (whence Nuttall's name, *O. ferox*) species, with yellow or sometimes (on the Upper Arkansas plains) purple flowers, and dry spiny pods, which contain large, much compressed, and broadly margined seeds.—Several more, probably half a dozen, flat-jointed *Opuntia* have been noticed in Arizona, some prostrate and with smaller joints; others tall, erect, with large joints (to a foot or more in length), many of them very spiny; of them not much is known, as the plants are difficult

to preserve and flowers and fruit have not often been found or collected. Full notes, living joints, good fruit and seed, and pressed flowers are desirable, to make us sufficiently acquainted with these plants. The best method of preserving the flowers is to split them open before attempting to dry them. Living plants or joints are very valuable, but alone are not sufficient, because in cultivation they very rarely flower and scarcely ever bear fruit.

OPUNTIA (CYLINDROPUNTIA) CLAVATA, Engelm.—A low, cespitose plant, with short (1–3' high, 1' thick), clavate, ascending, strongly tuberculate joints, the upper areolæ bearing 4–7 ebony-white, flattened, striate spines, surrounded by a number of smaller, bristly ones; yellow flowers, 2' wide; dry, yellow, oval pod, covered with numerous, large, woolly, and long-bristled areolæ.—El Rito, New Mexico, Rothrock, in 1874 (92). Also about Santa Fé, etc.

OPUNTIA (CYLINDROPUNTIA) PULCHELLA, Engelm. (see Watson's Bot. King's Expl. 119; Simpson's Report, Botany, t. 3).—A very small, purple-flowered species of Nevada. A flower brought home by Mr. Bischoff was, by a singular error, enumerated in the Catalogue of 1874 as *Cereus viridiflorus*.

OPUNTIA (CYLINDROPUNTIA) ARBORESCENS, Engelm. (see Watson, *l. c.* 120).—Cuero, New Mexico (101), Rothrock, in 1874; Cienega, South Arizona (near Tucson), the same (584); and from Camp Bowie, Ariz. (1002), by Mrs. Major Sumner. This handsome species extends northward to the plains of Colorado and Pike's Peak, covering extensive tracts. Remarkable for its horizontal, often whorled, branches; purple flowers, 2–2½' in diameter; ovary often with some spiny bristles, which at maturity disappear. The skeleton, as the cactus wood is rather fancifully called after the soft tissues have rotted away, forms a heavy, hollow cylinder, with regular rhombic holes or meshes corresponding to the tubercles and spine-bunches of the plant, and makes excellent canes. This species is closely allied to the Mexican *O. imbricata* and *O. decipiens*, *arborescens* being the northern, larger-flowered form, but the seeds are different.

OPUNTIA (CYLINDROPUNTIA) BIGELOVII, Engelm. (Pac. R. R. Rep. 4,

Bot. 50, t. 19).—An erect, bushy plant, 10–12° high, with oval or sub-cylindric joints, bearing on short oval tubercles 3–5 large (1' long) and many smaller spines, the larger ones loosely covered by glistening, whitish sheaths; purple flowers, small, 1 inch wide; fleshy, greenish berry, numerous small and very irregular seeds, or often abortive; wood a wide, fragile tube with short meshes.

OPUNTIA (CYLINDROPUNTIA) TESSELLATA, Engelm.—Very bushy, from a stout trunk, with solid wood, sometimes several inches thick; ultimate branches as thick as a swan's quill, covered with angular, flattened, ashy-gray tubercles, the uppermost bearing at their upper end single, long, loosely yellow-sheathed spines; flowers small (about  $\frac{3}{4}$  of an inch wide), yellow; small fruit, oval, covered with long, soft, brown bristles. Pac. R. Rep. *l. c.* t. 21.—On both sides of the Lower Colorado River, 6–7° high; the yellow, shining spines, crowded on the upper end of each year's growth, together with the scale-like tubercles, give the plant a singular and striking appearance.

There are several other cylindric *Opuntia* in Arizona, not collected in these Expeditions, and for the most part only imperfectly known. It is desired to direct attention to this interesting group, which, on account of the bulky forms and forbidding armament, are too much shunned by travellers.—*Opuntia echinocarpa*, Engelm. & Bigel., is a low and very spiny bush, with yellowish flowers and dry, spiny fruit. *Opuntia acanthocarpa*, Engelm. & Bigel., is taller, with elongated tubercles, or rather ridges, copper-colored flowers, and dry fruit bearing few, but stouter spines. *O. mamillata*, Schott, and *fulgida*, Engelm. & Bigel., are allied to *O. Bigelovii*, with thick tubercles or prominent crests, the former with small, the other with numerous long and shining, sheathed spines; fruit often abortive. Good specimens with flower, fruit, and good seed of the same plant (so that mixing species and forms may be avoided) are very desirable, as we know scarcely anything more about them than what the botanists of the Mexican Boundary Commission (often at the most unfavorable season) could find out, twenty-five years ago. *Opuntia leptocaulis*, DC. (*O. frutescens*, Engelm.), the most slender *Opuntia* known, bushy, with branches like pipe-stems, small yellow flowers, and red, somewhat fleshy berries, is common

from North Mexico, through Texas, to Arizona. It has been said that its flowers, contrary to the habit of the genus (which has diurnal flowers—*i. e.*, open in sunlight), are nocturnal, which, however, is now positively denied.

#### FICOIDEÆ.\*

MOLLUGO VERTICILLATA, L.—Point of Mountains, Arizona (723).

#### UMBELLIFERÆ.

ERYNGIUM WRIGHTII, Gray (Pl. Wright. 1, p. 78).—Erect, smooth, pale, somewhat branched; lower leaves narrowly spatulate, regularly pectinate or toothed, with each tooth terminating in a bristle; stem-leaves lanceolate, 3–5' long, deeply cleft, with the divisions terminating in a bristle; upper leaves shorter, more deeply and palmately parted; petals blue, with a long, inflexed point; leaflets of the involucre longer than the head; inner bracts slightly exceeding the flowers.—Sanoita Valley, Arizona (603), at 6,500 feet altitude.

MUSENIUM† TRACHYSPERMUM, Nutt.—Branching from the base; radical leaves ascending, petioled, pinnately parted, with the segments pinnatifid; rachis broad, 1–2''; fruit nearly as broad as long, and slightly roughened; involucre of 8–10 leaflets, 2–4'' long, narrow, but slightly dilated upward.—Colorado (726).

CICUTA MACULATA, L.—Nevada and Utah.

CARUM GAIRDNERI, Benth. & Hook.—Nevada, where, as in Utah, the tubers are an important article of food with the Indians.

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\* FICOIDEÆ.—“A miscellaneous group, chiefly of fleshy or succulent plants, with mostly opposite leaves and no stipules; differing from *Caryophyllaceæ* and *Portulacaceæ* by having distinct partitions to the ovary and capsule (which are therefore 2-many-celled); the petals and stamens sometimes numerous in the manner of *Cactaceæ* (but the former wanting in most of the genera); agreeing with all these orders in the campylotropous or amphitropous seeds; the slender embryo curved partly or completely round a mealy albumen.”—Fl. Cal. p. 250.

† MUSENIUM, Nutt.—Calyx-teeth conspicuous. Petals clawed, obovate, point inflexed. Stylopodia small, depressed, styles rather short. Fruit ovate, slightly compressed on the side, commissure rather broad; carpels 5-angled, a little compressed on the back, with the primary ribs filiform, rather prominent, lateral ones contiguous. Vittæ many. Carpophore bifid. Seed compressed a little on the back, with the sides a little incurved.—Perennial, caespitose herbs, branching from the base, smooth. Leaves pinnate or bipinnatifid, segments pinnatifid. Many-rayed umbel compound. Involucre none. Involucre of a few short leaflets. Flowers white or yellow.—BENTHAM & HOOKER.





[June 30, 1883.]

THE  
GARDENERS' CHRONICLE.

A Weekly Illustrated Journal

OF

HORTICULTURE AND ALLIED SUBJECTS.

(ESTABLISHED IN 1841.)

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JANUARY TO JUNE, 1883.

LONDON:  
41, WELLINGTON STREET, COVENT GARDEN, W.C.

1883.

## FLOWERS IN SEASON.

FROM Mr. Ware come flowers of the elegant *NARCISSUS GRACILIS*, Jooquil-like form, with long, slender tube, spreading sulphur-yellow segments, and a shallow, spreading cup of deeper yellow with a plaited edge. The flower is very fragrant. As the plant is not known in a wild state, it has been supposed to be a hybrid perhaps between *N. tazetta* and *N. poeticus*. The pollen is, however, well formed.

*CYPRIPEDIUM PUBESCENS* is a North American species, with broad plaited leaves like a *Veratrum*. The flowers are solitary, terminal, nearly 4 inches in their longest diameter, with broad lanceolate sepals of an olive-green colour, very narrow, linear lanceolate twisted petals of the same colour as the sepals, but with a beard of whitish hairs on the inner surface. The lip is long, bag-shaped, yellow.

*ZEPHYRANTHES TREATI* is a lovely bulbous plant, with erect, trumpet-shaped, six-parted flowers, of a white colour flushed with rose, and with a delicate perfume.

*POLEMONIUM RICHARDSONI* is like our old friend the Jacob's Ladder, but has larger and bolder flowers.

*IRIS TENAX* is a very lovely dwarf species, with the falls beardless, of a pale violet, marked at the base with a spatulate white mark, flushed with gold and traversed by purple radiating veins. The narrow petals are erect, and of a violet colour.

*DODECATHEON SPLENDIDUM* is like the common *D. Meadia*, but with smaller flowers. What it loses in size, however, it gains in colour, for the reflexed petals are of a rich magenta-pink, the mouth of the tube encircled by a rim of golden-orange.

*CORYDALIS NOBILIS*, with its bold, dense spikes of yellow flowers, with a central brown spot, hardly needs more than the mention; and the same may be said of *Trillium grandiflorum*.

*BERBERIS STENOPHYLLA*.—This is a beautiful evergreen hybrid, well adapted for flowering early in a cold-house. Some plants have profusely flowered this season, and were objects of great beauty for a considerable time, but they were kept carefully screened from the sun. Whether plants flowering so early under glass will by-and-bye carry a crop of purple berries, remains to be seen; but the fact that it does berry freely imparts to it an additional value as a decorative plant. The blossoms are of a charming pale orange colour, and very pleasing in appearance. For a figure, see *Gard. Chron.* 1880, vol. xiv., p. 213.

*GREVILLEA ACANTHIFOLIA*.—In one of the octagons of the winter garden at Kew are flowering specimens of this curious species. The flowers are borne in dense oblong one-sided heads terminating the branches, and derive character from the long bent styles, which vary in individuals from a pale rosy colour to purple. The corolla itself is pale, almost white, and unattended by the styles would be anything but ornamental. The leaves of this species too are remarkable, as showing the extent of variation in the genus, from strictly entire to highly divided, and in this case rigid and spiny pointed. The plant is figured in Hooker's *Exotic Flora*, 216.

*AZALEA INDICA*, *LADY POLTIMORE*.—The above *Azalea* has been planted out in the open air in the trial grounds of Messrs. Veitch & Son's nursery, Exeter, for two years past. At the present time it is in full bloom, having matured its growth and bud as freely and to perfection as its companions in the houses. The texture of the bloom has more substance than the old *indica alba*, and withstands the wind or rain better. It is a lovely white in colour, and for house work it is the most desirable of whites to grow. But as it adapts itself to what we may call a moderately severe winter, and pulls through it unscathed, here is a novelty for the American garden and pleasure grounds which cannot fail to please. *D. C. P.*

*BIGNONIA CAPREOLATA* VAR. *ATROSANGUINEA*.—This distinct and handsome variety of the Cross Vine of the Southern United States is now flowering in the conservatory at Kew. A figure prepared from the Kew plant appeared in a recent volume of the *Botanical Magazine*, tab. 6501. The

typical form has orange-yellow flowers, but the variety now noted has larger dark red purple corollas. *B. capreolata* is one of the loftiest climbers in the forests of the Southern United States, where it ornaments the rocks and trees with its luxuriant foliage and (usually) orange-yellow flowers. It succeeds in sheltered positions in many places in Britain; it would be interesting to have definite data concerning its behaviour in various localities.

*ERYTHRINA MARMORATA*, a variegated form of one of the species of Coral tree, is now in flower at Kew, and perhaps the first opportunity of properly determining it has therefore arisen. It turns out to be a variety of *E. indica*, a tree about 30 feet high, which is found in a wild state at the foot of the Himalayas, and also in Ceylon, Birma, and Malacca. *E. indica* is commonly cultivated in India and the Malayan peninsula and islands for supporting the weak stems of the Pepper plant, for which purpose it is kept dwarf. It affords a very soft porous wood, greatly used in India for making toys, light boxes, and similar articles which are usually overlaid with a thick coating of varnish or lacquer. *E. marmorata* has long racemes, borne at right angles to the stem—of large handsome orange-scarlet blossoms, and is a decidedly striking and desirable decorative stove plant. *Erythraea picta*, fig. 77 in Rumph's *Herbarium Amboinense*, seems to be exactly the recently introduced *E. marmorata* of English gardens.

## Florists' Flowers.

**TULIPS IN LANCASHIRE.**—The annual exhibition of the Royal National Tulip Society is fixed for Saturday, June 2, and will take place as usual in the Botanical Gardens at Old Trafford, and the date will not be altered. The prospects of the show are at present a little obscure, for the Tulips are unusually late this season, judging from the appearance of Mr. Samuel Barlow's beds at Stakehill, near Manchester. On Whit Sunday not a flash of colour was perceptible on any one of the numerous beds of the flowers. The late Dr. Hardy, of Warrington, always boasted that he had Tulips in flower in April, but unless there is a decided change of weather—unless warm, bright, sunny days and mild, growing nights happen immediately, Mr. Barlow will scarcely have a Tulip in flower in May. So much depends on the weather, and in Mr. Barlow's particular case there is abundant promise of a very fine head of bloom. The growth is healthy, and the buds have that clean bright appearance that is always indicative of good blooms.

At Stakehill there are four large beds full of Tulips, representing the finest collection in Europe, and it has recently been enriched by the addition of a number of seedlings from the collection of the late Mr. John Hepworth, of Huddersfield. It is just now, when the flowers are on the point of expanding, that the Tulip cultivator needs to be on the alert. There is great danger from hail and from heavy showers of rain. Soft warm showers do the bulbs great good up to the time that the flowers are colouring, but hail and heavy rains—thunder showers as they are termed—do much harm, and therefore it is necessary that coverings be at hand ready to put on when required. The covering should also be put on at night, because there is no knowing what weather may happen, and it is best to be on the right side. Present appearances indicate an agreeable change in the weather; if this should continue, a fine display of this gorgeous flower may be looked for at Manchester, on June 2. One new feature will be introduced at this show—the usual painted stands are abolished, and exhibitors from a distance need no longer be under the necessity of conveying stands from long distances.

During the last year or two a neat little bottle, broad at the bottom and tapering towards the top, has been provided for the use of exhibitors: these have been somewhat appropriately termed "botanical society's bottles," and their adoption will impart a uniformity to the arrangement of the flowers much needed. Hitherto the stands have greatly varied in size, pattern, and colour, and any decorative effect which might otherwise have been obtained was lost. The "florist" is frequently regarded as a being moving in a very narrow circle, and as the slave to antiquated ideas. But there are reforming tendencies

and progressive instincts in him nevertheless, and they are bound to find expression at some time or other. The Midland Counties and the North are now almost entirely the home of the Tulip. The London district, once a floral centre of Tulip cultivators, knows them no more, if we except Mr. Douglas, at Ilford. But where else round London is a small collection even to be found? If Mr. Barlow could be induced to come south at the blooming season, bringing with him some of the choicest flowers from his unique collection, a quickened interest in this old-fashioned flower might result. The Tulip has by no means been improved up to the point of perfection, though some of the newer breaks appear to fall but a little way short of faultless expression. *R. D.*

OPUNTIA SUBULATA,  
ENGELM.

IN the grounds of Mr. Thomas Hanbury at Morcola, near Mentone, the interesting *Cactus* which is well known in cultivation as *Peirescia subulata*, Muhlenberg, has bloomed this spring (February), and is now maturing its fruit, and through Mr. Hanbury's kindness I have been enabled to examine fresh specimens; these have fully convinced me of the necessity, long suspected, of removing the species from *Peirescia* to *Opuntia*. My attention was first drawn to this by the observation that the spines of this plant have, at least when first developed, barbs toward their points, and barbed spines (and bristles) are a singular peculiarity of all the members of the genus *Opuntia*, and are not found in any other *Cactus*. This is a curious instance where a vegetative character of apparently minor importance becomes so constant and so exclusive as to at once readily distinguish all the members of this large genus from any other *Cactus*. The barbs in this species are, however, slight, and are apt to disappear in older spines, and the smaller bristly spines generally so abundant (and annoying) in most *Opuntia* are almost entirely absent in this species.

Another, and the most essential character of the genus *Opuntia*, is found in the expansion of the funiculus, which envelopes the ovulum, and finally forms the whitish bony covering of the seed, which, if it was softer, we should call an arillus. This I first discovered in our plant several years ago in an otherwise incomplete specimen, kindly sent by Professor Todaro, of Palermo, and I find it so again in the flower now under inspection. This character is peculiar to all *Opuntias*, and is not seen in any other *Cactus*. *Peirescia*, on the other hand, has the smooth spines and the dark-coloured, mostly black, crustaceous seeds (destitute of a bony arillus) of all other *Cactaceae*.

The leaves, being somewhat persistent in *O. subulata*, have probably been the cause of the plant having been referred to *Peirescia* before flower or fruit were known, but more or less persistent leaves are of not rare occurrence in allied *Opuntia*, which on this ground have sometimes been referred to *Peirescia*; subulate leaves have thus far not been found in any true *Peirescia*. In this species they are the largest of any *Opuntia* known, 3 to 5 inches in length.

The narrowly piriform ovary of *O. subulata* is about 3 inches long, and is covered with something like twenty obcordate or rhombo-obcordate depressed tubercles, which bear in the notch a greyish woolly areola, rarely with a few bristles, and under it the thick, subulate, suberect, at last deciduous leaves (outer sepals), 1½ to 2 inches long. About eight small dirty purple petals, obovate to orbicular, very obtuse, form the corolla; and a few similar but acute sepals make the transition to the calyx. The slender style has about five branches.

The only fruit seen was Pear-shaped, 4 inches long and 2½ inches thick; the obcordate tubercles still showed their contour quite distinctly in ¼ order, but were entirely flat; a few of the upper short sepals were still attached; umbilicus narrow and very deep; eighteen very large seeds were found densely packed in the centre. The seeds were altogether the largest *Opuntia* seeds and probably the largest *Cactus* seeds, seen by me, 5 to 6 lines in the longest diameter, and 3 to 4 or even 5 lines thick, of irregularly angle-shape and not flat as *Opuntia* seeds commonly are. A very narrow commissure, the external part of the funiculus, runs around the seed; the bony coating very thick, albumen very scant, cotyledons contrary to the side of the embryo (as normally in most *Opuntia*).



Our plant is closely allied to *O. cylindrica*, which, like it, comes also from the west coast of South America.

The *Cylindropuntia* differ very materially from the common flat-jointed *Platopuntia*, not only by their external form but also by the character of their seed, which is destitute of the broad rim or commissure of the *Platopuntia* seed. They form three natural sections.

1. *Tunicata*.—Spines mostly numerous and very irritating, the larger ones covered with a loose sheath; seeds with a comparatively large albumen. Plants usually erect, often tall, wood reticulated forming a very hard skeleton: Peculiar to Mexico, and especially to the south-western parts of the United States.

2. *Clavata*.—Spines without sheaths, generally annulated, and the larger ones compressed; seeds as in last. Growth low, caespitose, without a solid skeleton. In the same regions as the last, perhaps also in South America.

3. *Pachysperma*.—Spines without sheaths, terete; leaves often somewhat persistent; seeds thick in proportion, albumen often very scanty, or scarcely any; wood unknown; growth tall or low. South America. Of this section I could only study *O. subulata*, *cylindrica*, and *vestita*, of the West Coast, and with red flowers. Perhaps the yellow-flowering *O. Salmiana* of Brazil also belongs here, and also the different South American *Opuntia* classed as *Ovatæ*; the *Platantha*, with flat, flexible spines, I do not know at all; they may form a fourth section. *G. Engelmann*, *St. Louis*, April, 1883.

### ADOLPH STRAUCH.

THE Directors of the Spring Grove Cemetery, Cincinnati, Ohio, have done a graceful act in recording on their Minutes an appropriate testimony to the memory of a great landscape gardener, who knew how to supplant the dingy horrors of the graveyard by a lovely park, whose beauties have more than once been commented on in these columns. We cite the following extract from the Minute in question, and trust that the example set by Mr. Strauch will be universally followed:—

"Elected Superintendent in 1854, in his thirty-second year, Adolph Strauch would have reached his sixty-first birthday on August 30 next. At the meetings of the Board he was always present to hear, answer, and advise upon whatever concerned the interests of the Association. His opinions were valued because, his entire time being spent in the grounds, nothing, however apparently unimportant, escaped his vigilant observation.

"Mr. Strauch originated the landscape lawn system for cemeteries; gradually developed its important details, and demonstrated its superiority so clearly that it has been generally adopted, and become the type of many others which have been established within the last ten years. It was clearly the creation of genius—a rare genius—but an eminently practical one, made successful by his great industry, tact, and personal popularity. It was not the work of a few years to overcome natural prejudices or the customs of a lifetime, or to surmount obstacles placed in his way by the lot-owners of earlier years, all of whom some years later became zealots for the new system, as well as his strongest friends. The execution of his plans required not alone years of patient labour, which would have discouraged ordinary men, but it became necessary to obtain the means by the sale of large individual lots to make the system successful, and he lived to see it accomplished and spoken of with pride as the sylvan park of the living as well as the dead, now perhaps the most important possession of the people of Cincinnati. Years ago he had filled the measure of his ambition by the consent of his profession, which ranked him as the equal of Repton and Puckler-Muskau as a master of art in landscape creation, which had been finally proved by him to be possible to be successfully applied in adorning and making attractive the last resting-places of humanity.

"It is a privilege to say of him personally that he was a favourite amongst all classes. A singular modesty combined with a natural, warm-hearted manner, made friends for him everywhere, who gave him their confidence and respect. Ever ready, particularly in times of bereavement, seldom has any man's advice been sought more confidently, and rarely has needed counsel been given more disinterestedly."

*LÆLIA MAJALIS* (fig. 101).—Our illustration of this charming Mexican Orchid was prepared from a very fine flower sent us a week or two ago from the collection of A. J. Hollington, Esq., Forty Hill, Enfield, whose gardener (Mr. Clinkaberry) grows the species most successfully in a Cattleya-house temperature in summer and cool treatment in winter. Its delicate rose colour, and chocolate-spotted and striped lip, forms a combination at once chaste and very pleasing.

### OUR FRUIT PROSPECTS.

It seems hard that, whilst we can always rely upon the assurance of a plum-pudding at the Christmas festival, the erratic motions of the movable feasts should this year, and that too with the prospect of such wondrous plenty before us, deprive us of that almost absolute essential to Whitsun festivity, a Gooseberry tart. Not only is Whitsuntide very early, but the season, or rather the products of the season, are late, hence we must wait yet a week or two ere the deliciously sour and delightfully hard unripe fruits will be large enough to grace, in indigestible pastry, the dinner-table. But Gooseberries have many better uses, and therefore we hail with satisfaction the prospect open of an immense crop, and hope that tens of thousands of jam-pots may be, in a few weeks, filled with the capital preserve, made from the green fruits as well as ripe

### DORONICUMS.

ABOUT the beginning of March, before the dreadful frosts from which the flower gardens of most of us suffered so much, I noticed that *Doronicum austriacum* was strongly recommended by a writer in the *Gardeners' Chronicle* as a hardy spring flower; but, a fortnight later, I observed a recommendation that those who did not wish to have it destroyed by frost had better grow it under glass. I had been thinking of sending a note to the same effect, but did not do so, because I did not feel sure what plant was intended by the name *D. austriacum*. The fact is that amongst *Doronicums*, as amongst many other plants, slight botanical differences, of no consequence to gardeners, have been made excuses for multiplying names until hopeless confusion is caused, and you never know what you will get from nurserymen under any name. For



FIG. 101.—LÆLIA MAJALIS.

ones. On the Currant bushes the bloom bunches are hanging in massive festoons, and it seems as if nothing now could prevent the production of a big crop of the welcome clusters. The past week has probably seen the climax of bloom on hardy fruits, the Apple trees especially having shown a wealth of colour and flower that promises one of the finest crops of the most useful and popular of all our hardy fruits we have had for some years. The bloom is large and stands well, so that only some unexpected disaster can render it void. On Pear trees the fruits have set in myriads, and Plums should be a heavy crop indeed. If jam makers are not busy this year it will be a misfortune, for not only do they, in their growing trade, prevent much once deplorable waste, but they can store in their manufacture a season's abundance against a season of scarcity. Sweet Cherries have bloomed as only Cherries can flower, and the drooping Morellos have been garlands of snow-white flowers. Very rarely has there been such a promise of plenty in fruits as is now seen, and if that promise be but realised the nation will be much the richer, and tens of thousands will be greatly blessed.

gardening purposes there are, as far as I know, three (and no more) distinct kinds of *Doronicum* in cultivation, about each of which I will say something; and if I say anything wrong I shall take it as a compliment and a favour if any reader will set me right.

First there is the old Leopard's-bane (*D. pardalianches*), a coarse plant 4 feet high, flowering in May, and at no other time. The flowers are about 3 inches across, of a rather pale yellow colour. In moist open soils this is a showy plant, but it is better suited for wild places than for the garden flower bed. It is recognised in lists of native flora as a naturalised British plant. I should have said that a marked character of it is its heart-shaped leaves, which, as well as the stalks, are generally covered with rough hairs. I have seldom found any confusion about this species.

The next, which I have already mentioned by the name of *D. austriacum*, is generally the first to attempt to flower in spring; but though the plant is perfectly hardy, the flowers and buds are so easily destroyed by frost as to make the plant in my garden