U.S DEPARTMENT OF AGRICULTURE.

DIVISION OF BOTANY.

CONTRIBUTIONS

FROM

THE U. S. NATIONAL HERBARIUM.

Vol. III.

REPORTS ON COLLECTIONS, REVISIONS OF GROUPS,
AND MISCELLANEOUS PAPERS.

REVISIONS OF NORTH AMERICAN GRAMINEÆ AND CACTACEÆ, STUDIES OF SPECIAL GROUPS, AND CATALOGUES OF PLANTS COLLECTED IN NEBRASKA, IDAHO, SOUTH DAKOTA, KANSAS, WYOMING, ALASKA, AND MEXICO, WITH GEOGRAPHIC REPORTS AND DESCRIPTIONS OF NEW GENERA AND SPECIES.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1892–1896.

CONTENTS.

PRELIMINARY REVISION OF THE NORTH AMERICAN SPECIES OF CACTUS, ANHALONIUM, AND LOPHOPHORA.

PREFATORY NOTE.

In the fall of 1890 Dr. George Vasey, then Botanist of the Department of Agriculture, arranged with me to prepare a revision of North American *Cactaceæ*. Owing to the peculiar difficulty of preserving material the family was poorly represented, even in our leading herbaria. To secure a large amount of additional material in the way of specimens and field notes the Department authorized me to visit the region of the Mexican boundary during the summer of 1891. Preliminary to this exploration it was necessary to examine the Engelmann collection of *Cactaceæ*, in the possession of the Missouri Botanical Garden. This collection, supplemented by the continual additions made at the garden, is by far the largest collection of skeletons and living specimens in this country, and also contains the large majority of our types.

In March, 1891, I visited this collection and made such notes as seemed necessary for use in the field, and in June, accompanied by Mr. W. H. Evans and Mr. G. C. Nealley, I began field work in the neighborhood of El Paso, Tex. After ten days of exploration it was necessary for me to leave the field work in charge of Mr. Evans, who, with Mr. Nealley, continued work westward, during July and a part of August, to southern California, along the Southern Pacific Railway. As a result a large number of complete plant bodies was secured, but very few of them were in flower and the field notes indicated little besides collection stations. During the following fall and winter preliminary determinations of this material were made by Mr. Evans.

In the fall of 1892 critical study of this and other collections was begun in connection with my assistants, Dr. Elmon M. Fisher and Mr. Edwin B. Uline, who have ever since rendered constant and most import assistance in the examination of material and bibliography, which alone has made the work possible in the midst of other pressing duties.

In the spring of 1893 these two gentlemen spent several weeks at the Missouri Botanical Garden in the critical study of its rich material, and during the latter part of their stay I assisted in the work. Dr. William Trelease, the director of the garden, had hastened the arrangement of the Engelmann material, and had mounted in convenient form the large mass of notes left by Dr. Engelmann. These notes contained

not only critical remarks upon known species, but also the diagnoses of many unpublished species which had come into his hands, notably those collected by Mr. William Gabb in 1867 in Lower California. The collections that have thus far been studied are:

(1) Those of the Missouri Botanical Garden; and thanks are especially due to Dr. Trelease for his generous cooperation in the use of this material, without which the work would have been impossible.

(2) Those of the Department of Agriculture, including the results of several recent explorations, for the use of which I am indebted to Mr. Frederick V. Coville.

(3) Those of the Gray Herbarium at Harvard University, which Dr. B. L. Robinson kindly placed at my disposal.

(4) Those of the California Academy of Sciences, notably rich in forms from Lower California and the adjacent islands, kindly loaned by Mr. T. S. Brandegee.

(5) Those of Dr. Louis Eschanzier, of San Luis Potosi, Mexico, who send a large series of Mexican forms collected in 1891.

(6) Numerous small sets from different correspondents, who have given both time and material in aiding the work.

It is needless to say that Dr. George Engelmann, the great pioneer student of this difficult family, has opened the paths in which we must follow, and it was exceedingly unfortunate that he was not able to complete the final revision that he had in mind.

The difficulties which beset the critical study of this group can not be easily exaggerated. Such scanty material as has been collected has been for the most part very incomplete, consisting of plant bodies without flower or fruit, flower or fruit without plant bodies, and bunches of spines without either. The species are displayed also in the most inaccessible regions, and their culmination is found in the still poorly known regions of Mexico.

On account of their singular forms and often brilliant flowers they have long been extensively cultivated, especially in Europe. These cultivated forms have formed the basis of original descriptions in almost all of the European publications, and in very rare cases have any types been preserved. As a result, the bibliography of *Cactaceæ* is appalling, and it is questionable whether satisfactory conclusions can be reached in the case of hundreds of published names. The earlier descriptions were not only meager, but were based upon what are now regarded very insufficient characters, and in the absence of types it is not only unsafe, but impossible to venture an opinion concerning their identity. In view of these facts, I have thought it advisable to present a preliminary revision of the order, which shall contain the results of the study of material confessedly insufficient. With such knowledge as we possess brought together, it is hoped that the study of this very interesting and much neglected group will be stimulated, and that more critical exploration of our southwestern territory and adjacent Mexico will make

a more satisfactory presentation possible. It would be useless to notice the vast number of reputed species that are not represented by actual specimens in our possession.

In the proposed preliminary account of the family, of which the present paper is the first part, only those genera are considered which form a part of the flora of the United States, and those species which I have been able to examine and to identify with reasonable certainty. All forms credited to the United States have been studied, and the account of these species may be considered fairly complete, but the far more numerous Mexican species are but scantily represented. The Mexican boundary is so unnatural a dividing line in the distribution of Cactaceæ that it has been disregarded, and all the species studied have been arranged in a lineal series of uniform prominence. So far as known the subject of geographical distribution is considered, but it will be seen how meager is our knowledge of this subject. It is to be hoped that this preliminary presentation will provoke exploration and study, and that species will not only be collected, but all the facts of their distribution noted. It is more than probable that our present notion of species in this group must be much modified, and doubtless many forms are at present kept specifically distinct which will prove to be but different phases of a single species.

In the matter of generic delimitation we are in still greater uncertainty, and several generic lines at present recognized must be regarded as purely arbitrary, a fact which must become still more evident with additional material. The whole group is to be regarded as made up of poorly differentiated forms and only long observation under cultivation can determine the possibilities of specific variation under the influence of environment, of age, of inherent tendencies. For instance, that these plants change in form and in spine characters with increasing age and after they have begun to flower can not be doubted, but what described forms have thus been separated in descriptions can only be guessed at.

John M. Coulter.

Lake Forest University,
Lake Forest, Ill., January, 1891.

1. CACTUS Linn. Sp. Pl. 466 (1753), restricted.

MAMILLARIA Haw. Synop. 177 (1812), not Stackh. (1809).

Usually globose to oblong plants (simple, branching or cespitose), but sometimes slender-cylindrical, covered with spine-bearing tubercles: flower-bearing areola axillary (with reference to tubercles), entirely separate from the terminal spine-bearing areola, although sometimes (CORYPHANTHA) connected with it by a woolly groove along the upper face of the tubercle: ovary naked: seeds smooth or pitted: embryo usually straight, with short cotyledons.—Originally defined by Linnæus in his *Systema*, ed. 1 (1735).

The Linnaean genus *Cactus* of 1753 included 22 species and was coextensive with the present order. In 1812 the species were separated by Haworth into five genera, the original generic name Cactus being discarded. Among these species *C. mamillaris* seems to have stood as the type, not only of the Linnaean genus Cactus, but also of Haworth's *Mamillaria*, and as such should retain the original generic name. Besides, *Mamillaria* was used as the generic name of an alga in 1809. *Cactus mamillaris* L. is the West Indian *Mamillaria simplex* Haw.

From one point of view the two sections of the genus (EUMAMILLARIA and CORYPHANTHA) deserve generic separation, for the character of grooveless and grooved tubercles seems to hold without exception, and the sections are separated with more certainty than are certain species of *Coryphantha* and *Echinocactus*. If genera are simply groups of convenience the separation should be made.

I. EUMAMILLARIA. *Flowers from the axils of the older or full-grown tubercles (hence usually appearing lateral), mostly small, and generally from whitish to pink or red: tubercles never grooved: fruit almost always clavate and scarlet.*

A. *Tubercles more or less quadrangular.*

* *Central spines not hooked.*

+– *More than one central spine.*

1. Cactus alternatus, sp. nov.

Subglobose, 10 cm. in diameter, simple: tubercles long (15 to 20 mm.) and spreading, with woolly axils: radial spines 3, rigid and recurved, 5 mm. long; central spines 3, very stout and much recurved, 20 to 30 mm. long, alternating with the radials; all ashy colored and often twisted: flower and fruit unknown.—Type in Herb. Coulter.

San Luis Potosi

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

The few spines, with the very short radials alternating with the very long and stout centrals, furnish a striking character. Occasionally one of the centrals is wanting.

2. Cactus acanthophlegmus (Lehm.) Kuntze, Rev. Gen. Pl. 260 (1891).
Mamillaria acanthophlegma Lehm. Delect. Sem. Hamb. (1833)

Subglobose with a deeply depressed vertex, or becoming cylindrical, 3 to 8.5 cm. in diameter: tubercles sharply quadrangular-conical, with densely woolly axils: radial spines 15 to 30, white, very slender (bristly) and radiant, sometimes coarse capillary, 4 to 7 mm. long, interwoven with those of neighboring tubercles and so covering the whole plant; central spines 2 to 4, robust and straight, erect or divergent, whitish or reddish, black-tipped, 5 to 6.5 mm. long: flowers reddish, 1 to 2 cm. broad: fruit unknown.—Type unknown.

From Coahuila and San Luis Potosi to Oaxaca. Fl. May.

Specimens examined: Coahuila (*Poselger* of 1856; *Pringle* 3116 of 1890): San Luis Potosi (*Eschanzier* of 1891).

The central spines are quite variable in number and arrangement. In case there are two they are vertically placed and are either erect and parallel or widely divergent. Even three centrals may occur in the same vertical plane; but more usually the three or four centrals are arranged about a center and are widely divergent. The tubercles are apt to persist and to become naked and corky with age. The axillary wool and the capillary radials are also apt to be more or less persistent, thus giving the whole plant a woolly appearance.

3. Cactus brandegei, sp. nov.

Cylindrical: tubercles sharply quadrangular-conical, 6 to 8 mm. long, with densely woolly axils: radial spines about 10, slender and rigid, whitish with dusky tips, spreading but not radiant, 7 to 10 mm. long; central spines 3 or 4, stouter and slightly longer, erect-spreading (sometimes slightly curved), reddish-brown below, becoming blackish above: flowers small (scarcely longer than the tubercle?): fruit unknown.— Type in Herb. Calif. Acad.

San Jorge, Lower California. Fl. April.

Specimens examined: Lower California (*Brandegee* of 1889, at San Jorge).

The species has somewhat the spine characters of *C. palmeri*, but the sharply quadrangular and longer tubercles with axillary wool free from bristles suggest a very different affinity.

4. Cactus densispinus, sp. nov.

Globose, 7.5 cm. in diameter, simple: tubercles short, with woolly axils: radial spines about 25, erect-spreading, slender but rigid, yellow (brownish to black with age), unequal, 8 to 10 mm. long; central spines 6, a little longer (10 to 12 mm.) and straight, more rigid and darker, black-tipped: seeds obovate, reddish-brown, 1 mm. long.—Type in Herb. Coulter.

San Luis Potosi

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

Very easily distinguished by its dense, erect spines, which so completely cover the plant as to give it the appearance of a large chestnut bur. Another much smaller form, which seems to be a variety, has stouter and longer ashy-white spines, the centrals darker-tipped, and the lower centrals slightly curved.

+– +– One short central spine (rarely two or none): ovaries immersed: seeds small, yellow and rugulose: simple.

5. Cactus heyderi (Muhlenpf.) Kuntze, Rev. Gen. Pl. 260 (1891).

Mamillaria heyderi Muhlenpf. Allg. Gart. Zeit. xvi. 20(1848).
Mamillaria declivis Dietr. Allg. Gart. Zeit. xviii. 235 (1850).
Mamillaria applanata Engelm. Pl. Lindh. 198 (1850).
Mamillaria texensis Labouret, Monogr. Cact. 89 (1858).

Depressed, globose, usually with depressed vertex, 8 to 12 cm. broad, 2.5 to 5 cm. high: tubercles elongated: radial spines 10 to 22, whitish, 5 to 12 mm. long, the lower usually the longer, stouter, and often darker; central spine 4 to 8 mm. long, light yellowish-brown, stout, straight, and porrect: flowers 2 to 2.5 cm. long, reddish-white: fruit incurved, 1.5 to 3 cm. long. (*Ill.* Cact. Mex. Bound. t. 9. figs. 4-14).— Type unknown.

From the Guadalupe River, Texas, to the mouth of the Rio Grande, and westward to Arizona and Sonora. Fl. April, May.

Specimens examined: Texas (*Lindheimer* of 1845, 1847, 1853; *Wright* 226, also collections of 1849, 1852, 1853, 1855, 1856; *Bigelow* of 1853; *Trelease* of 1892; *Nealley* of 1892): New Mexico (*Wright* 311; *Bigelow* of 1853, *Evans* of 1891): Arizona (*Pringle* of 1881): also growing in Mo. Bot. Gard. 1893; and in the World's Fair collection of *Mrs. Nickels*.

The radial spines are somewhat variable in relative length, often becoming almost equal, while sometimes the upper radials are very much reduced. The figure referred to in Cact. Mex. Bound. is not satisfactory as to the general habit of the plant, which is flat-topped rather than hemispherical.

6. Cactus heyderi hemisphaericus (Engelm.).

Mamillaria hemisphaerica Engelm. Pl. Lindh. 198 (1850).

Differs in being hemispherical instead of flat-topped, in its fewer (9 to 12) and shorter (4 to 8 mm.) radial spines, and much smaller less rough and lighter-colored seeds. (*Ill.* Cact. Mex. Bound. t. 9. figs. 15–17)— Type, the "Goebel's Garden" plants in Herb. Mo. Bot. Gard.

Throughout southern Texas and southern New Mexico, and southward; not extending so far north or west as the species, and apparently not so abundant within the United States. Fl. May.

Specimens examined: Texas (*Schott* 322, 614): New Mexico (*Evans* of 1891): also specimens cultivated in the Goebel Garden, St. Louis, in 1847, brought from "below Matamoras on the Rio Grande" by the St. Louis Volunteers, in 1816.

On account of its convex top the variety becomes somewhat higher than the species (5 to 7.5 cm.), and the flowers are sometimes slightly longer (2 to 3 cm.).

7. Cactus meiacanthus (Engelm.) Kuntze, Rev. Gen. Pl. 260 (1891).
Mamillaria meiacantha Engelm. Syn. Cact. 263 (1856)

Hemispherical or with depressed vertex, 7.5 to 12.5 cm. in diameter, with a broad top-shaped base: tubercles compressed, 14 to 18 mm. long: radial spines 5 to 9 (usually about 6), stout and strongly subulate, 6 to 10 mm. long, straight or somewhat curved, whitish or yellowish, the lower mostly a little longer, the upper one sometimes wanting; central spine shorter and stout, darker, straight, and porrect, turned upwards among the radials, or rarely wanting: flowers 2.5 to 3 cm. long, reddish-white: fruit incurved, 2 to 3 cm. long. (*Ill.* Cact. Mex. Bound. t. 9, figs. 1–3).—Type specimens are those of the collections of 1847, 1851, 1852, and 1853, from which the original description was drawn and all of which are in Herb. Mo. Bot. Gard.

From the Guadalupe River, Texas, to the "Great Bend" of the Rio Grande, westward through western Texas and New Mexico; also northern Mexico (Hemsley); Fl. May, June.

Specimens examined: Texas (*Wright* of 1851, 1852; *Bigelow* of 1853): New Mexico ("Missouri Volunteers" of 1847; unknown collector in 1880); also specimens cultivated in St. Louis in 1853, and others growing in Mo. Bot. Gard. 1893.

Dr. Engelmann regarded this species as possibly only a variety of C. heyderi, to which it is certainly very closely allied through var. *hemisphaerica*, but the different tubercles and fewer stouter spines serve so well to distinguish it that it seems best to retain its specific rank.

In reference to the citation of the original description an explanation seems necessary, which will apply to numerous similar cases. The Pacif. R. Rep. iv. 27 (1856), Syn. Cact. 263 (1858), and Cact. Mex. Bound. 9 (1859), have each been cited as the original publication. The confusion has arisen from the fact that in both the publications of 1856 the description in the Rep. Mex. Bound. is referred to, and in that report the plant is fully described as "sp. nov." However, the publication of the Boundary Report was long delayed on account of the preparation of the plates, and in the meantime both the publications of 1856 had appeared, in each one of which the species is distinctly characterized and reference made to the description in the forthcoming Boundary Report. As between the two publications of 1856 the Syn. Cact. (Proc. Amer. Acad. iii. 259) was evidently distributed first.

8. Cactus gummiferus (Engelm.) Kuntze. Rev. Gen. Pl. 260 (1891).
Mamillaria gummifera Engelm. Wisliz. Rep. 21 (1848).

Hemispherical, 7.5 to 12.5 cm. broad and 6 to 10 cm. high: tubercles 12 to 15 mm. long: radial spines 10 to 12, the lower stout, with dusky apex, 12 to 15 mm. long, twice or thrice as long as the whitish setaceous upper ones; central spine (sometimes two) shorter (about 4 mm.), stout, dusky and porrect: flowers 3 cm. long, reddish-white, brownish-red outside: fruit unknown. (*Ill.* Cact. Mex. Bound. t. 9. figs. 18–20)— Type probably lost, as no specimens could be found in the Engelmann Herbarium.

Chihuahua, near Cosihuiriachi.

So far as can be discovered, this species has not been collected since the original Wislizenus collection of 1846–47. The plants were cultivated by Dr. Engelmann and

made to bloom, showing the flowers to be larger and darker colored than in the rest of the group, from which the species also differs in its more robust habit, its very unequal radial spines, and the occasional occurrence of two centrals.

** *Central spine hooked.*

9. Cactus uncinatus (Zucc) Kuntze, Rev. Gen. Pl. 261 (1591).
Mamillaria uncinata Zucc. in Pfeiff. Enum. 34 (1837).
Mamillaria bihamata Pfeiff. in Otto and Dietr. Gart. vi. 274 (1840)
Mamillaria adunca Scheidw. (1845-1849?).
Mamillaria depressa Scheidw. (1845-1849?).

Usually globose (occasionally depressed or even subcolumnar), 5 to 6 cm. in diameter (doubtless becoming larger): tubercles 8 to 10 mm. long, woolly in the upper axils: radial spines 4 to 6, rigid, 4 to 6 mm. long, the upper one stouter than the rest and sometimes shorter, reddish-brown and horny, straight or slightly curved, the remainder straight and white with dusky tips; central spine stout and horny, reddish-brown, 7 to 10 mm. long: flowers greenish-white or tinged with red: fruit unknown—Type unknown.

Entirely Mexican, reported from Chihuahua to Saint Luis Potosi.

Specimens examined: San Luis Potosi (*Gregg* of 1848; *Parry* 268; *Eschanzier* of 1891): Chihuahua (*Wislizenus* of 1846–47; also Chihuahua specimens cultivated in the Jacoby Garden in 1856 and 1857).

The variations observed in this species do not seem sufficient for the establishment of varieties. The type form seems to have been globose, with 4 radial spines and a stout central one. The depressed forms with 6 radials and a more slender central represent var. *spinosior* Lem. (*M. depressa* Scheidw.); and the subcolumnar forms with 6 radials (the upper one of which is somewhat curved) and a stout strongly hooked central represent var *biuncinata* Lem. (*M. bihamata* Pfeiff.) Such combinations of characters, however, do not hold, as any one of the plant body forms may display any one of the spine characters referred to.

B. Tubercles terete.

* *Central spines none: mostly simple globose plants, with very numerous straight whitish setaceous radials.*

10. Cactus lasiacanthus (Engelm.) Kuntze, Rev. Gen. Pl. 259 (1891).
Mamillaria lasiacantha Engelm. Syn. Cact. 261 (1856).

Globose or ovate globose, 2 to 2.5 cm. high and 1 to 2 cm. broad: tubercles 4 mm. long, about 2 mm. in diameter, with naked axils: spines 40 to 60, in many series, very unequal, 2 to 4 mm, long, white and pilose, the upper exterior usually longer than the rest, the innermost usually much shorter: flowers 12 mm. long, whitish or pinkish (petals with red median band): fruit 1 to 2 cm. long: seeds about 1 mm. long, blackish and conspicuously pitted. (*Ill.* Cact. Mex. Bound. t. 3).—Type, the specimens of Wright in Herb. Mo. Bot. Gard.

From western Texas ("west of time Pecos, on low limestone hills, among herbage") to Arizona and Chihuahua. Fl. April, May.

Specimens examined: Texas (*Wright* 121, also of 1852; *Parry* of 1852): Arizona (*Miller* of 1881): Chihuahua (*Pringle* 213, 250,258): also specimens cultivated in St. Louis in 1852 and 1855.

11. Cactus lasiacanthus denudatus (Engelm.).

Mamillaria lasiacantha denudata Engelm. Cact. Mex. Bound. 5 (1859).

Larger, 2.5 to 3.5 cm. in diameter, with longer tubercles (5 to 6 mm.), and more numerous (50 to 80) longer (3 to 5 mum.) spines which are naked or nearly so. (*Ill.* Cact. Mex. Bound. t. 4) —Type, Wright specimen in Herb. Mo. Bot. Gard.

From western Texas (with the species) to Coahuila.

Specimens examined: Texas (*Wright* of 1852): Coahuila (*Palmer* of 1880).

In the Syn. Cact. Dr. Engelmann merges this variety with the species, and has been followed in this by subsequent writers, but the characters seem so (distinctive that its varietal rank has been restored.

12. Cactus micromeris (Engelm.) Kuntze, Rev. Gen. Pl. 260 (1891).

Mamillaria micromeris Engelm. Syn. Cact. 260 (1856).

With depressed top and very rarely branching, 1 to 3.5 cm. in diameter: tubercles very small (about 1 mm. long) and wart-like, crowded, shedding the spines with age and giving the base of the plant a tuberculated appearance: spines from white to ashy-gray, 1 to 3 mm. long; in young plants and on lower tubercles of adult plants about 20, equal and radiant; on flower-bearing tubercles 30 to 40, stellate-porrect in every direction, the 6 to 8 upper ones two to four times longer than the rest (4 to 8 mm.), clavate toward the apex and acute (the clavate top at length deciduous), intermixed with loose wool of about the same length and forming a small tuft on the top of the plant which includes and partly hides flowers and fruit: flowers whitish to light pink, almost central, very small (6 mm. in diameter), much reduced (3 to 5 sepals, 5 petals, 10 to 15 stamens, 3 stigmas): fruit 8 to 12 mm. long: seeds 1.5 mm. long, black and shining. (*Ill.* Cact. Mex. Bound. t. 1 and 2. figs. 1–4)—Type, the specimens of Wright in Herb. Mo. Bot. Gard.

On naked mountain tops and sides, extreme southwestern Texas (Val Verde County to El Paso) and southward into Coahuila and Chihuahua.

Specimens examined: Texas (*Wright* 227 of 1849, also of 1852; *Nealley* of 1892): Coahuila (*Bigelow* of 1853): Chihuahua (*Pringle* 212): also growing in Mo. Bot. Gard. 1893.

The plants densely covered above with delicate ashy-gray spines and with naked tuberculate base are readily recognized. It still remains an open question whether the flowers are developed from the axils of tubercles of the same season or the last ones of the preceding season. Dr. Engelmann inclined to the latter view, as all the other characters of the plant associate it with the "lateral-flowered" species; and in the absence of definite observation we have retained it there. If the nearly central flowers indicate that they are produced from growth of the same season the species would seem to be allied to Coryphantha, in which group its small flowers and small tubercles would be anomalous.

13. Cactus micromeris greggii (Engelm.).

Mamillaria micromeris greggii Engelm. Syn. Cact. 261 (1856).

Larger (2.5 to 5 cm. in diameter) and becoming oblong, with larger globose-ovate tubercles (2 to 2.5 mm. long), fewer rigid spines all radiant (interior 5 to 7 shorter and stouter, 1 to 2 mm. long; the outer 15 to 18, 3 to 4 mm. long), and fruit 1.5 to 2 mm. long. (*Ill.* Cact. Mex. Bound. t. 2. figs. 5–8)—Type, Gregg 508 in Herb. Mo. Bot. Gard.

Mountain ridges near Saltillo, Coahuila. Said by Budd to occur within the southern borders of Pecos County, Tex.

Specimens examined: Coahuila (*Gregg* 508; *Palmer* of 1880).

It is a question whether this variety does not merely represent an older and better developed plant than those upon which the species is based. Mr. Harry I. Budd, who has made extensive collections of Texan and Mexican Cacti for the market, reports that it is impossible to separate sharply the variety from the species in the field, and regards the difference merely as one of age. Unfortunately, only living material of the species could be examined, but its characters seem well sustained even in the most vigorous plants, some of which reach the size of the variety. Through this variety the species is brought very near the following:

14. Cactus bispinus.

Mamillaria microthele Muhlenpf. Allg. Gart. Zeit. p. 11 (1848), not Lem. (1838).

Differs from the last form (var. *greggii*) chiefly in its cespitose habit, much larger tubercles, and two unusually stout and short central spines (*fide* Engelmann, who examined specimens in Coll. Salm-Dyck).

Credited to Mexico in general, but said by Budd to occur within the southern border of Pecos County, Tex.

* * *Central spines present and one or more hooked.*

← *Mostly globose and simple plants* (*occasionally somewhat cylindrical*).

15. Cactus wrightii (Engelm.) Kuntze. Rev. Gen. Pl. 261 (1891).

Mamillaria wrightii Engelm. Syn. Cact. 262 (1856).

Globose or depressed globose (top-shaped below), 3 to 7.5 cm. in diameter, simple: tubercles 10 to 12 mm. long, with naked axils: radial spines 8 to 12, white (the upper dusky-tipped), pubescent, 8 to 12 mm. long central spines mostly 2 (usually side by side and divergent), rarely 1 or 3, scarcely longer, hooked and reddish-black: flowers 2.5 cm. long, bright purple: fruit about 2.5 cm. long, somewhat subglobose, purple: seeds 1.4 mm long, black and pitted. (*Ill.* Cact. Mex. Bound. t. 8. figs. 1–8)—Type, Wright of 1851 in Herb. Mo. Bot. Gard.

High plains and rocky places, from the Upper Pecos, east of Santa Fé, N. Mex., southward through extreme southwestern Texas (between the Pecos and El Paso), and into Chihuahua (near Lake Santa Maria).

Specimens examined: New Mexico (*Wright* of 1851; *Rusby* of 1880): also growing in Mo. Bot. Gard. 1893.

Dr. Engelmann calls attention to the fact that this species is closely allied to the Mexican *C. zephyranthoides* (Scheidw.), but in the absence of material representing the latter species no comparison can be made. In descriptions of the Mexican species the differently colored flowers and the much longer spines suggest differences that an examination of fruit and seed characters may still further emphasize.

16. Cactus goodrichii (Scheer) Kuntze. Rev. Gen. Pl. 260 (1891).
Mamillaria goodrichii Scheer in Salm Cact. Hort. Dyck. 91 (1850).

Globose or ovate, 5 to 7.5 cm. high, subsimple: tubercles ovate, short (3 to 5 mm.), somewhat corky and persistent, with dense wool in the young axils containing 5 to 8 stiff bristles: radial spines 11 to 15 (the uppermost one sometimes wanting), white and rigid, 5 to 7 mm. long, entangled with adjoining clusters; central spines 3 or 4 (often solitary in young plants), brownish-black, the upper ones divergent and straight (rarely showing a tendency to hook), the lower longer (9 to 10 mm.), stouter and hooked (usually upwards): flowers 12 to 18 mm, long, the petals yellowish-white with red midribs: fruit clavate and scarlet. (*Ill.* Cact. Mex. Bound. t. 8. figs. 9–14)—Type: Scheer says that the plant was brought from the Island of "Corros" (Cedros?) by Dr. Goodrich, and "unfortunately perished in the gardens," which generally means that there is not a fragment of the type in existence.

In dry ravines, from San Diego County, California, southward throughout Lower California and the neighboring islands (including Guadalupe Island). "Llavina."

Specimens examined: California (*Parry* of 1850, 1875; *Agassiz* of 1872; *Parish* 450 of 1882 at Vallecito): Lower California (*Gabb* 18 of 1867; *Brandegee* of 1889 on Magdalena Island, and 240 of 1890 from San Jose del Cabo): also specimens cultivated in Gard. Salm-Dyck.

By a misprint in Cact. Mex. Bound, the specific name appeared as "Goodridgii," and this error appears in almost every subsequent mention of the species, even in Watson's Bibliographical Index, although in Syn. Cact. and other references by Dr. Engelmann the correct form appears.

17. Cactus pondii (Greene).
Mamillaria pondii Greene, Pittonia, i, 268 (1889).

Oval or cylindrical, from low to 30 cm. high, simple or sparingly branched: radial spines 20 to 30, white and slender; centrals 4 or 5, the longest over 25 mm, long, rigid and strongly hooked, dark brown above the middle: flowers nearly 5 cm. long, bright, scarlet: fruit unknown.—Type, Pond specimens in Herb. Greene.

Cedros Island, off the west coast of Lower California. Fl. February.

Unfortunately, the type specimen has been mislaid, so that no examination of it could be made. Evidently related to *C. goodrichii*, but differing in its much more robust habit, more numerous radials, much longer spines, and larger scarlet flowers.

18. Cactus barbatus (Engelm.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria barbata Engelm. Wisliz. Rep. 22 (1848).

Depressed-globose, about 4 cm. in diameter, simple: tubercles 8 mm. long, with naked axils: radial spines very numerous (50 to 60), in two series, 6 to 8 mm. long, the outer (about 40) slender but rigid and white, the inner (10 to 15) a little stouter and yellow; usually one central spine, stout and erect, hooked downwards, brownish: flowers 18 to 20 mm. long, rose-red: fruit oblong, 10 to 12 mm. long, green (when mature?):

seeds minute, dark brown and lightly pitted. (*Ill.* Cact. Mex. Bound t. 6. figs. 9–12)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

Central Chihuahua. Fl. May, in cultivation.

Specimens examined: CHIHUAHUA (*Wislizenus* of 1846, 1850): also specimens cultivated in Baumann's Garden in 1857, 1858; also growing in Mo. Bot. Gard. 1893.

Dr. Engelmann observed a curious intermediate character in the origin of the flowers of this species, the first ones of the season appearing in the axils of the last tubercles of the preceding year, while the later ones develop from the axils of the first tubercles of the same season. The specimen growing in Mo. Bot. Gard, in 1893 had 3 central spines, one or two being hooked.

19. Cactus grahami (Engelm.) Kuntze, Rev. Gen. Pl. 260 (1891).

Mamillaria grahami Engelm. Syn. Cact. 262 (1856).

Globose or at length ovate, 2.5 to 7.5 cm. high, simple or branched from the base and even cespitose: tubercles ovate, 6 mm. long, dilated at base (corky and persistent when old), with naked axils: radial spines 15 to 30 in a single series, white, often dusky-tipped, slender but rigid, naked or puberulent, 6 to 12 mm. long, the shorter ones uppermost, the longer ones lateral; central spines 1 to 3, blackish from a paler base, the lower (often the only) one stouter and longer (6 to 18 mm.), hooked upward, the one or two upper ones (when present) shorter and slenderer, divergent: flowers 2 to 2.5 cm. long, rose-colored: fruit 2 to 2.5 cm. long: seeds 0.8 to 1 mm. long, black and pitted. (*Ill.* Cact. Mex. Bound. t. 6. figs. 1–8)—Type, Wright of 1852 and Bigelow of 1852 in Herb. Mo. Bot. Gard.

In rocky places, from the mountains of extreme southwestern Texas (west of the Pecos) to southern Utah, southern California (common along the Colorado), and Sonora. Fl. June-August.

Specimens examined: TEXAS (*Wright* of 1852; *Newberry* of 1858; *G. R. Vasey* of 1881; *Miller* of 1881; *Briggs* of 1892): NEW MEXICO (*Evans* of 1891): ARIZONA (*Bigelow* of 1852; *Schott* of 1858; *Cous* of 1865; *Palmer* of 1869, 1870; *Engelmann* of 1880; *Pringle* of 1884): UTAH (*Parry* of 1874): SONORA (*Schott* of 1853): also specimens cultivated in the Mo. Bot. Gard. in 1881.

In all references to the fruit of this species it is described as "oval and green," except in Ives Report, where Dr. Engelmann describes its real character as the ordinary fruit of EUMAMILLARIA. The immature fruit is "oval and green," but with maturity it becomes clavate and scarlet. The Utah specimens of Parry show an exceptional character in their 30 to 33 scabrous radial spines, but otherwise they are quite normal. *M. microcarpa* Engelm., Emory's Rep. 156. f. 3, should be dropped as a synonym of this species, at least as to figure and description. In all probability *C. grahami* is one of the forms of the Mexican *C. schelhasii* (Pfeiff.). Except that in *C. grahami* the radial spines are apt to be more numerous and longer, and the centrals much darker; and in *C. schelhasii* the 3 centrals seem to be always present and sometimes all hooked, the descriptions suggest no difference. In the absence of authentic specimens of the latter species, however, and with its fruit and seed entirely unknown, such a reference of *C. grahami* must be deferred.

20. Cactus bocasanus (Poselger).

Mamillaria bocasana Poselger, Gart. Zeit. 94 (1853).

Depressed-globose, 2 to 3 cm. high: tubercles 8 mm. long, with long axillary wool: radial spines 25 to 30, white and capillary, 10 to 25 mm. long; central spines 2 to 4, slender and naked (or slightly puberulent), the most central one hooked (usually upwards), 15 to 25 mm. long, the upper 1 to 3 shorter and straight, all yellow with red tips, the hooked one often brownish-red nearly to the base: flowers unknown: fruit green, about 4 mm. long: seeds cinnamon-brown, oblique, broadly obovate, with narrowly ovate basal hilum.—Type unknown.

San Luis Potosi, so far as known. Poselger says, "Texas, auf der Seira de Bocas, among rocks," which station we have been unable to locate.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891): also specimens cultivated in Hort. Pfersdorff in 1869; in Mo. Bot. Gard. in 1891; also growing in Mo. Bot. Gard. 1893.

The capillary radials give the plant a white-woolly appearance. The younger spines at the vertex are erect and tufted. It resembles *C. grahami*, but the tubercles are much more slender and not thickened at base, all the spines are more slender, the central hooked one is more reddish, and the fruit is much shorter.

21. Cactus eschanzieri, sp. nov.

Depressed-globose, 3 cm. in diameter, simple: tubercles broader at base, 6 to 8 mm. long, with naked axils: spines all pubescent; radials 15 to 20, with dusky tips, the lateral 10 to 12 mm. long, the lower weaker, shorter and curved, the upper shorter; solitary central spine reddish, slender, somewhat twisted, usually hooked upwards, 15 to 25 mm. long: flowers red (?): fruit reddish (?), ovate, about 10 mm, long: seeds reddish, oblique-obovate, 1.2 mm. long, pitted, with subventral hilum.— Type in Herb. Coulter.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

Resembles *C. grahami*, but with fewer and more slender pubescent spines, longer and less rigid central, more exserted fruit, and much larger reddish and strongly pitted seeds with subventral hilum.

22. Cactus tetrancistrus (Engelm.).

Mamillaria tetrancistra Engelm. Am. Jour. Sci. II. xiv. 337 (1852), in part.
Mamillaria phellosperma Engelm. Syn. Cact. 262 (1856).
Cactus phellospermus Kuntze, Rev. Gen. Pl. 261 (1891).

Ovate or ovate-cylindrical, 5 to 25 cm. high, 3.5 to 7.5 cm. in diameter, simple or rarely branching at base: tubercles ovate-cylindrical, 8 to 14 mm. long, with axillary bristle-bearing wool, at length naked: radial spines 30 to 60, in two series, the exterior bristle-like, shorter and white, the interior stouter, longer and dusky-tipped or purplish; central spines 3 or 4, stouter, longer, brown or blackish from a paler base, the upper 2 or 3 (10 to 14 mm. long) straight, or one or two or even all hooked, the lower stouter and longer (12 to 18 mm.), hooked

upwards: flowers about 2.5 cm. long: fruit 1 to 2.5 cm. long: seeds large (1.2 to 1.5 mm. in diameter), globose and wrinkled, partly immersed in a brown spongy or corky cup-shaped 3-lobed appendage. (*Ill.* Cact. Mex. Bound. t. 7)—Type, Parry of 1850, but modified by Le Conte 14 and Bigelow of 1854, all in Herb. Mo. Bot. Gard.

Gravelly soil and sandy stream-banks, from the eastern slopes of the mountains of southern California, throughout western Arizona and southern Nevada to southern Utah; referred also to "N. W. Mexico" by Hemsley (Biol. Centr.-Amer.).

Specimens examined: California (*Parry* of 1850; *Newberry* of 1858; *Parish* of 1882): Arizona (*Le Conte* 14; *Bigelow* of 1854; *Dr. Loew* of 1875: also *Palmer* of 1870, but with no locality.

In the original description this species was confounded with *C. grahami*, with which it grows and which it much resembles; and this, together with the fact that 4 central hooked spines are seldom found, induced Dr. Engelmann (Syn. Cact. 262) to propose the more appropriate but untenable name *M. phellosperma*. The resemblance to *C. grahami* is not so close as general appearance would indicate, as the more oblong or cylindrical form, longer and less crowded tubercles, more numerous spines, often more than one hooked central, large seeds, and remarkable seed appendages serve well to distinguish it.

+– +– *Plants with fasciculate slender cylindrical stems* (*30 to 45 cm. high, and 2.5 to 6 cm. in diameter*): Lower Californian.

23. Cactus roseanus (Brandegee).
Mamillaria longihamata Engelm. Mss.
Mamillaria roseana Brandegee, Zoe, ii. 19 (1891).

Fasciculately branched at base, the stems 30 to 45 cm. long (sometimes pendent from rocks and as much as 200 cm. long) and 2.5 to 5 cm. in diameter, the whole plant glaucous: tubercles elongated-conical, ascending, 10 to 12 mm. long, with woolly axils: radial spines 7 to 10, straight, rigid and sharp, 9 to 15 mm. long, dark reddish when young, becoming ashy, the upper ones the longer; the solitary central much longer (20 to 30 mm.), almost black below and with reddish tip, becoming ashy with age, usually hooked downwards: flowers numerous, 2.5 to 3.5 cm. long, bright scarlet: fruit obovate to globose, scarlet, 6 to 9 mm. in diameter, fleshy: seeds black and pitted.—Type in Herb. Calif. Acad.

Apparently common at low elevations throughout southern Lower California, especially the eastern side.

Specimens examined: Lower California (*W. M. Gabb* 17 of 1867, near Loreto; *Brandegee* of 1889, at San Gregorio; *Palmer* 139 of 1890, near La Paz; *Palmer* 880 of 1890, on Carmen Island; *Brandegee* 241 of 1890, at Rancho Colorado).

One of the most showy species of Lower California. The plant has the appearance of a Coryphanth, and is remarkable for its tall and slender habit, its large central hooks, and its globose fruit. Since 1867 this species has been in Herb. Engelmann, fully characterized as above under the very appropriate specific name *longihamatus*.

24. Cactus setispinus, sp. nov.
Mamillaria Setispina Engelm. Mss.

Fasciculate and ascending, simple or branched at base, the stems about 30 cm. high and 3 to 6 cm. in diameter, densely covered with remarkably long stout spines: tubercles short and broadly conical, with axillary wool: spines white. with black tips; radials 10 to 12, widely spreading, very unequal, 10 to 34 mm. long, slender and flexuous; central spines 1 to 4, more rigid and much longer (20 to 50 mm.), the upper ones straight, the lowest one longest and hooked (usually upwards) and often variously curved and twisted: fruit obovate and scarlet 30 mm. long: seeds, black and pitted.—Type, Gabb 15 in Herb. Mo. Bot. Gard.

Rocky or gravelly soil, San Julio Canyon. and in the vicinity of San Borgia, Lower California.

Specimens examined: Lower California (*W. M. Gabb* 15 of 1867, at San Borgia; *Brandegee* of 1889, from San Borgia and San Julio Canyon).

In his notes Mr. Gabb describes the flower as "large, 3 to 3.5 inches long, bell-shaped, of a beautiful purplish red color," concerning which Dr. Engelmann remarks "this would indicate a Coryphanth, but the tubercles show no trace of a groove, and, moreover, a withered remnant of a flower laterally attached (say 18 to 20 mm. long), so that I have no doubt that Mr. Gabb's statement is founded on some error." It is very probable that the flowers are scarlet and larger than Dr. Engelmann suggests. The species is closely allied to *C. roseanus*, but differs in its shorter tubercles and much longer spines. About a dozen stems rise in a clump, about a foot high, covering an area of 2 or 3 feet. These two species represent a very distinct Lower Californian group of cylindrical and hooked Eumamillarias. Both probably have showy scarlet flowers and may attain considerable length when growing upon rock ledges so as to become pendent. The specimens of *C. setispinus* from San Julio Canyon are from younger parts and show but a single long and hooked central. The San Borgia specimens show mostly 3 or 4 centrals, the lowest one hooked and becoming remarkably long and often variously twisted and curved. However, I can discover no difference except such as may be due to age.

* * * *Central spines present and not hooked.*

+ *Central spines more than one, longer than the radials, which are numerous, white and slender* (*capillary or bristle-like*) (*rigid in C. Halei*).

25. Cactus halei (Brandegee).
Mamillaria halei Brandegee, Proc. Calif. Acad. Sci. Ser. 2. ii. 161 (1889).

Stems cylindrical, 8 to 10 in a clump, about 30 cm. high and 5 to 7.5 cm. in diameter: tubercles short, with axillary wool: radial spines 10 to 22, rigid and erect-spreading, unequal, 6 to 15 mm. long; central spines numerous and erect-spreading, 1 to 3 of them very stout and prominent (25 to 35 mm. long); all the spines straight, at first reddish-brown, becoming yellowish and ashy, more or less dark-tipped: flowers 2.5 cm. long, bright scarlet (almost throughout): fruit 12 mm, long, clavate and red: seeds black and pitted. (*Ill.* l. c. t. 6)—Type in Herb. Calif. Acad.

Abundant on Magdalena and Santa Margarita Islands, western coast of Lower California. Fl. January.

Specimens examined: Lower California (*Brandegee* of 1889, on Magdalena Island).

The tubercles are so close together that the plant appears thickly covered with the unusually stout and erect-spreading straight spines, a few of the centrals being specially prominent. The plant is more slender than the ordinary "cylindrical" members of the genus, but stouter than the slender hooked forms of the preceding section.

26. Cactus rhodanthus (Link & Otto) Kuntze, Rev. Gen. Pl. 261 (1891).

Mamillaria rhodantha Link & Otto, Icon. t. 26 (1828-31)

Mamillaria lanifera Haw. Phil. Mag. lxiii., 41 ( ), not Salm-Dyck (1850).

Oblong or subcylindric, 30 cm. or more high, 7.5 to 10 cm. in diameter, often forking from the middle: tubercles conical, 12 mm. long, 8 mm. in diameter, with woolly axils: radial spines 16 to 20, bristle-like, white, the lower longer (8 to 10 mm.); central spines 6 or 7, rigid, whitish with black tip, 12 mm. long: flowers rose color, 12 mm. in diameter: fruit 2.5 cm. long, cylindrical. (*Ill.* l. c.)—Type unknown.

Referred to Mexico in general, but reported as yet from San Luis Potosi to southern Mexico. Fl. profusely all summer.

Specimens examined: San Luis Potosi (*Bourgeau* 47; *Pringle* 3679; *Eschanzier* of 1891): also growing in Mo. Bot. Gard. 1893.

The specimens of Bourgeau and Pringle have somewhat larger spines than the type, as indicated by the description.

27. Cactus rhodanthus sulphureospinus.

Mamillaria sulphurea Forst. Handb. Cact. (1846), not *Cactus sulphureus* Gill, (1830).

Mamillaria rhodantha sulphurea Salm, Hort. Cact. Dyck. 11 (1850).

Central spines sulphur-yellow; otherwise like the species.—Type unknown.

San Luis Potosi.

Specimens examined: **San Luis Potosi** (*Pfeiffer*, with no number or date; *Eschanzier* of 1891).

The varietal distinction maintained seems a small one, but it is constant and striking, so far as can be discovered.

28. Cactus capillaris.

Mamillaria lanifera Salm, Cact. Hort. Dyck. 98 (1850), not Haw.

Cactus laniferus Kuntze, Rev. Gen. Pl. 250 (1891).

Cylindrical and erect: tubercles crowded, conical, glaucous, with axillary bristles: radial spines capillary and very numerous, white and crisped, entirely covering the plant; central spines 4 to 6, rigid, straight and spreading, straw-colored, 8 to 12 mm. long: flowers equaling the tubercles, the yellow petals striped with red: fruit unknown.—Type unknown.

Referred to Mexico in general, but definitely known only from Coahuila.

Specimens examined: Coahuila (*Palmer* of 1880).

There is a confusion of synonymy between this species and *C. rhodanthus*, both having been named *Mamillaria lanifera*. The earlier *M. lanifera* of Haworth, how-

ever, is clearly *M. rhodantha* of Link & Otto; and although Prince Salm-Dyck revived the name for the present species, the law of homonyms will not permit it to stand. The name proposed refers to the abundant display of capillary radial spines, which is probably the most notable feature.

29. Cactus palmeri, sp. nov.

Cylindrical: tubercles crowded, glaucous, cylindrical (somewhat broadest above), about 4 mm. long, with dense axillary wool containing bristles: radial spines 25 to 30, very slender and white but rigid, about 5 mm. long, spreading or somewhat radiant, entangled with those of neighboring tubercles, and so covering the whole plant; central spines 3 to 5 (usually 4), more robust, erect or slightly divergent, brownish with darker tip, 7 to 8 mm. long: flowers small: fruit clavate and scarlet: seeds black and strongly pitted, 0.5 to 0.8 mm. in diameter.— Type, Palmer 921 in U. S. Nat. Herb.

San Benito Island, off the west coast of lower California.

Specimens examined: Lower California, San Benito Island (*Palmer* 921 of 1889, reported as *Mamillaria Goodrichii*).

Very closely allied to *C. capillaris* of eastern Mexico.

30. Cactus stellatus Willd. Enum. Suppl. 30 (1813).
Cactus pusillus DC. Cat. Hort. Monsp. 184 (1813), not Haw. (1803).
Mamillaria pusilla DC. Prod. iii. 459 (1828).

A very common West Indian species, apparently differing from the variety only in the very much fewer (12 to 20) radial spines, although numerous specimens, both dried and living, were examined for additional characters. This difference, however, is so constant and striking that, taken together with the wide geographical separation, it should stand as varietal.

31. Cactus stellatus texanus (Engelm.).
Mamillaria pusilla texana Engelm. Syn. Cact. 216 (1856).
Mamillaria texana Young, Fl. Texas, 279 (1873).

Ovate-globose, 2.5 to 3 cm. in diameter, 2.5 to 6 cm. high, proliferous and at length cespitose: tubercles 7 to 9 mm. long, the long axillary wool intermixed with several coarse twisted bristles: radial spines very numerous, in many series, the outer ones (30 to 50) capillary, white, elongated and flexuous or crisped (12 to 16 mm, long when straightened), the inner ones (10 to 12) more rigid, shorter (6 to 8 mm.), puberulent, whitish or yellowish, usually dark-tipped; central spines 5 to 8, rigid, straight, pubescent, unequal, white below and reddish or dark above: flowers 1.5 to 2 cm. long, the yellowish-white petals with reddish median band: fruit 1.5 to 2 cm. long: seeds black and shining, conspicuously pitted, 1.2 mm. long. (*Ill.* Cact. Mex. Bound. t. 5.)—Type, Bigelow specimens in Herb. Mo. Bot. Gard.

From the mouth of the Rio Grande to El Paso, Tex., and southward into Coahuila and Chihuahua. Fl. March-May.

Specimens examined: Texas (*Bigelow* of 1853; *Nealley* of 1892): Coahuila (*Bigelow* of 1853): also growing in Mo. Bot. Gard. 1892 and 1893.

The exterior capillary spines cover the whole plant as with a coarse wool.

32. Cactus pringlei, sp. nov.

Globose (?), 5 cm. in diameter: tubercles short-conical, about 6 mm. long, with very woolly axils: radial spines 18 to 20, setaceous-bristly and radiant, 5 to 8 m in. long; central spines 5 to 7 (usually 6), stout and horny, more or less recurved, spreading, 20 to 25 mm. long; all straw-colored, but the centrals darker: flowers deep red (darker, even brownish, outside), 8 to 10 mm. long: fruit unknown.— Type, Pringle of 1891 in Herb. Gray.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Pringle* of 1891).

Evidently a member of the *Chrysacantha* group and near *C. rhodanthus sulphureospinus*, but differs in the much shorter tubercles, straw-colored spines, shorter radials, much longer centrals, and smaller darker flowers.

33. Cactus sphaerotrichus (Lem.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria sphaerotricha Lem. Cact. 33 (1839).

Depressed-globose: tubercles cylindrical, obtuse, with some axillary bristles: radial spines very much crowded, exceedingly numerous, radiant, very slender and bristle-like, white; central spines 6 to 10 and even more, erect and more rigid: flowers pale reddish: fruit unknown.— Type unknown.

Referred to Mexico in general, but reported only from San Luis Potosi.

Specimens examined: Mexican specimens from Hort. Dyck in 1857; from Hort. Pfersdorff in 1869; and growing in Mo. Bot. Gard. 1893 (from material sent by Pringle from San Luis Potosi).

+– +– *The single central spine shorter than the radials* (*in C. longimamma centrals often more than one and somewhat longer*).

34. Cactus gabbii, sp. nov.
Mamillaria gabbii Engelm Mss.

Globose, 5 to 10 cm. in diameter, simple: tubercles cylindrical, slender, 12 to 14 mm. long, with woolly axils: radial spines about 13, 5 to 8 mm. long, lower ones longer and stouter, especially the lateral ones pectinate; the central shorter, straight, and robust: flowers small, yellowish-red: fruit unknown.—Type in Herb. Mo. Bot. Gard.

Among rocks, from San Ignacio to Mission San Fernando, Lower California, and "perhaps farther north in the interior."

Specimens examined: Lower California (*W. M. Gabb* 19 of 1867).

35. Cactus sphaericus (Dietr.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria sphaerica Dietr. Allg. Gart. Zeit. xxi. 94 (1853).

Obovate or clavate, 5 cm. or more high, proliferous and at length densely cespitose: tubercles elongated-ovate, acutish, 12 to 16 mm.

long with axillary wool: radial spines 12 to 14, setaceous, 7 to 9 mm. long, bulbous at base, straight or curved, white; central spine straight, subulate, somewhat shorter, but scarcely stouter: flowers yellow, 3.5 to 5 cm. long: fruit unknown.—Type unknown.

Sandy ridges in the valley of the Rio Grande (both sides of the river), from the mouth to Eagle Pass. Fl. from March throughout the season.

Specimens examined: Texas (*Schott* of 1852): also specimens cultivated in St. Louis in 1845 and 1861.

Dietrich's description was taken from plants collected by Poselger at Corpus Christi. The Schott specimens are from Eagle Pass. Dr. Engelmann calls attention to the fact that this species approaches Coryphantha in its exserted ovary and large flower, but the flowers are clearly from the growth of the preceding season. The species is said to be too near the Mexican *C. longimamma* of central and southern Mexico, but in the absence of type specimens of either the question can not be settled. The usual characterization of *C. longimamma* is as follows, which seems to make it distinct enough:

36. Cactus longimamma (DC.) Kuntze, Rev. Gen. Pl. 260 (1891).
Mamillaria longimamma DC. Rev. Cact. 113 (1829).

Ovate or at length cylindrical, simple or cespitose: tubercles oblong-ovate, large at base, 4 to 5 cm. long: radial spines 7 or 8, radiant and equal, 8 to 10 mm. long or more, more or less pubescent; central spines 1 to 3, somewhat longer and spreading: flower 4 cm. long, becoming 6 cm. broad when fully expanded, yellow. (*Ill.* DC. Mem. Cact. t. 5.)

II. Coryphantha. *Flowers from the base of a groove on young or nascent tubercles* (*hence appearing terminal*), *mostly large: spines never hooked* (*except in the doubtful C. brunneus*).

* *Flowers yellow.*

+ *The originally central flowers pushed aside by the continuous development of new tubercles: usually a single prominent central spine.*

37. Cactus missouriensis (Sweet) Kuntze, Rev. Gen. Pl. 259 (1891).
Cactus mamillaris Nutt. Gen. i. 295 (1818), not Linn. (1753).
Mamillaria missouriensis Sweet, Hort. Brit. 171 (1827).
Mamillaria simplex Torr. & Gray, Fl. N. Am. i. 553 (1840).
Mamillaria nuttallii Engelm. Pl. Fendl. 49 (1849).
Mamillaria notesteinii Britton, Bull. Torr. Bot. Club, xviii, 367 (1891).

Globose, 3.5 cm. in diameter, simple or nearly so: tubercles ovate-cylindrical, 12 to 14 mm. long, slightly grooved: radial spines 13 to 17, straight, whitish, setaceous, somewhat unequal, 8 to 10 mm. long; central spine more robust, straight and porrect, puberulent, 10 to 12 mm. long, often wanting: flowers about 2.5 cm. long, yellow or reddish: stigmas 2 to 5: fruit globose, scarlet, 6 to 8 mm. in diameter: seeds globose, black and pitted, 0.8 to 1.1 mm. in diameter. (*Ill.* Cact. Mex. Bound. t. 74., f. 6, seeds.)—Type unknown.

High prairies of the Upper Missouri, from Montana to South Dakota and southward through western Nebraska to western Kansas and the eastern slopes of the mountains of Colorado. Fl. May.

Specimens examined: Montana (*Notestein* of 1893): National Park (*Tweedy* 423): South Dakota, (collector unknown, in 1847, 1848, 1853): Nebraska (*Hayden* of 1855).

38. Cactus missouriensis similis (Engelm.).
Mamillaria similis Engelm. Pl. Lindh. 246 (1845).
Mamillaria nuttallii caespitosa Engelm. Syn. Cact. 265 (1856).
Mamillaria missouriensis caespitosa Watson, Bibl. Index, 403 (1878).

Cespitose, with 12 to 15 puberulent radial spines, the central very often wanting, larger flowers (2.5 to 5 cm. long), fruit and seeds (1.6 to 2.2 mm. in diameter), and 5 stigmas. (*Ill.* Cact. Mex. Bound. t. 74. f 7, seeds)—Type, Lindheimer, of 1845 (?) in Herb. Mo. Bot. Gard.

From the Kansas River, Kansas, and eastern Colorado, southward through Oklahoma to the San Antonio River, Texas.

Specimens examined: Colorado (*Greene* of 1870): Kansas (*Carleton* 551 of 1891, from Kingman County, distributed as *Mamillaria dasyacantha*): Oklahoma (*Carleton* 120 of 1891): Texas (*Lindheimer* of 1845, 1850; *Wright* of 1850; *Reverchon* 725): also specimens cultivated in Goebel's Garden in 1846; and in St. Louis in 1846, 1847, 1851.

The cespitose masses are often a foot broad.

39. Cactus missouriensis robustior (Engelm.).
Mamillaria similis robustior Engelm. Pl. Lindh. 200 (1850).
Mamillaria nuttallii robustior Engelm. and Bigel. Pacif. R. Rep. iv. 28 (1856).
Mamillaria missouriensis robustior Watson, Bibl. Index, 440 (1878).

Almost simple, with longer aid looser tubercles, 10 to 12 stouter radial spines (6 to 16 mm. long), a single stout central, larger flowers, and 7 or 8 stigmas.—Type, Lindheimer of 1845 in Herb. Mo. Bot. Gard.

From southeastern Colorado and the Canadian River (Oklahoma and Indian Territory), to the Colorado River of Texas.

Specimens examined: Texas (*Lindheimer* of 1845, 1846; *Bigelow* of 1853): also specimens cultivated in St. Louis in 1847.

In Bigelow's specimens the central spine is mostly lacking.

40. Cactus scheerii (Muhlenpf.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria scheerii Muhlenpf. Allg. Gart. Zeit. xv. 97 (1847).
Mamillaria scheerii valida Engelm. Syn. Cact. 265 (1856).

Ovate-globose, 7.5 to 17.5 cm. high, 7.5 to 12.5 cm. in diameter, simple or sparingly proliferous at base: tubercles large (2.5 to 3.5 cm. long), from a broad base and suddenly contracted and almost cylindric (10 to 14 mm. in diameter), deeply grooved (1 to 5 orbicular glands in the groove), distant, spreading and ascending, the lower ones shorter, more conical and somewhat imbricated, with broad axils and the younger densely woolly: radial spines 6 to 16, straight or slightly curved, stout, rigid, bulbous at base, whitish or yellowish (sometimes reddish) with dark tip, the 2 to 5 lower and lateral ones stouter and compressed (18 to 30 mm. long), the 4 to 11 upper ones weaker and terete (10 to 20 mm. long); central spines 1 to 5, stout and angled,

20 to 36 mm. long, mostly yellow (sometimes reddish), a single one very stout and porrect: flowers 5 cm. long, yellow (sometimes reddish tinged): fruit ovate or subglobose, green: seeds large (3 mm. long), flat and obovate, red.— Type unknown; that of the old var. *valida* is the Wright material in Herb. Mo. Bot. Gard.

Sandy ridges, southwestern Texas, from Eagle Pass and head of the Limpia to El Paso, and southward into Chihuahua, Coahuila, and San Luis Potosi; also southern Mexico (*fide* Hemsley). Fl. July.

Specimens examined: Texas (*Wright* 416, 478, of 1851, 1852; *Evans* of 1891): San Luis Potosi (*Eschanzier* of 1891).

The var. *valida* was described by Dr. Engelmann without having seen *C. scheerii*, the only knowledge of that species being obtained from the description of Prince Salm-Dyck in Cact. Hort. Dyck., which seemed to indicate a smaller form, with fewer spines than the Texan form. However, when visiting the collections of Prince Salm-Dyck, Dr. Engelmann found original specimens of *C. scheerii* which were exactly his var. *valida*. So far as collections show the Texan form seems to be more robust than the Mexican, but the material is too scanty to justify such a generalization. Dr. Engelmann speaks of this species as "a stately plant, by far the largest, of the northern Mamillariæ" Its tubercles are bright green and in beautiful contrast with the showy yellow spines.

41. Cactus robustispinus (Schott) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria robustispina Schott in Engelm. Syn. Cact. 265 (1856).

A large stout plant, simple or cespitose: tubercles large, subterete, nearly 2.5 cm. long (and about the same distance from each other): radial spines 12 to 15, stout and rigid, 18 to 30 mm. long, the lower ones the stouter, more dusky, straight or often curved downwards, the upper straight and fascicled; the solitary central spine stout, compressed, curved downwards (occasionally an additional straighter upper one), not much longer than the radials, the base nearly 2 mm. wide; all the spines horny and black-tipped; flowers 3.5 to 5 cm. long with very slender and constricted tube, saffron-yellow: fruit green seeds large (3 to 3.2 mm, long and 2 mm. in diameter), obliquely obovate and curved, smooth and brownish. (*Ill.* Cact. Mex. Bound. t. 74. fig. 8, seeds)—Type, Schott specimens in Herb. Mo. Bot. Gard.

"On grassy prairies on the south side of the Babuquibari Mountains," Sonora. Fl. July.

Specimens examined: Sonora (*Schott* of 1853-4).

Dr. Engelmann remarks that the seeds of this species are larger than those of any other Mamillaria known to him.

42. Cactus recurvatus (Engelm.) Kuntze Rev. Gen. Pl. 259 (1891).
Mamillaria recurvispina Engelm. Syn. Cact. 265 (1856), not Vries.
Mamillaria recurvata Engelm. Trans. St. Louis Acad. ii. 202 (1863).

Globose or depressed-globose, 7.5 to 20 cm. in diameter, simple: tubercles ovate, deeply grooved, crowded, somewhat imbricate, 10 to 12 mm. long: radial spines 12 to 20, bulbous at base, compressed, rigid, recurved or flexuous, 8 to 18 mm. long, whitish or horny, interwoven with adjacent clusters; central spine solitary (sometimes an additional

upper one), stouter and longer (12 to 20 mm.), dark, mostly strongly recurved and appressed (rarely straightish): flowers about 3.5 cm. long, yellow (brownish-tinged outside): fruit unknown.—Type, Schott specimens in Herb. Mo. Bot. Gard.

From Sonora to southern Mexico. Fl. June-August.

Specimens examined: SONORA (*Schott* of 1855).

43. Cactus salm-dyckianus (Scheer) Kuntze. Rev. Gen. Pl. 261 (1891).
Mamillaria salm-dyckiana Scheer in Salm, Cact. Hort. Dyck. 134 (1850).

Subglobose: tubercles very broad and retuse, almost 2-parted by the tomentose groove, with axillary floccose wool: radial spines 7 or 8, very rigid, widely radiant, somewhat curved, 3 to 3.5 cm. long, in older tubercles 3 to 6 additional slender and straight or twisted spines; the solitary central spine very stout, erect, almost 5 cm. long: flowers and fruit unknown.—Type: Scheer says that this plant, brought from Chihuahua by Potts, "unfortunately perished," and the description was drawn from fragments, which in those days were not apt to be preserved.

Chihuahua.

Specimens examined: CHIHUAHUA ("Salm of 1857").

The specimen referred to is in Herb. Mo. Bot. Gard., and reveals no additional characters; nor can the label be interpreted, except that it indicates that the specimen is from plants cultivated successfully in the gardens of Prince Salm-Dyck.

+ + *Flower and fruit remaining central in the very woolly vertex of the plant.*

+ + *Central spine solitary or wanting.*

44. Cactus compactus (Engelm.) Kuntze Rev. Gen. Pl. 260 (1891).
Mamillaria compacta Engelm. Wisliz. Rep. 21 (1848).

Depressed-globose, 5 to 10 cm. in diameter, simple: tubercles short-conical, crowded, 8 mm. long: radial spines 13 to 16, rigid, recurved and appressed, interwoven with adjacent clusters, whitish or horny, 10 to 20 mm. long; the erect central spine often wanting: flowers 3 to 3.5 cm. long and broad, yellow (brownish without): fruit oval, green: seeds 1.4 mm. long, smooth and yellow. (*Ill.* Cact. Mex. Bound. t. 74. fig. 2, seeds)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

Mountains of Chihuahua. Fl. June-July.

Specimens examined: CHIHUAHUA (*Wislizenus* of 1846): also specimens cultivated in St. Louis in 1848, 1850, 1854.

45. Cactus radians. (DC.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria radians DC. Rev. Cact. 111 (1829).
Mamillaria pectinata Engelm. Syn. Cact. 266 (1856).

Globose, 3.5 to 7.5 cm. in diameter, simple: tubercles conical, from a 4-angled base, lower ones short (4 to 6 mm.), upper flower-bearing ones longer (10 to 12 mm.), terete and grooved: radial spines 16 to 24, somewhat recurved from a bulbous compressed base, stiff and pectinate, horny or whitish (at length ashy), interwoven with adjacent clusters, those on lower tubercles about equal (6 to 10 mm.), on flower-bear-

ing tubercles elongated, mixed with a few stouter ones and fasciculated (lower ones 10 to 12 mm. long, upper ones 12 to 18 mm. long and forming an apical tuft); centrals none: flowers over 5 cm. long and about 6 to 7.5 cm. in diameter when expanded, bright sulphur-yellow: fruit ovate and green, about 12 mm. long: seeds compressed, brownish smooth and shining, 1.8 mm. long. (*Ill.* Cact. Mex. Bound. t. 11)—Type unknown; that of *M. pectinata* Engelm. is the Wright material in Herb. Mo. Bot. Gard.

Extending from the hills along the Lower Pecos to El Paso, southwestern Texas, southward through Coahuila and San Luis Potosi to southern Mexico.

Specimens examined: Texas (*Wright* 226 of 1849, also of 1852; *Evans* of 1891): Coahuila (*Palmer* of 1880; *Mrs. Nickels*): San Luis Potosi (*Parry & Palmer* 265; *Eschanzier* of 1891): also specimens cultivated in St. Louis in 1853; in Mo. Bot. Gard. in 1892; and in Harv. Bot. Gard.

Even in the absence of the type I have ventured to refer *Mamillaria pectinata* Engelm. to this species. Dr. Engelmann had concluded that the two were "not sufficiently distinct," and the examination of Mexican forms which pass as *C. radians* abundantly confirms this conclusion. Besides, every character in the original description of *C. radians* applies exactly to these Mexican plants and to our Texan specimens as well. Aside from the fact that the Mexican specimens are apt to be more robust, I can discover no difference whatever. For discussion of relationships see under *C. scolymoides*.

46. Cactus radians pectenoides, var. nov.

Differs in its cespitose habit, fewer (16 or 17) and stouter spines (8 to 9 mm. long), and its larger and longer (10 mm.) less deeply grooved tubercles.—Type in Herb. Coulter.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

47. Cactus corniferus (DC.) Kuntze, Rev. Gen. Pl. 260 (1891).
Mamillaria cornifera DC. Rev. Cact. 111 (1829).
Mamillaria impexicoma Lem. Hort. Monv. Cult. 5 (1839).
Mamillaria cornifera impexicoma Salm. Cact. Hort. Dyck. 20 (1850).

Globose, 7.5 cm. in diameter, simple: tubercles oblong-ovate, 2 cm. long, crowded, the younger axils woolly: radial spines 15 to 26, rigid and horny, curved or sometimes straight, reflexed, bulbous at base, yellowish (whiter with age) and with dark tips, very sharp, 10 to 12 mm, long; the central one much stouter, darker, slightly deflexed, 12 to 16 mm long, sometimes wanting: flower unknown: fruit obovate, red, 2 cm. long: seeds reddish, angular, smooth, 2 mm. long.—Type unknown.

From San Luis Potosi to southern Mexico.

Specimens examined: San Luis Potosi (*Parry* of 1879; *Eschanzier* of 1891): also specimens cultivated in Mo. Bot. Gard. in 1892; growing in same garden in 1893.

Mamillaria impexicoma Lem., afterwards reduced to a variety, was based upon fewer radial spines and no central. As the central is occasionally wanting in con-

nection with the most numerous radials, and present with the fewest, such a form would have to be separated solely on the absence of the central spine, and even in the original description of *impexicoma* the central spine is only said to be "sometimes wanting." It has been impossible for me to separate the forms. It should be said that the fruit and seed characters given above were taken front a specimen whose few radials and no centrals would undoubtedly refer it to *impexicoma*. As yet we are ignorant of the flower of *C. corniferus*. For discussion of relationships see under *C. scolymoides*.

+– +– *Central spines 1 to 4.*

48. Cactus scolymoides (Scheidw.) Kuntze. Rev. Gen. Pl. 261 (1891).
Mamillaria scolymoides Scheidw. Allg. Gart. Zeit. ix. 44 (1841).

Globose or ovate, 5 to 7.5 cm. high. subsimple: tubercles conical, 10 to 16 mm. long, the upper elongated, incurved and imbricate: radial spines 14 to 20, straight or often recurved, white or horny, 10 to 20 mm. long (the upper the longer); central spines 1 to 4, longer (18 to 32 mm.), more dusky, curved, the upper ones turned upwards and intermixed with the radials, the lower one stouter, longer, and curved downwards: flowers 5 cm. long: fruit unknown.—Type unknown.

From the Pecos River, western Texas, westward into southern New Mexico, and southward into Chihuahua and San Luis Potosi.

Specimens examined: Texas (*Hays* of 1858): New Mexico (*Bigelow* of 1853): Chihuahua (*Wislizenus* of 1846): also specimens cultivated in St. Louis in 1858.

Specimens collected by Mrs. Anna B. Nickels across the Rio Grande from Laredo, Texas, and showing neither flower nor fruit, seem to intergrade between *C. scolymoides* and *C. scolymoides sulcatus*. The habit is that of the former, the tubercles are those of the latter, while the spines are somewhat different from either. The number of central spines in these specimens is very hard to determine, as on the adult tubercle they all assume a radial position. The usual adult arrangement is an apparent absence of central spines; 10 to 12 rigid, spreading and more or less recurved radials (increasing in length from the lowest), which are mostly white or the upper more or less dusky; and above, just behind the radial row, 2 or 3 stout recurved-ascending spines, which are white with tips more or less reddish-black, one of the spines usually much stouter and longer than the others. This form may represent a distinct species, but it seems very unsafe to add species to the *C. scolymoides* group without the fullest information.

Prince Salm-Dyck refers *C. scolymoides* to "M. daimonoceras Lem. Cact. gen. nov., p. 5," but no mention of such a name can be found in the work referred to. Labouret refers *C. corniferus* to the same name and reference. If "M. daimonoceras" was anything more than a garden or herbarium name used by Lemaire I have been unable to find it, and Dr. Engelmann's notes indicate that his search met with the same result. It is possible that the name was applied loosely to this assemblage of closely related forms that seem to cluster about *C. corniferus*.

A most perplexing question of relationship is presented by the forms that have been called *pectinatus, scolymoides, sulcatus* (*calcaratus*), *Echinus*, and the Mexican forms *radians, impexicomus*, and *corniferus*. It may be that they are all merely varieties of one strong polymorphic type, but our knowledge of *corniferus* is so incomplete, and material of other forms is so scanty, that I can not venture to make such an assertion. However, it seems probable that *radians, pectinatus, scolymoides, sulcatus* and *Echinus* all have green fruit, while in *impexicomus* and *corniferus* it is red. It has also seemed proper to merge *radians* and *pectinatus*, also *impexicomus* and *corniferus*, and to refer *sulcatus* to *scolymoides* as a variety. These seven forms are thus reduced at least to four species.

49. Cactus scolymoides sulcatus (Engelm.).

Mamillaria sulcata Engelm. Pl. Lindh. 246 (1845), not Pfeiff. (1848).

Mamillaria strobiliformis Muhlenpf. Allg. Gart. Zeit. xvi. 19 (1848), not Scheer (1850).

Mamillaria calcarata Engelm. Pl. Lindh. 195 (1850).

Cactus calcaratus Kuntze, Rev. Gen. Pl. 259 (1891).

Differs in its smaller size; proliferous and much more cespitose habit, the dilated base of the more spreading tubercles, fewer (8 to 12) radial spines, usually a single central spine (wanting in young plants) and somewhat larger flowers. (*Ill.* Cact. Mex. Bound. t. 74. fig. 1, seeds)—Type, Lindheimer of 1844 in Herb. Mo. Bot. Gard.

Texas, from the Brazos to the Nueces.

Specimens examined: Texas (*Lindheimer* of 1844; *Fendler* 34; *Wright* of 1850, 1854, 1857): also specimens cultivated in St. Louis in 1845, 1848, 1853, 1859.

This seems to represent the northeastern extension of the species, and doubtless it will be found merging into it south and west of the Nueces. Curiously enough one of the prominent distinctions originally given was the single central spine, while in the type specimen there occur tubercles with more than one central.

50. Cactus echinus (Engelm.) Kuntze, Rev. Gen. Pl. 260 (1891).

Mamillaria echinus Engelm. Syn. Cact. 267 (1856).

Globose or subconical, 3.5 to 6.5 cm. in diameter, simple: tubercles terete, conical, grooved above, 10 to 12 mm. long: radial spines 16 to 30, pectinate, straight or little curved, rigid and appressed (interwoven with neighboring clusters), ashy-white (often dusky at apex), 8 to 12 mm. long, the uppermost longer (12 to 20 mm.); central spines 3 or 4, the upper ones turned upward and intermixed with the radials, the lower one very stout, 15 mm. long, subulate from a very thick bulbous base, straight (rarely slightly curved) and porrect (deciduous in old specimens): flowers 3 to 5 cm. long: fruit oval, elongated, about 2 cm. long, green: seeds elongated-obovate. brown and smooth, about 1.8 mm. long. (*Ill.* Cact. Mex. Bound. t. 10)—Type, the Wright and Bigelow specimens in Herb. Mo. Bot. Gard.

On limestone hills, from the Pecos River, southwestern Texas, and southern New Mexico, westward to the Rio Grande (from Presidio del Norte northward). Fl. June.

Specimens examined: Texas (*Wright* of 1849, 1851, 1852; *Bigelow* of 1852; *Engelmann*, with no number or date; *Evans* of 1891).

The characteristic appearance of the plant is given by the very stout and straight central spine standing in each cluster perpendicular to the plant body. The range of this species, between the Pecos and the upper Rio Grande, suggests another separated group, such as is presented by *C. scolymoides sulcatus* to the east, between the Brazos and Nueces. Very frequently specimens of *C. echinus* occur in which some of the tubercles do not develop central spines, and then the spine characters resemble those of *C. radians*. In *C. radians*, also, an occasional porrect central spine is found. These intergrading forms I have only seen in Mexican material. For discussion of relationships see under *C. scolymoides*.

** *Flowers red.*

+ *Central spine solitary or sometimes wanting.*

51. Cactus dasyacanthus (Engelm.) Kuntze, Rev. Gen. Pl. 259 (1891).
Mamillaria dasyacantha Engelm. Syn. Cact. 268 (1856).

Subglobose, 3.5 to 6.5 cm. high, simple: tubercles slender and terete, spreading, lightly grooved even to the base, 8 to 10 mm, long: radial spines 30 to 50, mostly in two series, straight and loosely spreading, the exterior ones (25 to 35) capillary and white, 6 to 18 mm. long, the interior ones (7 to 13) stiffer (setaceous), longer and darker and black-tipped; the central spine straight and porrect, 12 to 20 mm. long, often wanting: flowers small, red: fruit ovate, small (8 to 10 mm. long?): seeds globose-angled, almost black, pitted, 0.8 to 1.2 mm. long (*Ill.* Cact. Mex. Bound. t. 12. figs. 17-22)—Type, Wright 110 in Herb. Mo. Bot. Gard.

From Eagle Pass, Texas, westward to El Paso and southern New Mexico, and southward into Chihuahua.

Specimens examined: Texas (*Wright* 110 of 1852): New Mexico (*Vasey* of 1881; *Mearns* of 1892, in Big Hatchet Mountains): Chihuahua (*Pringle* 251 of 1885, in part).

Pringle 251 as distributed to Nat. Herb. is *C. tuberculosus*.

52. Cactus maculatus, sp. nov.

Obovate-cylindrical, 6 by 8 cm., somewhat cespitose: tubercles ovate, terete, 10 mm. long, grooved to the base, with naked axils: radial spines 10 or 11, straight and spreading, rigid, blackish (becoming ashy with age), black-tipped, 12 mm. long; central spine large, more or less spotted, erect, 25 to 35 mm. long: flower 13 mm. long, pinkish: fruit unknown.—Type in Herb. Coulter.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

Somewhat resembles *C. tuberculosus* in general appearance, but very different in spine characters.

53. Cactus brunneus, sp. nov.

Obovate-cylindrical, 3 by 6 cm., simple: tubercles ovate, grooved to the base, 5 to 6 mm. long, with woolly axils: radial spines 11 to 15, spreading, rather rigid and brownish (lighter with age), 8 to 10 mm. long; central spine much larger, 20 mm, long, hooked: flower and fruit unknown.—Type in Herb. Coulter.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

+ + *Central spines 3 to 12.*

54. Cactus conoideus (DC.) Kuntze, Rev. Gen. Pl. 260 (1891).
Mamillaria conoidea DC. Rev. Cact. 112 (1829).
Mamillaria strobiliformis Engelm. Wisliz. Rep. 113 (1848), not Scheer (1850).

Ovate-conical, 3.5 to 10 cm. high, 4 to 7 cm. in diameter below, with densely woolly vertex, simple: tubercles conical, about 12 mm, long,

closely appressed-imbricate ("giving the plant the appearance of a pine-apple or cone"): radial spines 10 to 16, ashy to white, straight and stout, 6 to 10 mm. long, the upper longer (10 to 15 mm.); central spines 3 to 5, stouter, brownish-black, 10 to 16 mm. long, the two or three smaller ones erect-spreading, the single lower one more rigid, porrect or deflexed, 15 to 20 mm. long: flowers 2 to 3 cm. long and wide, deep purple: fruit unknown. (*Ill.* DC. Mem. Cact. t. 2)—Type unknown.

On rocks, Coahuila and Nuevo Leon to San Luis Potosi and southern Mexico.

Specimens examined: Coahuila (*Palmer* 378 of 1882; *Pringle* 3117 of 1890): Nuevo Leon (*Wislizenus* of 1847): San Luis Potosi (*Poselger* of 1851; *Eschanzier* of 1891).

55. Cactus potsii (Scheer) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria potsii Scheer in Salm Cact. Hort. Dyck. 104 (1850).

Cylindrical, 30 to 35 cm. high, 2.5 to 3 cm. in diameter, somewhat branching: tubercles ovate, obtuse, very lightly sulcate, with somewhat woolly axils: radial spines very numerous (entirely covering the whole plant), slender and white; central spines 6 to 12, stouter from a broad base: flowers large, green, or reddish: fruit red.—Type unknown.

From the Rio Grande region, near Laredo, Texas, to Chihuahua.

Specimens examined: Texas (*Poselger* of 1851): Chihuahua (specimens from Coll. Salm-Dyck.).

56. Cactus tuberculosus (Engelm.) Kuntze, Rev. Gen. Pl. 261 (1891).
Mamillaria strobiliformis Scheer in Salm Cact. Hort. Dyck. 104 (1850), not Muhlenpf. (1848), nor Engelm. (1848).
Mamillaria tuberculosa Engelm. Syn. Cact. 268 (1856).

Ovate to cylindrical, 5 to 15 cm. high, 2.5 to 5 cm. in diameter, simple or branching at base: tubercles short-ovate from a broad base, 5 to 6 mm. long, deeply grooved, crowded and imbricate, at length covering the older parts as naked and gray corky protuberances: radial spines 20 to 30, slender but stiff, white, radiant and interwoven with adjacent clusters, 4 to 8 mm. long (uppermost rarely 10 to 12 mm.); central spines 5 to 9, stouter, purplish above, the upper ones longer, erect, 10 to 14 mm. long (sometimes even 16 to 18 mm.), the lower one shorter (6 to 8 mm.), stout, porrect or deflexed: flowers about 2.5 cm. in diameter, pale purple: fruit oval, elongated (sometimes almost cylindric), red, about 18 mm. long: seeds subglobose, brown and pitted, very small (0.8 to 1.2 mm. long). (*Ill.* Cact. Mex. Bound. t. 12. figs. 1-16)—Type of Scheer's *strobiliformis* is unknown; but the specimens of Prince Salm-Dyck in Herb. Mo. Bot. Gard. are marked "authentic" by Dr. Engelmann. The Wright specimens in the same Herb, represent the type of *M. tuberculosa* Engelm.

From the mountains of extreme southwestern Texas (common west of Devil's River), southward into Chihuahua and Coahuila. Fl. May-June.

Specimens examined: Texas (*Wright* 18, 19, 20, 23, 24, 29, 30,31,32, 535, of 1849 and 1852; *Bigelow* of 1852; *Engelmann*, with no number or date; *Evans* of 1891): Chihuahua (*Pringle* 250, 251 in part, and 258 of 1885): Coahuila (*Palmer* of 1880): also specimens from Coll. Salm. Dyck in 1857; also growing in Mo. Bot. Gard. 1893 (specimens, sent by *G. G. Briggs* in 1892 from El Paso, Texas.

The identification of Engelmann's *tuberculosa* with Scheer's *strobiliformis* was made by Dr. Engelmann himself upon an examination of Scheer's type. The use of the specific name *tuberculosa* is necessitated by the law of homonyms, as *strobiliformis* had been used twice already before it was taken up by Scheer. *M. strobiliformis* Muhlenpf. is *C. scolymoides sulcatus;* and *M. strobiliformis* Engelm. is *C. conoideus*.

57. Cactus viviparus Nutt. in Fraser's Cat. (1813).
Mamillaria vivipara Haw. Syn. Succ. Suppl. 72 (1819).

Low and depressed-globose, usually proliferous and cespitose (forming large masses), but sometimes simple: tubercles terete and loose, lightly grooved: radial spines 12 to 20, stiff and white, often dark-tipped, 6 to 8 mm. long; central spines usually 4 (sometimes less, often more, even as many as 8), brownish, 8 to 12 mm. long, 3 spreading upwards, the lowest stouter and shorter and deflexed: flowers about 3.5 cm. long (large for the size of the plant) and even broader when expanded, bright purple: stigmas pointed with a short mucro: fruit oval, pale green, juicy, 12 to 18 mm. long: seeds yellowish-brown, obliquely obovate and curved about the small hilum, 1.4 to 1.6 mm. long). (*Ill.* Cact. Mex. Bound. t. 74. fig. 3, seeds)—Type unknown.

On the northwestern plains, from the boundary provinces of British America (western Manitoba, Assiniboia and Alberta), and throughout the Upper Missouri region, southward through western Nebraska to western Kansas and to the eastern foothills of central Colorado. It is also mentioned by Howell (Cat. of Oregon, Washington and Idaho plants), as occurring beyond the Rocky Mountain divide in Idaho and Washington, which is probable, but no specimens have been seen.

Specimens examined: Montana (*Hayden*, nos. 1854, 1855; *Vernon Bailey* of 1890, near Bridger): Colorado (*Hayden* of 1869): Nebraska (*Rydberg* 1379 of 1893, Thomas Co.): also specimens cultivated in St. Louis in 1869; also growing in Mo. Bot. Gard. 1893.

It seems best to keep this northwestern form specifically separate from that large assemblage of southern forms that have been commonly referred to it. The forms referred to this species from western Kansas (Smyth's check list) have not been examined, and they may represent intermediate forms, inclining to simple habit and ovate form, as in the Colorado forms. The southern type (*C. radiosus*) is distinguished from *C. viviparus* not only by its very different range, but also by its ovate to cylindrical form, simple habit, more numerous (12 to 40) and longer (6 to 22 mm.) radial spines, usually more numerous (3 to 14) central spines in which the upper are more robust than the lower, porrect lower central, obtuse stigmas, and brown obovate straight seeds.

58. Cactus radiosus (Engelm.).

Mamillaria vivipara Engelm. Pl. Fendl. 49 (1849), not Haw. (1819).
Mamillaria radiosa Engelm. Pl. Lindh. 196 (1850).
Mamillaria vivipara radiosa texana Engelm. Syn. Cact. 269 (1856).

Ovate or cylindrical, 5 to 12.5 cm. high and about 5 cm. in diameter, simple or sparingly proliferous: tubercles terete, more or less grooved above, 8 to 12 mm. long: radial spines 20 to 30, straight, slender, white with dusky apex, very unequal, 6 to 8 mm long; central spines 4 or 5, stouter, yellowish or tawny, 8 to 12 mm. long, the upper ones the longer and more robust, the lowest one shorter and porrect: flowers 3.5 to 5.5 cm. long, about the same diameter when fully open, violet to dark purple: stigmas 7 to 9, obtuse: fruit oval and green: seeds yellowish or brown, obovate, pitted, fully 2 mm, long. (*Ill.* Cact. Mex. Bound. t. 74, fig. 5, seeds)—Type, Lindheimer of 1846 in Herb. Mo. Bot. Gard.

Extending across southern Texas, from the Guadalupe to El Paso. thence into contiguous New Mexico and across the Rio Grande near Juarez (northern Chihuahua). Fl. May-June.

Specimens examined: Texas (*Lindheimer* of 1846): New Mexico (*Bigelow* of 1855): Chihuahua, near Juarez (*Evans* of 1891): also specimens cultivated from the type in St. Louis in 1846.

Attention has been called under *C. viviparus* to the characters that distinguish from *C. radiosus* The characters there given for the latter species apply to the whole group of included forms. The type of the species is the var. *Texana* of Engelmann's Syn. Cact. and Mex. Bound., which is characterized in the above description.

59. Cactus radiosus neo-mexicanus (Engelm.).

Mamillaria vivipara radiosa neo-mexicana Engelm. Syn. Cact. 269 (1856).

Generally lower (3.5 to 10 cm.) and subglobose to ovate or even sub-cylindrical, branching at base or simple, with more numerous (12 to 40) radial spines, more numerous (3 to 12) and purplish centrals, and smaller seeds. (*Ill.* Cact. Mex. Bound. t. 74. fig. 4, seeds)—Type, presumably the Wright, Bigelow, and Schott specimens from western Texas, New Mexico, and Sonora, all in Herb. Mo. Bot. Gard.

From southern Utah, central Colorado, and western Kansas, southward through western Texas, New Mexico and Arizona into Chihuahua and Sonora.

Specimens examined: Kansas (*Carleton* 530 of 1891, in Meade County): Oklahoma (*Carleton* 233 of 1891): Colorado (*Hall and Harbour* of 1862; *Brandegee* 645 of 1873; *Hicks* of 1890): Utah (*Siler* of 1870): New Mexico (*Wislizenus* of 1846; *Fendler* 244, 271, of 1847: *Wright* 298; *Bigelow* of 1853; *G. R. Vasey* of 1881): Texas (*Wright* of 1849, 1851, 1852; *Bigelow* of 1853): Arizona (*Rothrock*, with no number or date): Sonora (*Schott* of 1855): Chihuahua (*Evans* of 1891, near Juarez).

It is through this variety that *C. radiosus* approaches most nearly to *C. viviparus*, in the forms with few radials and centrals, but the specific characters seem to hold. This is the *Mamillaria vivipara* of the Syn. Fl. Colorado (Porter and Coulter).

60. Cactus radiosus arizonicus (Engelm.).
Mamillaria arizonica Engelm. Bot. Calif. i. 244 (1876).

A robust globose or ovate simple form (7.5 to 10 cm. in diameter), with long (12 to 25 mm.) deeply-grooved tubercles, 15 to 20 long (10 to 30 mm.) rigid whitish radial spines, and 3 to 6 centrals deep brown above.—Type, the specimens of Cous, Palmer, Bischoff and Johnson, all in Herb. Mo. Bot. Gard.

Sandy and rocky soil from southern Utah through northern and western Arizona to southern California.

Specimens examined: Arizona (*Cous* of 1865; *Cous & Palmer* of 1865 and 1872; *Palmer* of 1869; *Bischoff* of 1871; *Miller* of 1881; *Rusby* 617 of 1853; *Pringle* of 1884): Utah (*Johnson* of 1871, 1872, 1874; *Parry* of 1875, 1877): California (*Parish* of 1880): also specimens cultivated in Mo. Bot. Gard. in 1881; and in Meehan's Gard. in 1882.

61. Cactus radiosus deserti (Engelm.).
Mamillaria deserti Engelm. Bot. Calif. ii. 449 (1880).

Subglobose or oval (5 to 10 cm. high) and simple, with deeply grooved tubercles (slender and about 12 mm. long), 25 to 30 rather long (10 to 16 mm.) grayish white radial spines (the larger with reddish tips), 3 or 4 shorter and stouter centrals with 5 or 6 intermediate ones above, small (2.5 cm. long) straw-colored flowers (becoming purplish-tipped), 5 or 6 stigmas, and obliquely obovate curved seeds.—Type, Parish 433 in Herb. Mo. Bot. Gard.

In the mountains bordering the deserts of southeastern California (San Bernardino County) and extending to central Nevada (Reese River Valley).

Specimens examined: California (*Parish* 453 of 1880, also of 1882; *Bailey* of 1890): Nevada, Lincoln County (*Coville & Funston* of 1891, Death Valley Expedition): also specimens cultivated in Meehan's Gard. in 1882.

The smaller straw-colored flowers alone suggest the propriety of keeping this form specifically distinct, but even in size and color there is an occasional tendency toward the specific character. The obliquely obovate curved seeds resemble those of *C. viviparus*. The plant densely covered with stout ashy-gray interlocking spines is easily recognized.

62. Cactus radiosus chloranthus (Engelm.).
Mamillaria chlorantha Engelm. Wheeler's Rep. 127 (1878).

Oval to cylindrical (7.5 cm. in diameter, sometimes 20 to 22.5 cm. high), with 20 to 25 gray radial spines almost in two series, 6 to 9 stouter reddish or brownish-tipped centrals (12 to 25 mm. long), and yellowish or greenish-yellow flowers 3.5 cm. long and wide. Type: Southern Utah specimens of both Parry and Johnson occur in Herb. Mo. Bot. Gard., but they are all referred to *C. radiosus arizonicus*, and I can find no trace of any specimens of *C. radiosus chloranthus* in the Engelmann collection.

Southern Utah, east of St. George (*Parry; Johnson*).

The plant is evidently near *C. radiosus deserti*, of which variety it seems to be the Utah representative, but in the absence not only of the type, but even of authentic specimens, the two are kept separate, a thing fully justified by the description.

63. Cactus radiosus alversoni, var. nov.

Differs from var. *deserti* in its more robust and branching habit (becoming 12.5 cm. tall and 10 cm. in diameter), shorter and thicker tubercles, more numerous (12 to 14 centrals) stouter and longer (12 to 22 mm.) spines, all of which are black-tipped (the centrals black half way down, shading into red), and pink flowers.—Type, Alverson's specimens in Herb. Mo. Bot. Gard. and in Herb. Coulter.

In the desert region of extreme southeastern California.

Specimens examined: Southern California (*A. H. Alverson* of 1892): also growing in Mo. Bot. Gard. 1893.

The covering of stout bushy interlocking spines is like that of var. *deserti*, but the black and reddish coloration gives a decidedly different appearance. On account of this appearance of a reddish-black brush the plant has been popularly called "foxtail cactus." The decidedly pink flowers were sent by Mr. S. B. Parish from specimens growing in cultivation in San Diego, and are not from the original collection of Mr. Alverson.

64. Cactus macromeris (Engelm.) Kuntze Rev. Gen. Pl. 260 (1891).
Mamillaria macromeris Engelm. Wisliz. Rep. 13 (1848).
Mamillaria heteromorpha Scheer in Salm. Cact. Hort. Dyck. 128 (1850).
Mamillaria dactylithele Labouret, Monogr. Cact. 146 (1858).

Ovate or cylindrical, 5 to 10 cm. high, simple or branching from the base and at length cespitose: tubercles large, loose and spreading, from a dilated base, more or less elongated (12 to 30 mm.) and teretish (often incurved), the groove absent in young plants and never reaching the axil: radial spines 10 to 17, slender and terete, or stouter and often angled, spreading, 12 to 40 mm. long, whitish (or more or less rose-colored when young), straight or a little curved; central spines 4 (or fewer in young plants or even wanting), spreading, 25 to 55 mm. long, stouter, bulbous at base, mostly black (the lowest the longest and stoutest), straight or sometimes curved or twisted: flowers 6 to 7.5 cm. long and of same diameter, deep red to purple: fruit ovate-subglobose, green, 15 to 25 mm, long: seeds globose-obovate, yellow, and smooth. 1.2 to 1.6 mm. long. (*Ill.* Cact. Mex. Bound. t. 14 and 15)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

Mostly in loose sand, in the valley of the Rio Grande (on both sides of the river), from southern New Mexico to Eagle Pass, Texas, and doubtless further down.

Specimens examined: New Mexico (*Wislizenus* of 1846; *Wright* 384, 531, of 1852; *G. R. Vasey* of 1881): Texas (*Wright* of 1850, 1851, 1852; *Bigelow* of 1852): Chihuahua (*Evans* of 1891; *Budd* of 1891): also growing in Mo. Bot. Gard. 1893.

This species shows an interesting transition from Coryphantha to *Echinocactus*. The woolly groove of the Coryphantha extends from the spine-bearing areola to the axil of the tubercle, where it expands into the flower-bearing areola. In *C. macromeris*

the groove extends only about half way down the tubercle and gives origin to the flower-bearing areola on the side of the tubercle; while in *Echinocactus* the flower-bearing areola becomes adjacent to the spine-bearing areola and the flower appears at the summit of the tubercle.

ARTIFICIAL KEY TO THE SPECIES.

It seems impossible to make a simple artificial key that will serve as a useful guide to each individual species and variety. Our knowledge of so many of the species is imperfect, that no set of characters can be applied throughout. However, as no plants are collected in such fragmentary condition, it will be useful to construct a key based upon such characters as are always likely to be present, even if specific distinctions are not always reached. In many cases, species are so closely and differently related to each other that the complete descriptions will have to be consulted to determine the differences, and in such cases the artificial key can only indicate the group. Even the full descriptions are very compact, all characters not necessary for discrimination having been eliminated. No attempt need be made to determine any species by means of the flowers alone. In most cases more or less of the plant body will be available, presenting spine and tubercle characters, and these are used in the following key. The distinction between *Eumamillaria* and *Coryphantha*, on the basis of grooveless and grooved tubercles should always be made out easily. It may be useful to suggest as a caution, however, that often tubercles in drying develop folds which simulate grooves, and especially is this true in quadrangular tubercles. In such cases it is necessary to restore the original plumpness of the tubercle by boiling, before the presence or absence of the groove can be definitely determined. The species and varieties are indicated only by their specific or varietal names in the following key, and the numbers refer to the serial numbers of the synoptical presentation. Forms occurring within the United States are italicisized:

I. *Tubercles never grooved.*

* *Central spines none.*

Radials 5 to 9, stout.
*meiacanthus** (7).
Radials 20 to 40.
micromeris (12), greggii (13).
Radials 40 to 80.
lasiacanthus (10), *denudatus* (11).

** *Central spine solitary and not hooked.*

+ *Central spine longer than the radials.*

Radials 7 or 8: tubercles very long (40 to 50 mm.).
longimamma (36).
Radials 15 to 20: tubercles 6 to 8 mm. long.
eschanzieri (21).

+– +– *Central spine shorter than the radials.*

Radials 5 to 9, stout.
meiacanthus (7).
Radials 9 to 22.
heyderi (5), *hemisphaericus* (6), gummiferus (8), gabbii (34), *sphaericus* (35).

* * * *Central spine solitary and hooked.*

+– *Stems slender cylindric: Lower Californian.*

Centrals 1, 20 to 30 mm. long.
roseanus (23).
Centrals 1 to 4, 20 to 50 mm. long.
setispinus (24).

+– +– *Stems depressed-globose to ovate.*

Radials 4 to 6, rigid.
uncinatus (9).
Radials 8 to 12.
wrightii (15).
Radials 15 to 30.
grahami (19), eschanzieri (21).
Radials 50 to 60.
barbatus (18).

* * * * *Central spines more than one, and none of them hooked.*

+– *Slender or sometimes stout cylindrical plants, branching at base: Lower Californian.*

brandegei (3), setispinus (24), halei (25).

+– +– *Depressed-globose to ovate and stout cylindrical.*

++ *Radials few* (*3 to 12*) *and rigid: Mexican.*

Radials 3: centrals 3.
alternatus (1)
Radials 7 or 8: tubercles 40 to 50 mm. long.
longimamma (36).
Radials 10 to 12: tubercles 12 to 15 mm. long.
gummiferus (8).

++ ++ *Radials numerous* (*16 to 60*), *capillary or bristle-like.*

Radials 15 to 30, slender but rigid (bristly).
acanthophlegmus (2), densispinus (4), bispinus (14), rhodanthus (26), sulphureospinus (27), palmeri (29), pringlei (32).
Radials 30 to 60 or more, mostly capillary.
tetrancistrus (22), capillaris (28), *texanus* (31), sphaerotrichus (33).

* * * * * *Central spines more than one and but one of them hooked.*

Radials 10 to 15.
goodrichii (16), setispinus (24).
Radials 15 to 30.
pondii (17), *grahami* (19), bocasanus (20).
Radials 30 to 60.
tetrancistrus (22).

* * * * * * *Central spines more than one, and more then one of them hooked.*

Radials 8 to 12.
wrightii (15).
Radials 30 to 60.
tetrancistrus (22).

II. *Tubercles with a more or less prominent groove.*

* *Central spines none.*

+– *Radials whitish and rigid, oppressed (pectinate) and interwoven with adjacent clusters.*

Depressed-globose and simple.
compactus (44).
Globose and simple.
radians (45), corniferus (47).
Cespitose.
pectenoides (46), *sulcatus* (49).

+– +– *Radials more slender and spreading.*

Radials 10 to 17.
missouriensis (37), *similis* (38), *macromeris* (64).
Radials 30 to 50, capillary.
dasyacanthus (51).

* * *Central spine solitary, not hooked.*

+– *Central spine porrect.*

Radials 6 to 17.
missouriensis (37), *robustior* (39), *scheerii* (40).
Radials 30 to 50, white and capillary.
dasyacanthus (51).

+– +– *Central spine curved downwards.*

Radials 8 to 12.
sulcatus (49).
Radials 12 to 26.
robustispinus (41), recurvatus (42), corniferus (47), *scolymoides* (48).

+– +– +– *Central spine erect: Mexican.*

Radials 7 or 8: central 50 mm. long.
salm-dyckianus (43).
Radials 10 or 11: central 25 to 35 mm. long.
maculatus (52).
Radials 13 to 16.
compactus (44).

* * * *Central spine solitary and hooked.*

brunneus (53).

* * * * Central spines more than one and none of them hooked.

Centrals 2: radials 6 to 20.
scheerii (40), robustispinus (41), recurvatus (42), *scolymoides* (48).
Centrals 3: radials 6 to 40.
scheerii (40), *scolymoides* (48), *echinus* (50), conoideus (54), *neo-mexicanus* (59), *arizonicus* (60).
Centrals 4 or 5: radials 6 to 40.
scheerii (40), *scolymoides* (48), *echinus* (50), conoideus (54), *tuberculosus* (56), *viviparus* (57), *radiosus* (58), *neo-mexicanus* (59), *arizonicus* (60), *macromeris* (64).
Centrals 6 or 7: radials 12 to 40.
potsii (55), *tuberculosus* (56), *viviparus* (57), *neo-mexicanus* (59), *arizonicus* (60), chloranthus (62).
Centrals 8 to 14: radials 12 to 40 or more.
potsii (55), *tuberculosus* (56), *viviparus* (57), *neo-mexicanus* (59), *deserti* (61), *chloranthus* (62), *alversoni* (63).

GEOGRAPHICAL DISTRIBUTION

It is only possible to deal with the forms that occur within the borders of the United States, as even individual stations of common Mexican forms are little if at all known. These United States forms represent a northern extension of an abundant Mexican display. The group EUMAMILLARIA, containing twelve of the thirty-one forms defined as occurring north of the Rio Grande, makes the feeblest extension northward, at no place being found far from the boundary, and all the twelve are Mexican forms which extend but slightly into the United States. Only five of the forms are found east of the Pecos: *heyderi*, the most widely distributed EUMAMILLARIA, extending from the southeastern border of Texas westward along the whole Mexican boundary except in California; *hemisphæricus*, extending through southern Texas and southern New Mexico; *meiacanthus*, also along the Mexican border of Texas and New Mexico; *texanus*, a low ground form of the Rio Grande Valley, extending from the mouth of the river to El Paso, and suggesting a connection with the West Indian *stellatus*; and *sphæricus*, another low ground valley form of similar range, but apparently only extending up the Rio Grande to the region of Eagle Pass.

The Pecos forms the eastern boundary of five other EUMAMILLARIA forms: *micromeris*, extending northward from Coahuila and Chihuahua, apparently only in the mountains between the Pecos and El Paso; *wrightii*, of similar narrow northward extension, but ranging further northward on the high plains of the Upper Pecos in New Mexico; *denudatus*, also with a narrow northward extension west of the Pecos; *lasiacanthus*, extending from Chihuahua with a northern limit between the Pecos and Arizona; and *grahami*, a Sonoran type which has spread between the Pecos and southeastern California.

The ten preceding forms have evidently entered our borders from the highlands of Sonora and Chihuahua, with the exception of the Rio Grande Valley forms, *texanus* and *sphæricus*. Another species, *tetrancistrus*, is also a Sonoran type which has reached the eastern slopes of the

mountains of southeastern California, and extended through western Arizona to southern Nevada and southern Utah, the most extended northern range of any EUMAMILLARIA. The twelfth form, *goodrichii*, is Lower Californian, and extends into California only in San Diego County. A summarized statement of the distribution of our twelve EUMAMILLARIA would be that two of them have extended from the low grounds of Coahuila and Chihuahua and spread along the valley of the Rio Grande; nine have come from the high grounds of Chihuahua and Sonora, four of which have extended eastward to the low levels of southeastern Texas; four have kept to the highlands west of the Pecos, and one has kept to the Colorado Valley and its tributaries, while one has a short northern extension from Lower California.

The nineteen forms of CORYPHANTHA are decidedly more northern in their distribution, and are our characteristic representatives of the genus *Cactus*. Ten of these, however, are but northern extensions of Mexican forms, and six of the ten have simply that tongue-like northern extension in the mountains between the Pecos and the Upper Rio Grande (above. El Paso), viz.: *dasyacanthus, tuberculosus, scheerii* (which has also spread somewhat east of the Pecos), and the three pectinate and closely related forms *radians, echinus*, and *scolymoides*. Of the four remaining Mexican forms, *macromeris* is a low ground Rio Grande Valley form, extending from above El Paso well towards the Lower Rio Grande; *potsii* just crosses the border in the neighborhood of Laredo; and radiosus and *neo-mexicanus* have by far the greatest northern extension, stretching from Sonora and Chihuahua to southern Utah and central Colorado, and eastward to the Guadalupe River of Texas.

The nine remaining coryphanths are distinctly forms of the United States, occupying two well-marked regions, viz.: the northern plains, and the desert region of western Arizona and adjacent California, Nevada, and Utah. In the former region is found the widespread *viviparus*, which extends from the southern borders of British America to the plains of eastern Colorado and western Kansas, and even crosses the Rocky Mountain divide into northern Idaho and northeastern Washington; and *missouriensis*, which also ranges from the high prairies of the Upper Missouri to the same southern limit, and is continued southward into Texas in its varieties *similis* and *robustior*.

In the Arizona desert region, four distinct but closely allied forms have become differentiated from the strong *radiosus* stock, viz.: *arizonicus, deserti, alversoni*, and *chloranthus*, all of which might be regarded as distinct species. In southeastern Texas is found an isolated form, *sulcatus*, occurring between the Brazos and Nueces rivers. That *viviparus* must be regarded as a strong northern extension of the *radiosus* stock can not be doubted, as the low depressed cespitose northern form seems to merge southward so gradually into the simple more robust ovate to cylindrical forms of *radiosus* as to suggest the propriety of regarding them all as specifically identical.

The result of a closer inspection of the distribution of these nearly related forms is worthy of note. *C. viviparus* extends from British America and the Upper Missouri to eastern Colorado and western Kansas; *neo-mexicanus* (the form most nearly related to *viviparus*) extends from central Colorado and southern Utah into Mexico; at the southeastern edge of this range begins *radiosus* and extends eastward through southern Texas; from the western edge of *neo-mexicanus* the form *arizonicus* extends westward into southern California, touching *chloranthus* at its Utah limit, and at its California extension reaching *alversoni* and *deserti*, the latter of which extends northward into the desert region of southeastern California and adjacent Nevada. Taking this type as of Mexican origin, it seems to have entered the United States from Sonora and Chihuahua, and to have spread in three directions, viz.: eastward through southern Texas; westward and northwestward into southern California and southern, Utah; and northward to the head waters of the Missouri and British America, though we would limit the northern extension of the present specific type to central Colorado, and would regard the still more northern forms as of the same origin but entitled to specific rank.

2. ANHALONIUM Lem. Cact. Gen. Nov. (1839).

Depressed or flattened, simple, unarmed plants, covered with peculiar imbricated tubercles above and their scale-like remains below: tubercle with lower and upper parts very different; lower part comparatively thin and flat; upper exposed part triangular in outline and divergent, very thick and hard, the lower surface smooth and keeled, the upper surface plane or convex, smooth or tuberculate or variously fissured, with a broad wool-bearing groove or simply a more or less evident tomentulose apical areola: spine-bearing areola obsolete: flower-bearing areola at the summit of the lower peduncle-like portion of the very young tubercle (thus appearing axillary with reference to the exposed part of the tubercle) and bearing a dense penicellate tuft of long soft hairs which conceals the lower part of the flower and the entire fruit and persists about the apical region of the plant as matted and apparently axillary wool: ovary naked: seeds large, black, and tuberculate: embryo obovate, straight.

According to the present views concerning generic limitations in *Cactaceæ*, *Anhalonium* must certainly be kept distinct from *Mamillaria*, and to such a view Dr. Engelmann had finally come. The generic distinction is based upon such characters as (1) the complete suppression of the spine-bearing areolae; (2) the strong differentiation of the tubercles into two very distinct regions; (3) the production of the flower at the apex of the basal or peduncle-like portion (which becomes flattened and expanded at maturity) of a very young tubercle; and (4) the large tuberculate seeds.

In the case of *engelmanni* the broad woolly groove of the upper portion of the tubercle expands below into the flower-bearing areola, but terminates blindly above just behind the sharp apex. In *prismaticum* and *furfuraceum* the groove is obliterated, but there usually remains a small (more or less tufted) areola and depression

just behind the apex to mark its upper extremity. This apical areola therefore, does not represent a spine-bearing areola, but the closed upper extremity of a tubercle groove.

It seems evident that Anhalonium is a much modified *Cactus*, and that its affinity is with the coryphanths, through such a species as *C. macromeris*, in which the flower becomes extra-axillary. If in *macromeris*, with the flower standing well up on the tubercle, the portions of the tubercle above and below the flower should become very different from each other, the upper portion being so much modified as to cause the spine-bearing areola to be obliterated, the condition of things in *Anhalonium* would be obtained.

* *Upper surface of tubercle with a broad and deep wool-bearing longitudinal groove which widens below.*

1. Anhalonium engelmanni Lem. Cact. 42 (1839).
Mamillaria fissurata Engelm. Syn. Cact. 270 (1856).
Anhalonium fissuratum Engelm. Bot. Mex. Bound. 75 (1859).

Depressed globose or flat, top-shaped below and tapering into a thick root, 5 to 12 cm. in diameter: tubercles (upper portion) appressed-imbricate, 12 to 18 mm. long and about as wide at base, the upper surface convex and variously fissured (presenting an irregular warty appearance) even to the edges: flowers apparently central, about 2.5 cm. long and broad, shading from whitish to rose: fruit oval, pale green, about 10 mm. long: seeds 1.6 mm. long. (*Ill.* Bot. Mex. Bound. t. 16)—Type unknown; but specimens of Wright, Bigelow, and Parry in Herb. Mo. Bot. Gard. are the basis of Engelmann's *Mamillaria fissurata*.

On limestone hills, in the "Great Bend" region of the Rio Grande in Texas, and southward into Coahuila. Fl. September-October.

Specimens examined: Texas (*Wright* of 1850; *Bigelow* of 1852; *Parry*, with no number or date; *Lloyd* of 1890; *Evans* of 1891; *Briggs* of 1892): also growing in Mo. Bot. Gard. 1893.

This species is very closely related to the Mexican *A. kotchubeyi* Lem. (*A. sulcatum* Salm-Dyck), but unfortunately no type of that species seems to be in existence, and Dr. Engelmann notes (Mex. Bound. Rep. 75) that "it seems no living or dead specimen is at present extant in Europe." Judging from the description, the upper surface of the tubercles in *A. kotchubeyi*, aside from the central furrow, is smooth; at least the margin is "very entire."

* * *Upper surface of tubercle not grooved, but usually with a tomentose pulvillus at the tip.*

2. Anhalonium prismaticum Lem. Cact. 1 (1839).
Mamillaria prismatica Lem. Hort. Univ. i. 231 (1839).
Cactus prismaticus Kuntze, Rev. Gen. Pl. 261 (1891).

Flat above, top-shaped below, 7.5 to 12.5 cm. in diameter: tubercles (upper portion) closely imbricate but squarrose-spreading, sharply triangular-pyramidal and very acute (with a sharp cartilaginous tip, which usually disappears with age and leaves the older tubercles blunt or retuse), 18 to 25 mm. long and about as wide at base, the upper surface almost plane and smooth, except that it is more or less

pulverulent and usually bears a small tomentose pulvillus (often evanescent later) just behind the claw-like tip: flowers rose-color: fruit elongated- oval and reddish. (*Ill.* Lem. Cact. t. 1.)—Type unknown.

Referred to Mexico in general, but reported definitely only from San Luis Potosi. Undoubtedly found in Coahuila, and possibly crosses the Rio Grande in the region of the "Great Bend."

Specimens examined: San Luis Potosi (*Eschanzier* of 1891): Mexico in general (specimens from Coll. Salm-Dyck in 1858; *Schott* of 1858): also specimens cultivated in Mo. Bot. Gard. in 1881; also growing in same garden in 1893.

3. Anhalonium furfuraceum (Watson).

Mamillaria furfuracea Watson, Proc. Amer. Acad. xxv. 150 (1890).

Very closely related to *prismaticum;* but triangular portion of tubercle acuminate and shorter, having an irregularly mamillate upper surface, and the acumination ending abruptly in a cartilaginous depression containing a tomentose pulvillus: flowers 2.5 to 3 cm. long, white or pinkish, the sepals brownish.—Type, Pringle 2580 in Gray Herb.

At Carneros Pass, Coahuila.

Specimens examined: Coahuila (*Pringle* 2580 of 1889).

The type of this species was not among the collections received from Cambridge, but a specimen of the same distribution from the National Herbarium shows tubercle dimensions different from those recorded in Dr. Watson's description. In that description the triangular terminal surface is said to be "about an inch broad by one-half inch," which is decidedly different from the equilateral surface of the tubercle of *prismaticum*. In the National Herbarium specimen of *furfuraceum*, however, of the same distribution, the surface is almost equilateral, measuring 15 mm. long by 18 mm. wide at base. Without the acuminate upper portion the breadth of the triangular portion would be about double its length. The lower rim of the cup-like depression which terminates the tubercle and contains the pulvillus is sometimes slightly prolonged into a tooth, which in *prismaticum* becomes the sharp tip of the tubercle. The "minutely furfuraceous-punctulate" character of the tubercle is common to all the species of *Anhalonium* I have seen, and simply represents the external openings of the remarkably long cuticular passageways to the stomata.

4. Anhalonium pulvilligerum Lem. Cact. (1839).

Anhalonium elongatum Salm-Dyck (1850).

This seems to be a third grooveless Mexican species. I have seen no specimens, but judge from the description that it differs from the two preceding species chiefly in its less crowded and more elongated tubercles (triangular portion 5 cm. long by 2.5 cm. broad at base), which are covered at apex with a tomentose pulvillus.

GEOGRAPHICAL DISTRIBUTION.

This curious genus is strictly Mexican, and, so far as at present recorded, is characteristic of Coahuila, but a single species (*engelmanni*) of the four or five known crossing the Rio Grande in the Great Bend.

3. LOPHOPHORA, gen. nov.

Depressed-globose, proliferous and cespitose, tuberculate-ribbed, unarmed plants: tubercles at first conical and bearing at summit a flower-bearing areola with a dense tuft or short pencil of compact erect hairs, when mature becoming broad and rounded (with the remnant of the penicellate tuft as a persistent pulvillus in a small central depression) and coalescing into broad convex vertical ribs: spine bearing areolae obsolete: flowers borne at the summit of nascent tubercles: ovary naked (that is free from scales, but often downy): fruit and seed unknown.

These forms have been variously referred to *Anhalonium* and *Echinocactus*, but seem to deserve generic distinction. They differ from *Anhalonium* in the entire suppression of the upper highly differentiated portion of the tubercle, in the broad and rounded development of the lower portion, and in the coalescence of the enlarged tubercles into broad vertical ribs. In fact, in young specimens, the plant appears almost smooth, with shallow furrows radiating from the depressed apex. The genus differs from *Echinocactus* in the suppression of the spine-bearing areolae, and the naked ovary. In the examination of developing tubercles the relation to *Anhalonium* is evident. In the latter genus the young tubercle bears on the summit of its pedicel-like lower portion the tufted flower-bearing areola the modified upper portion of the tubercle at that time appearing as a bract beneath the flower. In *Lophophora* there is the same condition of things, except that the bract-like upper portion is wanting. From this point of view it would appear that the differences between *Lophophora* and *Echinocactus* are intensified by the fact that the flower-bearing areola in the former genus is to be regarded as really lateral on a tubercle the upper part of which has disappeared. This genus occurs abundantly in southeastern Texas, extending southward into Mexico. Mrs. A. B. Nickels reports that the Indians use the plants in manufacturing an intoxicating drink, also for "breaking fevers," and that the tops cut off and dried are called "mescal buttons."

1. Lophophora williamsii (Lem.).
Echinocactus williamsii Lem. Allg. Gart. Zeit. xiii. 385 (1845).
Anhalonium williamsii Lem. in Forst Handb. Cact. i. 233 (1846).

Hemispherical, from a very thick root, often densely proliferous, transversely lined below by the remains of withered tubercles: ribs usually 8 (in young specimens often 6), very broad, gradually merging above into the distinct nascent tubercles which are crowned with somewhat delicate penicellate tufts, which become rather inconspicuous pulvilli on the ribs: flowers small, whitish to rose: stigmas 4. (*Ill.* Bot. Mag. t. 4296)—Type unknown.

Along the Lower Rio Grande, Texas, and extending southward into San Luis Potosi and southern Mexico.

Specimens examined: Texas (*Mrs. Nickels* of 1892): San Luis Potosi (*Eschanzier* of 1891): also growing in Mo. Bot. Gard. 1893.

2. Lophophora williamsii lewinii (Hennings).
Anhalonium lewinii Hennings, Gartenflora, 410 (1888).

A much more robust form, with more innocuous (usually 13) and hence narrower and more sinuous ribs, anti much more prominent tufts. (*Ill.* Monats. Kakteenkuude, October, 1891)—Type unknown.

Along both sides of the Lower Rio Grande.

Specimens examined: Texas (*Win. Lloyd* of 1890, mouth of the Pecos; *Mrs. Nickels* of 189, 1893): Mexico (specimen collected across the Rio Grande, near Laredo, in 1894): also growing in Mo. Bot. Gard., 1893.

The extreme specific and varietal forms seem worthy of specific distinction, but abundant growing material in Mo. Bot. Gard. showed such complete intergradation that a specific line of separation was found to he impossible. The varietal form is said to be an important one in the ceremonial rites of the Indians.

GEOGRAPHICAL DISTRIBUTION.

These forms are evidently Mexican in origin, and the specimens seen are all from the Rio Grande region. They have crossed that river below the "Great Bend," and probably belong to lower-lying, more eastern Mexican provinces than do the species of *Anhalonium*. *L. williamsii* is reported from southern Mexico, but so little is known of the distribution of these plants that their eastern Mexican range is conjectural.

PRELIMINARY REVISION OF THE NORTH AMERICAN SPECIES OF ECHINOCACTUS, CEREUS, AND OPUNTIA.

PREFATORY NOTE.

This is the completion of the work on our North American Cactaceæ, which was begun by the preliminary revision of Cactus, Anhalonium, and Lophophora, published as Contributions from the F. S. National Herbarium, Vol. III, No. 2 (issued June 10, 1894). The occasion for such an undertaking and the opportunities for carrying it out were explained in the prefatory note to that paper. As the work progressed, however, it became more and more evident that the revision could consist only of the systematic collection of our present knowledge, based upon the study of the very inadequate material accessible in herbaria and gardens. The difficulties of the group, as regards types and nomenclature, were pointed out in the previous paper, and the undertaking would have been abandoned only that it seemed but proper to contribute to the knowledge of the group such facts as had come to light in the course of several years' study, especially as an excellent opportunity had been given to examine Dr. Engelmaun's types and unpublished notes. It may be well to repeat the statement here that all known forms within the United States have been included, but only such Mexican and West Indian forms as could be personally examined. A maze of names and descriptions have been handed down in various writings, but it would be of no advantage to introduce them except as substantiated by specimens.

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4. ECHINOCACTUS Link & Otto, Verb. Preuss. Gartenb. Ver. 3, 420, t. 13 (1827).

Usually globose, but becoming oblong or even stout-cylindrical, mostly with spine-bearing ribs (sometimes represented only by vertical or spiral rows of tubercles): flower-bearing areolæ usually contiguous to the young spine-bearing areolæ and just above them, but sometimes farther removed (connected with then by a short groove), and rarely even in the axil of a tubercle: ovary bearing scales which are naked or woolly in the axils: fruit succulent or dry: seeds often albuminous embryo usually curved, with more or less foliaceous cotyledons.—*Astrophytum* Lem. (1839); *Gymnocalycium* Pfeiff. (1844); *Malacocarpus* Salm-Dyck (1850).

As the genera of *Cactaceæ* have no very definite boundaries it is to be expected that *Echinocactus* will be found merging into neighboring genera. The mamillate forms, such as *E. simpsoni*, are clearly intermediate between *Cactus* and *Echinocactus*, but are nearer the latter in what are considered the more essential characters; while the oval and cylindric forms look toward certain species of *Cereus*, though the general globose outline is well maintained. Inasmuch as the flowers are related to the nascent spiniferous areolæ the *Cactus* relationship is with the Coryphanths, among which, as has been pointed out, *Cactus macromeris* has its *Echinocactus* tendencies. The genus *Cereus* holds the same sort of relationship to the Eumamillarias, the flowers in both appearing in connection with the mature spiniferous areolæ. As shown recently by W. F. Ganong[1] the so-called floriferous and spiniferous areolæ are simply more or less separated regions of a single pulvinus, which appears in its simple form in *Opuntia*. The same observer also calls attention to the occurrence of two but minute leaves in *Cactus*, *Echinocactus*, and *Cereus*, structures which are prominent in *Opuntia*, and have been taken to be a distinguishing mark of that genus.

* *Scales of the ovary subulate, copiously woolly in the axil: fruit dry and enveloped in wool: spines (wanting in No. 7) rigid and annulate, not hooked.*—Eriocarpi.

← *Ribs 10 to 27, acute.*

1. Echinocactus polycephalus Engelmann. & Bigel.; Engelm. Syn. Cact. 276 (1856).

Globose (15 to 25 cm. in diameter) to ovate (25 to 40 cm. high, 12.5 to 25 cm. in diameter) and cylindrical (reaching 60 to 70 cm. high and about 25 cm. in diameter), profusely branched at base: ribs 13 to 21 (occasionally 10): spines 8 to 15, very stout and compressed, more or less recurved and reddish; radials 4 to lit comparatively slender (the

[1]Morphologie und Biologie der Cacteen.

uppermost most so), 2.5 to 5 cm. long; the 4 centrals much stouter and longer (3 to 9 cm.), very unequal, the uppermost one usually the broadest and curved upward, the lowest one usually the longest and decurved: flowers yellow: fruit globose, 16 to 20 mm, in diameter: seeds irregularly ungulate and minutely tuberculate, 4 mm. long. (*Ill.* Pacif. R. Rep. iv, t. 3, figs. 4-6)—Type, Bigelow of 1851 in Herb. Mo. Bot. Gard.

Stony and gravelly ground of the desert valleys in the southern part of the Great Basin, from southern Utah and southern Nevada through Arizona to southeastern California and Sonora.

Specimens examined: Utah (*Palmer* of 1877; *Johnson* of 1877; *Siler* of 1883): Arizona (*Palmer* of 1870; *Bischoff* 1871; *Nealley* of 1891): California (*Bigelow* of 1854; *Clayton* with no number or date; *Wright* of 1882; *Coville & Funston* 153, Death Valley Exped.).

The plants are simple only when young, forming at maturity bunches of 20 to 30 (or even more) cylindric heads. Dr. Merriam speaks of this species as "resembling loose clusters of cocoanuts," and is commonly called "nigger-head" in the desert region.

2. Echinocactus polycephalus xeranthemoides, var. nov.
Echinocactus xeranthemoides Engelm. MSS.

Globose and smaller (2.5 to 12.5 cm. high): ribs 13, sharp and interrupted: spines about 12 (10 to 15), straight or slightly curved; radials smaller (about 3 cm.); the 4 centrals 3 to 5 cm. long, the lowest broadest and porrect from the center of the areola.—Type, Siler of 1881 and 1883 in Herb. Mo. Bot. Gard.

Extreme southwestern Utah and western Arizona, on the Kanab plateau and southward in the region of the Colorado.

Specimens examined: Utah (*Siler* of 1883, "Kanab Mts.") Arizona (*Siler* of 1881, near the Colorado "on the Kanab wash;" *Rusby* 619, of 1883, at Peach Springs; *Evans* of 1891, between Gila Bend and Yumna).

Dr. Engelmann, having only the Siler specimens, regarded this as probably a new species, which view extreme forms might justify. However, more material makes it evident that it can not be more than a variety of *polycephalus*. The two forms belong together in the desert region of the Colorado, and both have the same profusely branching habit. The variety is much the smaller form, with usually more numerous spines, which are distinguished by the very prominent broad and porrect lower central, but there are intergrading forms which obscure this distinction.

3. Echinocactus parryi Engelm. Syn. Cact. 276 (1856).

Globose or depressed, becoming 20 to 30 cm. high and 25 to 40 cm. in diameter, simple: ribs 13, tuberculate-interrupted: spines stout, more or less compressed, white; radials 8 to 11, straight or a little curved, upper slenderer, lowest wanting; the 4 centrals a little stouter and longer (3.5 to 5 cm.), lowest longest and decurved: fruit oblong. (*Ill.* Cact. Mex. Bound. t. 32, figs. 6, 7)—Type probably lost. Dr. Engelmann had hut a few bunches of spines, the rest of the description being made up from Dr. Parry's notes, but I have failed to find these bunches of spines in the Engelmann collection.

Desert region of Chihuahua, "southwest of El Paso toward Lake Guzman, over an area of 60 or 80 miles in extent."

The species is clearly very near *E. polycephalus*, but should be distinguished from it readily by its simple habit, and white spines.

4. Echinocactus texensis Hopf. Allg. Gart. Zeit. x, 297 (1842).
Echinocactus lindheimeri Engelm. Pl. Lindh. 246 (1845).

Mostly depressed (sometimes globose), 20 to 30 cm. in diameter, 10 to 15 cm. high, simple: ribs mostly 21 (sometimes 27, and in smaller specimens 13 or 14) and undulate: spines stout and fasciculate, reddish, compressed; the exterior 6 or 7 radiant, straightish or curved, unequal, 12 to 20 mm. long in some eases, 30 to 50 mm. in others, much shorter than the solitary and stout recurved central, which is sometimes 1 to 6 mm, broad: flowers about 5 cm. long, particolored (scarlet and orange below to white above): fruit subglobose, scarlet, 16 to 18 mm. in diameter: seeds reniform and compressed, black, smooth, and shining (or minutely pitted), 2.4 to 2.8 mm, long. (*Ill.* Cact. Mex. Bound. t. 33, figs. 1-6)—Type, Lindheimer 44 in Herb. Mo. Bot. Gard.

Common from the Colorado River of Texas to the Rio Grande, extending as far west as the Pecos, and southward into the north-eastern states of Mexico.

Specimens examined : Texas (*Lindheimer* 41, and of 1850; *Wright* of 1818 and 1810; *Bigelow* of 1853; *Hall* 234; *Nealley* of 1801, near Del Rio): Tamaulipas (*Berlandier* 1836): Nuevo Leon (*Wislizenus* of 1847): Coahuila (*Gregg* of 1847): Mexico in general (*Poselger* of 1850): also specimens cultivated in St. Louis in 1864,

According to Labouret, this is *E. courantii* Lemaire, but I have had no means of verifying the statement.

+ + *Ribs 5 to 10, very broad and obtuse.*

5. Echinocactus horizonthalonius Lem. Cact. Gen. Nov. 19 (1839).
Echinocactus equitans Scheidw. Bull. Acad. Brux. vi, 88 (1839).
Echinocactus horizonthalonius centrispinus Engelm. Syn. Cact. 277 (1856).
Echinocactus laticostatus Engelm. & Bigel. Pacif. R. Rep. iv, 32 (1856).

Glaucous, depressed-globose or at length ovate or even cylindric with age, 4 to 20 cm. high, 6.5 to 15 cm. in diameter, simple: ribs 8 to 10 (fewer in very young specimens), often spirally arranged, the tubercles scarcely distinct by inconspicuous transverse grooves: spines 6 to 9, stout, compressed, reddish (at length ashy), recurved or sometimes almost straight, nearly equal, 2 to 4 cm. long (sometimes long and slender and almost terete, sometimes short, stout and broad); radials 5 to 8, upper ones weaker, lowest wanting; a single stouter decurved central (sometimes wanting): flowers pale-rose to purple, 6 cm. long or more: fruit red: seeds subglobose (usually looking shriveled and angular), rugose and minutely tuberculate, black, 2.5 to 3 mm. long. (*Ill.* Cact. Mex. Bound. t. 31 and 32, figs. 1-5)—Type unknown. The Wright and Wislizenus specimens in Herb. Mo. Bot. Gard. are types of *centrispinus* Engelm.

On stony ground, between the Pecos and Rio Grande in southwest era Texas and southern New Mexico, and extending southwest into Chihuahua, Coahuila, and San Luis Potosi.

Specimens examined: Texas (*Wright* of 1849, 1851, 1852; *Lemmon* of 1881; *G. R. Vasey* of 1881; *Evans* of 1891: *Nealley* of 1892): Chihuahua (*Wislizenus* of 1846): Coahuila (*Salm-Dyck* of 1857; *Palmer* 380, at Saltillo): San Luis Potosi (*Parry & Palmer* 272, of 1878.)

The distinction between *horizonthalonius* and *centrispinus* is an untenable one, being simply the presence or absence of the central spine. Dr. Engelmann had reached the same conclusion after examining a large amount of both living and dried material in European collections. I can not discover whether *horizonthalonius* of Lemaire or *equitans* of Scheidweiler has priority of publication. Both appeared in the same year, and hence I have retained the name in common use. Havard says that "this species, and perhaps others, under the name of 'bisagre' are sliced, candied in Mexican sugar, and kept in confectioneries."

6. Echinocactus ingens (Karw.) Zucc.; Pfeiff. Enum. 54 (1837).
Melocactus ingens Karw. ex Pfeiffer.
Echinocactus karwinskii Zucc. ex Labouret, not ex Pfeiffer..

Glaucescent, globose, or oblong, becoming 15 to 18 dm. high: ribs 8 (in small specimens, possibly more numerous in large ones), tuberculately interrupted and with broad sinuses: radial spines 8, reddish-brown, straight, rigid, and interwoven, 2.5 to 3.5 cm. long; central spine solitary and similar: flowers yellow, about 2.5 cm. long, and a little broader: fruit ovate, 3 cm. long: seeds reniform, black and shining, 4 mm. long.—Type unknown.

Coahuila and San Luis Potosi, to southern Mexico.

Specimens examined: Coahuila (*Poselger*, without number or date): San Luis Potosi (*Parry & Palmer* 271; *Parry* of 1878; *Weber*): Mexico, no State mentioned (*Palmer* of 1872).

The spine measurements are taken from small specimens. One of the largest of the genus.

7. Echinocactus myriostigma (Lem.) Salm, Cact. Hort. Dyck. ed. 1, 22 (1844).
Astrophytum myriostigma Lem. Cact. Gen. Nov. 4 (1839).
Cereus callicoche Gal.: Scheidw. Bull. Acad. Brux. vi, 88 (1839).

Depressed-globose, 12.5 cm. in diameter: ribs 5 or 6, very broad, covered with numerous somewhat pilose white spots, and with deep, obtuse sinuses: spines none; flowers large, pale-yellow. (*Ill.* Bot. Mag. t. 4177; III. Hort. t. 292)—Type unknown.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Pringle* 3680): also specimens cultivated in Berlin in 1868, and at Cambridge (Mass.) in 1882.

I have been unable to discover whether the name of Galeotti or that of Lemaire, has priority, as both were published in the same year. Sometimes called "bishop's hood."

* **Scales of the ovary ovate, orbicular, or cordate, their axils almost naked: fruit scaly, never woolly.*—Leiocarpi.

+– *Central spines flat, stout, and annulate, the lower one more or less recurved and sometimes hooked: ribs not tuberculately interrupted.*—Cornigeri.

++ *Spines similar* (*all stout, reddish, and annulate*).

8. Echinocactus viridescens Nutt; Torr. & Gray, Fl. i, 551 (1840).

Globose or depressed, simple or branching at base, 10 to 30 cm. high, 15 to 25 cm. in diameter: ribs 13 to 21 (fewer when young), compressed and scarcely tuberculate: spines more or less curved and sometimes twisted, reddish below, shading into greenish or yellowish above; radials 9 to 20, 1 to 2 cm. long, the lowest shortest, and robust and decurved; centrals 4, cruciate, much stouter, compressed and 4-angled. 2 to 3.5 cm. long, the lowest broadest, longest, and straightest: flowers yellowish-green, about 4 cm. long: fruit oval or subglobose, greenish, 10 to 20 mm. long; Seeds obliquely obovate, 1.6 mm. long, very minutely but distinctly pitted. (*Ill.* Cact. Mex. Bound. t. 29)—Type unknown.

Dry hills and ridges near San Diego, California; also collected on the, sea beach by Schott.

Specimens examined: California (*Schott*, without date or number; *Parry* of 1850; *Newberry* of 1858; *Cooper* of 1862; *Agassiz* of 1872; *Pringle* of 1882: also plants cultivated in St. Louis and Washington).

The fruit is said to have the shape and taste of a gooseberry.

9. Echinocactus cylindraceus Engelm. Syn. Cact. 275 (1856).

Echinocactus viridescens cylindraceus Engelm. Amer. Journ. Sci. ser. 2, xiv, 328 (1852).

Globose to ovate or ovate-cylindrical, simple or branching at base, becoming as much as 9 dm. high and 3 dm. in diameter: ribs 13 in younger specimens, 20 to 27 in older ones, obtuse and tuberculate: spines stout, compressed, more or less curved, reddish; radials about 12, with 3 to 5 additional slender ones at upper edge of areola, 2.5 to 5 cm. long, the lowest stouter and shorter and much hooked; centrals 4, very stout and 4-angled, about 5 cm. long and 2 to 3 mm. broad, the uppermost broadest and almost straight and erect, the lowest decurved: flowers yellow: fruit subglobose, pale greenish, about 2.5 cm. in diameter: seeds black, larger than in the last. (*Ill.* Cact. Mex. Bound. t. 30)—Type, Parry of 1850 in Herb. Mo. Hot. Gard.

From San Felipe, California (eastern slope or the mountains), into Lower California, and eastward to southern Utah, New Mexico, and southwestern Texas.

Specimens examined: California (*Parry* of 1850; *Palmer* of 1870): Lower California (Orcutt of 1883): Utah (*Palmer* of 1870): New Mexico (*Parry*, without number or date): Texas (no collector named).

10. Echinocactus peninsulæ Engelm. MSS.

Globose to cylindrical, simple, 1.5 to 15 dm. high, 1.5 to 3.5 dm. in diameter, sometimes becoming as much as 25 dm. high: ribs about 21, straight or rarely oblique: spines red; radials about 11, robust, 2 to 3 cm. long, the upper longer; centrals 4, stouter, compressed and angled, 4 to 6 cm. long, the lowest longer (even 8 cm.), more robust, hooked downward: flowers from golden-yellow to red: fruit obovate.—Type, Gabb 11 in Herb. Mo. Bot. Gard.

Lower California, from Cape San Lucas to near San Diego.

Specimens examined: Lower California (Gabb 11 of 1867).

The larger forms occur in gravelly soil not far from the coast, at not over 200 to 300 feet elevation; the smaller ones (globose and about 15 cm. in diameter) more in the mountains and northward. Evidently near to *emoryi*, but becoming much taller and with more numerous and unequal radials and more numerous centrals.

11. Echinocactus emoryi Engelm. in Emery's Rep. 150 (1848).

Glaucescent, globose to ovate, 3 to 9 dm. high, 3 to 6 dm. in diameter: ribs 13 to 21, obtuse and strongly tuberculate: radial spines 7 to 9, nearly equal, stout, 2.5 to 5 cm. long, erect or a little recurved, reddish, darker toward the apex, at length ashy, the laterals a little longer; a solitary central porrect or at length recurved or somewhat hooked, a little longer and stouter; all with horny tips: flowers red and tipped with yellow (dark brownish-purple outside), about 7.5 cm. long: fruit oval, 2.5 to 4 cm. long: seeds black and pitted, 2 mm. long. (*Ill.* Cact. Mex. Bound. t. 28; Cact. Whippl. Exped. t. 3, fig. 3)—Type: the Emory specimen was not found in the Engelmann collection, but the specimens of Bigelow and Schott, included in the full description of Cact. Mex. Bound., are in Herb. Mo. Bot. Gard.

From the valley of the Mojave (southeastern California) to the valley of the Gila (southwestern Arizona), and southward into Sonora; also on Cedros Island.

Specimens examined: California (*Bigelow* of 1854): Sonora (*Schott* 3; *Palmer* of 1869; *Pringle* of 1881): also specimens cultivated in Hort. Pfersdorf.

In the original description of the Emory plant the fruit is said to be oval and 2.5 to 3.5 cm. long, with black and pitted seeds 2 mm. long, but in all later descriptions Dr. Engelmann says that the "fruit and seed are unknown," without any explanation as to the dropping of the original statement. The Pringle of 1884, however, abundantly confirms this character, showing a fruit as munch as 4 cm. long.

12. Echinocactus emoryi rectispinus Engelm. MSS.

Globose, at length cylindrical, larger: radial spines very unequal, the 3 upper ones 10 to 12.5 cm. long, the lower 3.5 to 7.5 cm. long and paler; the central very long (30 to 32 cm.), straight or slightly decurved: flower and fruit unknown.—Type, Gabb 12 in Herb. Mo. Hot. Gard.

Lower California ("vicinity of Molije on the mountain sides 1,000 feet high") and Sonora,

Specimens examined: Lower California (*Gabb* 12, of 1867): Sonora (*Palmer* of 1869).

++ ++*Spines dissimilar, at least the lateral radials white and setaceous and not annulate* (*sometimes wanting in Nos. 13 and 17*),

13. Echinocactus cornigerus DC. Rev. Cact. 36, t. 7 (1826).

Globose or depressed-globose, 25 to 40 cm. in diameter: ribs about 21, very acute and wavy (not tuberculately interrupted): radial spines 6 to 10, white and comparatively slender, or wanting; centrals red and very robust, angular-compressed, with long, sharp, horny tips, the

upper 3 erect-spreading, 2 to 3 cm. long, the lower 2 weaker and declined, the central one longer, more rigid and keeled, very broad (5 to 8 mm.) and hooked downward: flowers purple, 2.5 to 3.5 cm. long: fruit ovate: seed reniform, slightly pitted, 1.5 mm. long. (*Ill.* DC. *l. c.* t. 7; Mém. Cact. t. 10)—Type unknown.

In Mexico, from Nuevo Leon southward to Guatemala.

Specimens examined: San Luis Potosi (*Parry & Palmer* 270, 273; *Pringle* 3270; *Eschanzier* of 1891): Nuevo Leon (*Bourgeau* 1183): Vera Cruz (*Weber* of 1865): State of Mexico (*Poselger* of 1851): Mexico, with no State assigned (*Mallincrodt* 176).

A form with the lower central yellow and the flowers salmon is noted by Mrs. Anna B. Nickels.

14. Echinocactus wislizeni Engelm. Wisliz. Rep. 12 (1848).

At first globose, then ovate to cylindrical, 5 to 12 dm. high: ribs 21 to 25 (13 in small specimens), acute and oblique, more or less tuberculate: radial spines 1.5 to 5 cm. long, the 3 upper and 3 to 5 lower ones stiff, straight or curved, annulate, and red (in old specimens the 3 stout upper radials move toward the center and become surrounded by the upper bristly ones), the 12 to 20 laterals (sometimes additional shorter ones above) bristly, elongated, and flexuous, horizontally spreading, yellowish white; centrals 4, stout, angled, and red, 3.5 to 7.5 cm. long, the 3 upper straight, the lower one longest (sometimes as much as 10 to 12 cm.), very robust (that and channeled above), and hooked downward: flowers yellow or sometimes red, 5 to 6.5 cm. long: fruit ovate, yellow, soon becoming hard: seeds obliquely obovate, black and rough, 2 to 2.5 mm. long. (*Ill.* Cact. Mex. Bound. t. 25, 26; Cact. Whippl. Exped. t. 3, figs. 1,2)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

From southern Utah, through eastern Arizona to the Rio Grande region about El Paso and southward into Chihuahua; also in Lower California.

Specimens examined: Utah (*Bischoff* of 1871; *Siler* of 1875): Arizona (*Parry* of 1852; *Bischoff* of 1871; *Palmer* of 1873; *Rothrock* 492; *G. R. Vasey* of 1881, near Pantano; *Pringle* of 1882; *Rusby* of 1883; *Wilcox* of 1894, Fort Huachuca): New Mexico (*Wislizenus* of 1846, near Doña Ana): Texas, region about El Paso (*Wright* of 1851; *Bigelow* of 1851, 1853; *Evans* of 1891): Chihuahua (*Pringle* 211): Lower California (*Brandegee* of 1889, near San Franciscito).

Including its variety *lecontei*, the largest *Echinocactus* north of the Mexican boundary, and with its congeners known as the "barrel cactus." Young specimens may differ materially in spine characters.

15. Echinocactus wislizeni lecontei Engelm. Wheeler's Rep. 128 (1878).

Often somewhat taller (sometimes becoming 24 dm. high and 6 dm. in diameter), usually more slender, and at last clavate from a slender base: ribs somewhat more interrupted and more obtuse: lower central spine more flattened and broader, curved (rather than hooked) or

twisted, usually not at all hooked, sometimes as much as 15 cm. long: flower rather smaller. (*Ill.* Pacif. R. Rep. iv, t. 2, figs. 3-5; Cact. Mex. Bound. t. 27)—Type, LeConte 11 in Herb. Mo. Bot. Gard.

Rocky ground, from southwestern Utah and southern Nevada through western Arizona and adjacent California to Sonora and Lower California. Apparently not east of the Great Basin.

Specimens examined: Utah (*Palmer* of 1877; *Siler*): Arizona (*LeConte* 11; *Bigelow* of 1854; *Newberry* of 1858; *Palmer* of 1867, 1869, 1874; *Parry* of 1881; *Pringle* of 1881; *Evans* of 18t)1): California (*Parish* of 1880; *G. R. Vasey* of 1880): Sonora (*Palmer* of 1869): Lower California (*Brandegee* of 1889, at Boca dc Las Animas, San Gregorio, and Posa de Los Dolores).

The Western representative of *E. wislizeni*, although the discovery of that form by Brandegee in Lower California indicates that the two are not geographically so distinct as was formerly supposed. In the Lower Californian specimens of *lecontei* the central spine (the prominent lower one) often becomes very broad and long and hooked, as in *cornigerus*. Among the Mexicans both *E. wislizeni* and *E. lecontei* have the reputation of being "traveler's plants," useful for allaying thirst, and the local name is variously reported as "biznaga," "bisnada," and "visnada."

16. Echinocactus wislizeni albispinus Toumey, Gard. & For. viii, 154 (1895).

Differs from *lecontei* in being oblong, and in the much fewer radials (11 in all, 2 upper and 3 to 5 lower rigid, and 2 or 3 laterals on each side flexuous), all of which (or only the flexuous ones) are whitish. (*Ill.* l. c.)—Type in Toumey Herb.

Southern Arizona and Lower California.

Specimens examined: Arizona (*J. W Toumey* of 1892, near Tucson) Lower California (*M. E. Jones* of 1882.)

There can be no doubt but that this form with much fewer radial spines occurs throughout the range of *lecontei*, to which it is most closely allied. The radials are not merely reduced in number, but are remarkably diverse in character. In the Arizona specimens before me, the two upper radials are stout and annulate, colored like the centrals, but much smaller; then two flexuous laterals on each side are long and white; next the two remaining laterals on each side are rigid and red, and sometimes annulate; and the lowest spine is the shortest, slender, and almost flexuous. The large central, as in *lecontei*, has a curved horny tip (not a hooked one), and is broadly flattened above.

17. Echinocactus pilosus Gal.; Salm, Cact. Hort. Dyck. 148 (1850).
Echinocactus piliferus Lem.; Lab. Monogr. Cact. 188 (1858).

Globose, 15 to 45 cm. high: ribs 13 to 18, compressed, little if at all interrupted: radial spines represented by 3 slender ones at the lowest part of the pulvillus or wanting; centrals 6, very stout, at first purplish, then becoming pale-yellow, the 3 upper ones erect, the 3 lower recurved-spreading: flowers unknown, but probably like those of the variety.—Type unknown.

Coahuila and San Luis Potosi.

Specimens examined: Coahuila (*Palmer* 375): San Luis Potosi (*Parry* 273; *Weber* of 1865, 1866): also specimens cultivated in Mo. Bot. Gard., 1883.

18. Echinocactus pilosus pringlei, var. nov.

Differs in that the radial spines are represented by 3 or 4 flexuous spines at upper edge of pulvinus and 4 or 5 at lower edge; centrals 6 or 7: flowers 3.5 to 4 cm. long, brownish-red.—Type, Pringle 151 in Herb. Gray.

Coahuila.

Specimens examined: Coahuila (*Pringle* 154. distributed as *pilosus*).

+– +– *Spines dissimilar; radials subsetaceous: centrals angled or terete or sometimes flattish, generally at least one hooked at apex and often becoming much elongated.*—Hamati.

++ *Central spines annulate.*

19. Echinocactus hamatocanthus Muhlenpf. Allg. Gart. Zeit. xiv, 371 (1816).
Echinocactus longihamatus gracilispinus Engelm. Syn. Cact. 273 (1856).
Echinocactus hæmatochroanthus Hemsl. Biol. Centr. Amer. i, 532 (1886).

Subglobose or at length ovate, 1.5 to 6 dm. high (flowering often when not more than 5 cm. high): ribs 13 to 17, often oblique, broad, and obtuse, tuberculate-interrupted: spines 16 to 20, purplish or variegated when young, at length ashy; radials 12 to 14, spreading, straight, curved, or flexuous, the upper and lower ones 2.5 to 7.5 cm. long, the laterals 5 to 10 cm.; centrals 4 to 8, angulate compressed, the upper ones turned upwards, straight or curved or twisted, 5 to 12 cm. long, the lowest one stouter, elongated (7.5 to 10.5 cm.), hooked and often flexuous, porrect or deflexed: flowers 6.5 to 9 cm. long, yellow tinged with red (usually yellow within and red without): fruit ovate, green (?), 2.5 to 5 cm. long: seeds globose-obovate, 1.4 to 1.6 mm. long, pitted.—Type unknown.

From the Texan region of the "Great Bend" to the vicinity of Presidio del Norte and the mountains of the Limpia, but apparently not so far west as El Paso.

Specimens examined: Texas (*Wright* 223 of 1849, 764 of 1853; *Bigelow* of 1852).

Dr. Havard says that the ripe fruit is red, and "as delicious as that of the strawberry cactus." In this case, the "green" fruit of the collectors is simply the color of immaturity.

20. Echinocactus hamatocanthus longihamatus (Gal.).
Echinocactus longihamatus Gal.; Pfeiff. Abbild. ii, t. 16 (1843-50).
Echinocactus flexispinus Engelm. Wisliz. Rep. 27 (1848), not Salm (1850).
Echinocactus setispinus *longihamatus* Poselger, Allg. Gart. Zeit. xxi, 119 (1853).
Echinocactus longihamatus crassispinus Engelm. Syn. Cact. 273 (1856).

Spines much more robust; radials 8 to 11; centrals 4, angled, the lowest one flexuous and more or loss hooked. (*Ill.* Cact. Mex. Bound. t. 21-24)—Type unknown.

From the "Great Bend" region of Texas southward through Chihuahua, Durango, Coahuila, and Nuevo Leon, said by Hemsley to occur in southern Mexico.

Specimens examined: Texas (*Nealley* of 1891; *Evans* of 1891): Chihuahua (*Wislizenus* of 1847, type of *flexispinus* Engelm.): Durango

(*Gregg* 464): Coahuila (*Palmer* 373, 374): Nuevo Leon (*Gregg* 197; *Pringle* 2237): also specimens cultivated in Harvard Bot. Gard., 1882; and in Mo. Bot. Gard., 1882.

21. Echinocactus hamatocanthus brevispinus (Engelm.).

Echinocactus longihamatus brevispinus Engelm. Syn. Cact. 274 (1856).

Spines more slender than in *longihamatus*; radials 8 to 11, 1 to 5 cm. long; centrals 4, terete, 3.5 to 5 cm. long, the lowest hooked and scarcely exceeding the radials.—Type unknown.

In the "Great Bend" region of Texas and westward to New Mexico.

Specimens examined: Texas (*Wright* of 1851): New Mexico (*Nealley* of 1891).

These three forms of *hamatocanthus* simply express extreme variations, as there is the greatest variation in spine characters. The type is a Mexican one, crossing the Rio Grande at the "Great Bend," and reported as far west as El Paso in but a single case. From its occurrence in Chihuahua, however, all the forms may be expected in the El Paso region. Doubtless all the forms occur in Mexico, but I have seen *hamatocanthus* and *brevispinus* only from the Texan side of the Rio Grande.

++ ++ Central spines not annulate.

= *One central spine* (*generally the upper one*) *elongated and mostly white.*

22. Echinocactus uncinatus Gal.; Pfeiff. Abbild. ii, t. 18 (1843-50).

Glaucescent, globose to oblong: ribs 13, obtuse, tuberculate-interrupted: radial spines 7 or 8, 2.5 to 5 cm. long, the upper 4 or 5 straw-color, straight, flattened, the lower 3 purplish, terete, and hooked; centrals 4, the upper 3 rather stout and straight, about 2.5 cm. long, the lowest one very long, flattened, hooked at apex: flowers brownish-purple: fruit ovate, 1.5 to 2.5 cm. long: seeds much compressed, curved, smooth and shining, 1.2 to 1.4 mm. long. (*Ill.* l. c.; Cact. Mex. Bound. t. 74, fig. 9, seed)—Type unknown.

Chihuahua, Coahuila, and San Luis Potosi.

Specimens examined: Coahuila (*Gregg* 617; *Poselger* of 1850): San Luis Potosi (*Gregg* 585): also specimens cultivated in Goebel's Gard. (St. Louis), 1845; and in Hort. Pfersdorf in 1869.

The usual reference of this name to Hopf. in Foerst. Handb. 321 (1846) is found to be a *nomen nudum*.

23. Echinocactus uncinatus wrightii Engelm. Syn. Cact. 272 (1856).

Oval, 7.5 to 15 cm. high, 5 to 8.5 cm. in diameter: radial spines 8, arranged as in the last; central spine solitary, angled, flexuous and hooked, elongated (5 to 15 cm.), erect, straw-color with dark tip: flowers 2.5 to 3.5 cm. long, dark-purple: fruit reddish: seeds curved, contracted at base, keeled on the back, tuberculate, 1.4 to 1.6 mm. long. (*Ill.* Cact. Mex. Bound. t. 74. fig. 10, seed)—Type, Wright and Bigelow specimens in Herb. Mo. Bot. Gard.

Abundant from El Paso, Texas, to the Pecos, but extending almost to the mouth of the Rio Grande, and southward into Chihuahua.

Specimens examined: Texas (*Wright* of 1849, 1851, 1852; *Bigelow* of 1852; *Nealley* of 1891, near Rio Grande City): Chihuahua (*Pringle* 76).

Commonly in tufts of grass or hidden among low bushes, the long tuft of yellowish-white hooked central spines often difficult to distinguish from the surrounding bunches of dead grass.

24. Echinocactus polyancistrus Engelm. & Bigel.; Engelm. Syn. Cact. 272 (1856).

Ovate or at length subcylindric, becoming 10 to 25 cm. high and 7.5 to 10 cm. in diameter: ribs 13 to 17, obtuse, tuberculately interrupted: radial spines 20 or more, compressed and white, the uppermost wanting, the 4 upper ones broader and longer (2.5 to 5 cm.) and dusky-tipped, the laterals shorter (2 to 2.5 cm.), the lowest ones very short (1.2 cm.) and subsetaceous; central spines of several forms, the uppermost one (rarely a second similar but smaller one above or beside it) compressed-quadrangular, elongated (7.5 to 12.5 cm.), white with dusky tip, curved upward, the other 5 to 10 teretish or subangled, bright purple-brown, upper ones longer (5 to 9 cm.) and mostly straight, the others gradually shortening (to about 3 cm.) downward and sharply hooked: flowers red or yellow, 5 to 6 cm. long and wide: fruit pyriform, becoming almost destitute of scales: seeds large and tuberculate. (*Ill.* Pacif. R. Rep. iv, t. 2, figs. 1, 2)—Type, Bigelow of 1854 in Herb. Mo. Bot. Gard.

Gravelly hills and plains, from the Mohave desert region of southeastern California (headwaters of the Mohave) to the sage plains of western Nevada; apparently not abundant.

Specimens examined: California (*Bigelow* of 1854; *Coville & Funston* 167, Death Valley Exped.): Nevada (*Gabb* of 1867; *Shockley* 314).

The measurements of plant bodies and spines are taken from the larger southern forms of the Mohave desert. The Nevada plants are but 7.5 to 10 cm. high, with spines rarely more than 5 cm. long, the radials but 1 to 2.5 cm. Said to resemble a pineapple in general size and appearance. The number of hooked spines varies from 3 to 7 according to age and development. In the original description as given in the "Cactaceæ" of Whipple's Expedition the flower characters are drawn from immature buds. Shockley's Nevada specimens are in full flower and show the lower half of the ovary to be naked, a few small rounded fimbriate sepals above, those of the limb few, larger and petal-like; petals 10, about 3 cm. long, spatulate, entire, slightly mucronate-tipped.

25. Echinocactus whipplei Engelm. & Bigel.; Engelm. Syn. Cact. 272 (1856).

Globose ovate, 7.5 to 12.5 cm. high, 5 to 10 cm. in diameter: ribs 13 to 15 (often oblique), compressed and tuberculately interrupted: radial spines usually 7, compressed, straight or slightly recurved, 12 to 18 mm. long, lower ones shorter than the others, all white excepting the two darker lowest laterals; central spines 4, widely divergent, the uppermost one flattened, straight and white, 2.5 to 4 cm. long (1 to 2.5 mm. broad at base), turned upward in the plane of the radials (completing the circle of radials), the others a little shorter (2.5 to 3 cm.), quadrangular-compressed, dark brown or black becoming reddish and finally ashy, the 2 laterals straight, the lowest one stouter and sharply hooked downward: flower greenish-red, 2 to 3 cm. long: ovary with few (2 to 5) scales: seeds

large (3.9 to 3.4 mm, long), black and minutely tuberculate. (*Ill.* Pacif. R. Rep. iv, t. 1)—Type, Bigelow of 1853 in Herb. Mo. Bot Gard.

Sandy soil, often half buried, valley of the Lower Colorado and Little Colorado, northern Arizona.

Specimens examined: ARIZONA (*Bigelow* of 1853; *Newberry* of 1858; *Brandegee* of 1875).

26. Echinocactus whipplei spinosior Engelm. Trans. St. Louis Acad. ii, 199 (1863).

Globose, 7.5 cm. in diameter: ribs 13: radial spines 9 to 11, 12 to 36 mm. long, the lower ones often dusky, the 2 upper ones often elongated, flattened and curved; the 4 centrals 3.5 to 5 cm. long, the uppermost one flexuous and white, the other 3 a little shorter, dusky, all or only the lowest one hooked: flowers about 2.5 cm. long: fruit oval, 12 mm. long.—Type, H. Engelmann of 1858 in Herb. Mo. Bot. Gard.

In Desert Valley, west of Sevier Lake, Utah, and abundant in southwestern Colorado.

Specimens examined: UTAH (*H. Engelmann* of 1858): COLORADO (*Brandegee* of 1875, La Plata Valley and Mesa Verde).

So far as known, *E. whipplei* is confined to the region of its original discovery (valley of the Little Colorado, northern Arizona), and *spinosior* to the deserts of southern Utah and southwestern Colorado, a considerable distance to the north. Intergrading forms may be found in the intermediate region, but until they are, the northern and southern forms seem abundantly distinct.

== *Central spines similar and none of them specially elongated.*

a Ribs obtuse: flowers small (*2.5 to 3 cm. long*).

27. Echinocactus brevihamatus Engelm. Syn. Cact 271 (1856).

Globose-ovate, from a turbinate fibrous root, very dark green: ribs 13, deeply tuberculate-interrupted, the tubercles with a woolly groove extending to the base, where it expands into the flower-bearing areola: radial spines mostly 12, terete, straight, white or yellowish with dusky tips, 10 to 20 mm. long, the upper the longer, central spines 4 (rarely 1 or 2 additional ones), flattened, white with black tips, the 2 lateral ones divergent upward, straight or a little recurved, exceeding the radials, 28 to 44 mm. long, the uppermost one weaker, 16 to 20 mm. long, the lowest stoutest and darkest, porrect or deflexed, hooked downward, 18 to 20 mm, long: flowers 24 to 32 mm. long and 18 to 20 mm. wide when fully expanded, rose-color: fruit and seed unknown. (*Ill.* Cact. Mex. Bound. t. 18, 19)—Type, Wright and Bigelow specimens in Herb. Mo. Bot. Gard.

From Eagle Pass and the San Pedro River, Texas, southward into Coahuila and Nuevo Leon.

Specimens examined: TEXAS (*Bigelow* of 1852, 1853; *Wright* 86): NUEVO LEON (*Palmer* 1080).

The strong tubercles with the axillary flower-bearing areola connected with the spine-bearing areola by a woolly groove is such a striking Coryphanth character that it suggests a much closer relationship than the present position would imply.

It still further emphasizes the fact that the generic lines in *Cactaceæ* are of very uncertain definition.

20. Echinocactus scheerii Salm, Cact. Hort. Dyck. 155 (1850).

Globose or ovate, 3.5 to 5 cm. in diameter, from a long terete root: ribs 13, deeply tuberculate-interrupted, the tubercles ovate and grooved half way down radial spines 15 to 18 (or 11 to 13 in younger specimens), strictly radiant, 6 to 12 mm, long, about equal, setaceous and rigid, straight or a little recurved, white or straw-color with dark apex, the uppermost sometimes elongated; central spines 3 or 4, angled, brownish-black and white variegated, the upper ones straight, divergent upward, 12 to 24 mm, long, the lowest one shorter, porrect and hooked: flowers greenish-yellow, about 2.5 cm. long, much less in diameter: fruit small, green, almost naked: seeds large (about 2 mm. long), brown and minutely tuberculate. (*Ill.* Cact. Mex. Bound, t. 17)— Type unknown.

In the region about Eagle Pass, off the Rio Grande, Texas, and southward into northern Mexico.

Specimens examined: Texas (*Poselger* 5 of 1850; *Schott* of 1854): Mexico, no State recorded (*Weber* of 1866).

This species is also suggestive of a very close alliance with *Cactus*. The prominent tubercles are not arranged in very evident ribs, and the woolly groove extending half way down the tubercle is suggestive of *Cactus macromeris*. The relationship becomes still more emphasized if the seeds accompanying the Poselger specimens, from which the seed description is drawn, be really those oh *scheerii*. They are the only brown seeds I know in *Echinocactus*, and the cotyledons are much smaller than is usual in the genus.

b. Ribs acute: flowers large (*4 to 7.5 cm. long*).

29. Echinocactus pubispinus Engelm. Trans. St. Louis Acad. ii, 199 (1863).

Small, turbinate, oval, 5 cm. high, 2.5 to 3 cm. in diameter: ribs 13, somewhat oblique, compressed and tuberculate-interrupted: spines velvety-pubescent, at length naked, white with dusky apex; radial spines 5 or 6 below, it to 12 above, 2 to 8 mm. long, the upper 1 or 2 stouter and longer, straight or curved or hooked; central spine wanting, or occasionally a single stouter, longer (10 to 12 mm.) one, erect and always strongly hooked; flowers and fruit unknown.—Type, H Engelmann of 1859 in Herb. Mo. Bot. Gard.

Pleasant Valley, near Salt Lake Desert, Utah.

Specimens examined: Utah (*H. Engelmann* of 1859).

The species seems never to have been rediscovered.

30. Echinocactus sinuatus Dietr. Allg. Gart. Zeit. xix, 345 (1851).
Echinocactus setispinus sinuatus Poselger, Allg. Gart. Zeit. xxi, 119 (1853).
Echinocactus setispinus robustus Poselger, *l. c.*
Echinocactus treculianus Lab. Monogr. Cact. 202 (1858).

Globose, 10 to 20 cm. in diameter, bright-green: ribs 13, oblique, acute, and tuberculate-interrupted, the tubercles shortly grooved: radial spines 8 to 12, setiform and flexible, the 3 upper and 3 lower purplish-

brown and straightish (the lower ones sometimes more or less hooked), 2 to 2.5 cm. long, the 2 to 6 laterals more slender, longer. (2.5 to 3.5 cm.), often flattened, puberulent and whitish, sometimes flexuous or hooked central spines 4, puberulent, yellowish (or purplish-variegated), the 3 upper ones slender, flattened or subangled, erect and generally straight (rarely hooked), 4 to 5 cm. long, the lowest one much stouter, flattened or even channeled, straw-color, flexuous, more, or less hooked (sometimes straight), 5 to 10 cm. long: flowers yellow, 5 to 7.5 cm. long: fruit oval, green, 16 to 18 mm. long: seeds obovate or lenticular, shining and minutely punctate, 0.8 to 1.2 mm. long. (*Ill.* Cact. Mex. Bound. t. 74, figs. 11-14, seeds)—Type unknown, but probably Poselger of 1850 in Herb. Mo. Bot. Gard.

From the Rio Grande, near Eagle Pass, and the San Pedro and Pecos, Texas, westward to Arizona (near Comstock) and southward into Coahuila.

Specimens examined: Texas (*Wright* of 1852, on the Limpia, also 2, 223, 639): Arizona (*Nealley* of 1891, near Comstock): Coahuila (*Poselger* of 1850).

31. Echinocactus setispinus Engelm. Pl. Lindh. ii, 201 (1850).
Echinocactus setispinus setaceus Engelm. Pl. lindh. ii, 201 (1850).

Subglobose, 5 to 7.5 cm. in diameter: ribs 13, more or less oblique, often undulate or somewhat interrupted: radial spines 14 to 16, setiform and flexible, 10 to 20 mm. long, the uppermost (the longest) and lowest ones yellowish-brown, the laterals white; central spines 1 to 3, setiform and flexuous, dark, 24 to 32 mm. long: flowers funnelform, 4 to 7 cm. long, yellow, scarlet within: fruit globose, fleshy and red, about 8 mm. in diameter: seeds globose-obovate and oblique, strongly tuberculate, 1.2 to 1.6 mm. long. (*Ill.* Cact. Mex. Bound. t. 20, in part)— Type, Lindheimer of 1844 in Herb. Mo. Bot, Gard.

From the Brazos River, Texas, to the Rio Grande and southward into Tamaulipas. In mesquit thickets, etc.

Specimens examined: Texas (*Lindheimer* of 1844, 1850; *Wright* of 1848, 1850; *Hall* 234): Tamaulipas ("St. Louis Volunteers" of 1846): also specimens cultivated at St. Louis in 1846, presumably from the type.

This smaller form, which happened to be described first, is the eastern lowland representative of the next, extending from the lowlands of southeastern Texas to those of northeastern Mexico.

32. Echinocactus setispinus muhlenpfordtii (Fen.).
Echinocactus muhlenpfordtii Fen. Allg. Gart. Zeit. xv, 65 (1817).
Echinocactus hamatus Muhlenpf. Allg. Gart. Zeit. xvi, 18 (1848).
Echinocactus setispinus hamatus Engelm. Pl. Lindh. ii, 201 (1850)

Ovate-globose to oblong-cylindrical, larger, becoming 10 to 20 cm. high: radial spines fewer (10 to 12), stouter, larger (12 to 32 mm.); Central spine stouter, 24 to 32 mm. long, hooked: otherwise as the last. (*Ill.* Cact. Mex. Bound. t. 20, in part)—Type unknown.

Extending from San Antonio, Texas, westward to the region of Eagle Pass and El Paso and southward into Coahuila and Chihuahua.

Specimens examined: Texas (*Lindheimer* of 1846, near San Antonio; *Schott* of 1852, at Eagle Pass; *Bigelow* of 1852, 1854, at Eagle Pass; *Evans* of 1891, near El Paso; *Nealley* of 1891, near Camp Hudson): also specimens cultivated in St. Louis in 1840, 1847, 1849, 1855, 1859.

The two forms of this well known species seem worthy of separation. Although there is much intergrading where the two ranges overlap, the extreme eastern and northern forms seem almost specifically distinct from those of the extreme west.

+ + + Spines never hooked.

++ *Ribs very numerous, crowded, acutely compressed, and wavy: upper* (*usually radial*) *spine broad, thin and flat, the others teretish.*

33. Echinocactus phyllacanthus Mart.; Otto & Dietr. Allg. Gart. Zeit. iv, 201 (1836).

From globose to cylindrical, with depressed vertex, simple or proliferous, 6 to 8.5 cm. broad: ribs 40 to 55 (sometimes as few as 30), very much crowded and compressed, thin, acute, and very wavy, continuous or somewhat interrupted: radial spines 5 (sometimes 6 or 7), straight and spreading, the 2 lowest ones white, rigid, 4 to 6 mm. long, half as long as the 2 darker, angled, larger laterals, the uppermost spine thin and broad (3 mm.), channeled above, faintly annulate, flexible, grayish-pink, 15 to 25 mm. long; central spines none: flowers small, dirty white: fruit unknown.—Type unknown.

San Luis Potosi, to southern Mexico.

Specimens examined: San Luis Potosi (*Parry & Palmer* 269; *Eschanzier* of 1891): also specimens cultivated in Hort. Jacoby in 1857, and in Mo, Bot. Gard. in 1879.

The specific name refers to the thin and broad flexible "leaf-like" upper spine.

34. Echinocactus lancifer Dietr. Allg. Gart. Zeit. vii, 154 (1839).

Depressed, globose, 6 cm. in diameter, simple: ribs about 40, crowded and thin, very acute and wavy, scarcely interrupted: spines straw-color or very pale yellow; radials 7, the 4 lower ones short (5 to 6 mm.), rigid and recurved, the remaining ones annulate, angled, bulbous at base, the 2 laterals reflexed-spreading, 3 cm. long, shorter than but similar to the solitary annulate central spine (which is often flattened toward the apex), and half as long as the broad, thin, and scarcely rigid uppermost radial, which is channeled above: flowers deep rose-color: fruit unknown.—Type unknown.

Suit Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

35. Echinocactus spinosus Wegener, Allg. Gart. Zeit. xii. 66 (1844).
Echinocactus wippermanni Muhlenpf. Allg, Gart. Zeit. xiv, 370 (1846).
Echinocactus acifer Hopf. ex Foerst. Handb. Cact. 520 (1846).

Depressed-globose, 6 cm. in diameter, simple, densely woolly on the younger areolæ: ribs 36 to 40, oblique, crowded, thin and acute, very

wavy and tuberculate-interrupted: radial spines 14 to 22, setaceous and white, more or less rigid, 12 to 14 mm. long (upper much shorter), radiantly interwoven with those of adjacent clusters and densely covering the whole plant; central spines usually 4 (occasionally 1 to 3), grayish with dusky tips, faintly annulate, the lateral ones concave above, slightly longer than the terete lower one (which is sometimes wanting) and usually twice as long as the thin flat upper one: flowers and fruit unknown.—Type unknown.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891).

Two forms appear in the Eschanzier collection: one with about 20 radials and 4 centrals, of which the laterals are twice as long as the upper; the other with 11 radials and 3 centrals (the lowest one wanting), of which the laterals are not twice as long as the upper. In the original *wippermanni* the radials are 18 to 22, and the centrals 1 to 3.

36. Echinocactus coptonogonus major Salm, Cact. Hort. Dyck. 156 (1850).

Depressed, from a large indurated naked napiform base, 10 to 15 cm. across the top: ribs 10 to 15, acute from a broad base, more or less transversely interrupted and sinuous: spines 3, annulate, very stout and erect from deeply sunken areolæ, reddish when young, becoming ashy gray; upper spine stoutest, erect and straight, or slightly curved upward, flattened and keeled, and occasionally twisted, 4 to 5.5 cm. long, the two laterals erect-divergent, straight, or slightly curved, terete above and somewhat quadrangular below, 2 to 3 cm. long; all from an abruptly enlarged base: flowers not seen, but said to be small and white, with purplish median lines.—Type unknown.

San Luis Potosi to southern Mexico.

Specimens examined: San Luis Potosi (*Eschanzier* of 1891): also specimen growing in Mo. Bot. Gard., 1893.

The flat top of the plant seems covered with the stout, erect and interlocking sword-like spines, the central (and uppermost) one of each cluster of three being much the largest and rising perpendicularly. The spines rise from such deep-seated areolæ that the acute rib below each areola projects between the two lateral spines like a blunt tooth. *E. coptonogonus* differs from the variety in its munch smaller spines, which are five in number, the two lowest being very small and deflexed.

++ ++ *Ribs tuberculate-interrupted: spines dissimilar* (*one or more compressed*).

37. Echinocactus hystrichacanthus Lem. Cact. Gen. Nov. 17 (1839).

Globose conical, very stout, 6 dm, or more in diameter: ribs acute, repand and crenate: spines reddish-brown with golden tips, annulate; radials 8 to 10, radiant, unequal, subterete; centrals 4, the lowest porrect, angular and very long: flowers and fruit unknown.—Type unknown.

From Coahuila to Vera Cruz.

Specimens examined: Coahuila (*Thurber* of 1853; *Poselger* of 1855): Vera Cruz (*Poselger* of 1851): also specimens cultivated in Hort. Bot. Berol. in 1869.

38. Echinocactus bicolor Gal.; Pfeiff. Abbild. Cact. ii, t. 25 (1843-50).
Echinocactus bicolor pottsii Salm, Cact. Hort. Dyck. 173 (1850).
Echinocactus pottsii Scheer; Seem. Bot. Herald, 291 (1852-57), not Salm.

Globose-ovate, stoat, 3.5 to 10 cm. in diameter, sometimes becoming 20 cm. high: ribs 8, oblique and obtuse, compressed: lower radial spines and centrals variegated red and white; radials 9 to 17, spreading and recurved, slender and rather rigid, the lowest one shortest (1.5 to 2 cm.), the laterals longer (2 to 4 cm.), about equaling the 2 to 4 flat flexuous ashy upper ones; centrals 4, flat and flexuous, 3 to 6 cm. long, the uppermost thin and not longer than the erect and rigid laterals, the lowest very stout, porrect and very long: flowers funnelform, purple, 5 to 7.5 cm. long: fruit unknown. (*Ill.* l. c.)—Type unknown.

Chihuahua, Coahuila, and San Luis Potosi.

Specimens examined: Chihuahua (*Wislizenus* of 1846; *Potts* of 1850; *Evans* of 1891): Coahuila (*Palmer* 379): San Luis Potosi (*Palmer* of 1879; *Eschanzier* of 1891): "Northern Mexico" (*Poselger*): also specimens cultivated in Mo. Bot. Gard., 1881, and in Harvard Bot. Gard., 1882.

The radial spines usually number 9 to 11, but the Chihuahua specimens of Evans show 14 to 17, thus resembling *schottii*. The chief distinctive character between the two is found in the relative development of the of centrals, in *bicolor* the lowest, in *schottii* the uppermost being the most prominent. In the former, also, the uppermost central is not only more prominent than the laterals, but it is flat; while in the latter it is not only the most prominent but is carinate below.

39. Echinocactus bicolor schottii Engelm. Syn. Cact. 277 (1856).

Ovate or ovate-cylindric, 10 to 15 cm. high, 5 to 7.5 cm. in diameter: radial spines 15 to 17, straight; uppermost central broadest and longest (3 to 4 flat above and keeled below, straight or a little curved, the 3 others compressed or subterete, shorter and straight.—Type, Schott of 1853 in Herb. Mo. Bot. Gard.

"On cretaceous hills covered with chaparal," from near Mier on time Lower Rio Grande, Texas, to San Luis Potosi.

Specimens examined: Texas (*Schott* of 1853): San Luis Potosi (*Palmer* of 1882).

40. Echinocactus orcuttii Engelm. West Amer. Sci. ii, 46 (1886).

Cylindrical, 6 to 10.5 dm. high, 3 dm. in diameter, single or in clusters up to 18 or more, not rarely decumbent: ribs 18 to 22, often oblique: spines extremely variable, angled to flat, 1 to 7 mm. wide; radials 11 to 13, unequal, lowest and several laterals thinnest; centrals 4: flowers about 4 cm. long, deep-crimson in center bordered by light greenish-yellow: fruit globose and green, about 16 mm. in diameter: seeds (unripe) brown, tuberculate, 1.8 mm, long. (*Ill.* W. Amer. Sci. ii, 47)— Type, Orcutt of 1883 in Herb. Mo. Bot. Gard.

"Palm Valley, Lower California, 30 to 50 miles southeast of San Diego."

Specimens examined: Lower California (*C. R. Orcutt* of 1883).

41. Echinocactus limitus Engelm. MSS.

Globose and large, 3 dm. or more in diameter: ribs 21, oblique, thick and broad (compressed above), slightly interrupted: radial spines 12 to 16, about 2.5 cm. long, upper and lower most prominent, laterals Occasionally somewhat twisted; central spines 4, ashy-red, finely annulate, slightly recurved, upper and lower ones flat and broad, 1 to 4.5 cm. long, lateral ones angular and shorter: flowers campanulate, purplish-brown or dusky, 3.5 to 4 cm. long and broad: fruit green.—Type, Hitchcock of 1876 in Herb. Mo. Bot. Gard.

Along the "boundary line south of San Diego, with *Agave shawii* and *Cereus emoryi*."

Specimens examined: Boundary line between California, and Lower California (*G. M. Hitchcock* of 1876): also specimens cultivated at Shaw's Garden in 1876.

ǂ ǂ ǂ *Ribs deeply sulcate or tuberculate: spines similar* (*all flat or all terete*) *and interwoven with those of adjacent clusters* (*except in No.* 49).

= *Tubercles more or less confluent at base: flowers reddish* (*unless in No.* 47).

42. Echinocactus johnsoni Parry, Bot, King Surv. 117 (1871).

Oval. 10 to 15 cm. high: ribs 17 to 21, low, rounded, tuberculately interrupted, close-set, often oblique, densely covered with stoutish reddish-gray spines: radial spines 10 to 14, 1.5 to 3 cm. long, the upper longest; centrals 4, stouter, recurved, 3.5 to 4 cm. long: flowers 5 to 6.5 cm, long and wide, from deep red to pink: seeds reticulate-pitted.—Type, Johnson of 1870 in Herb. Mo. Bot. Gard.

Near St. George, Washington County, extreme southwestern Utah, and extending into southern Nevada (about Vegas Wash, *fide* Coville), and doubtless into adjacent California. (Inyo County).

Specimens examined: Utah (*Johnson* of 1870, 1874; *Parry* of 1870; *Palmer* of 1877).

Dr. Merriam says that this species is "eaten by the Paiute Indians, who peel it as we would a cucumber.»

43. Echinocactus johnsoni octocentrus, var. nov.

Central spines 8, strongly bulbous at base, the upper half red, recurved-spreading, 2.5 to 3 cm, long: flowers 3 cm. long and wide, pink.—Type, Coville & Funston 278 in Nat. Herb.

Rusting Springs Mountains, Inyo County, California.

Specimens examined: California (*Coville & Funston* 278 of 1891).

This variety seems to represent the extreme western form of the species.

44. Echinocactus unguispinus Engelm. Wisliz. Rep. 27 (1848).

Depressed-globose, 10 cm. in diameter, 7.5 cm. high: ribs 21, tuberculate-interrupted: radial spines about 21, slender, white, recurved, interwoven with those of adjacent clusters, the lower ones 12 to 20 mm. long, the upper ones 24 to 30 mm. long; central spines 5 (rarely 6), stouter, longer, horny, turned upward, the upper ones 24 to 36 mm. long, the lowest one very stout, brown-tipped, curved downward,

20 to 24 mm. long: flowers (from shrivelled specimens) about 2.5 cm. long and probably pale-red: fruit unknown. (*Ill.* Cact. Mex. Bound. t. 35, figs. 6-8)—Type, Wislizenus of 1847 in Herb. Mo. Bot. Gard.

Chihuahua, about Pelayo.

Specimens examined: CHIHUAHUA (*Wislizenus* of 1847).

"The large recurved spines, especially the stoutest central one, which is of a bluish horn-color, with a brown point, and is curved and bent downward like a large fang, cover the whole surface of the plant, and give it a very pretty appearance." The fruit and seed characters of the original description were taken from fruits collected by Dr. Gregg about San Lorenzo (Chihuahua), which Dr. Engelmann at the time did not doubt belonged to this species, but which afterwards proved to belong to *E. uncinatus*. The prominent tubercles have the woolly groove characteristic of Coryphanths. This species has been referred to *intertextus*, but is probably distinct.

45. Echinocactus intertextus Engelm. Syn. Cact. 277 (1856).

Ovate-globose, 2.5 to 10 cur, high: ribs 13, acute, somewhat oblique, tuberculate-interrupted, the tubercles with a woolly grove: spine short and rigid, reddish from a whitish base and with dusky tips; radials 16 to 25, closely appressed and interwoven, the upper 5 to 9 setaceous and white, straight, 5 to 12 mm. long, the laterals more rigid and a little longer (8 to 14 mm.), the lowest, stout and short (4 to 8 mm.), a little recurved; centrals 4, the 3 upper ones turned upward and exceeding the radials and interwoven with them (10 to 18 mm. long), the lower one very short (2 to 4 mm.), stout and porrect: flowers about 2.5 cm. long and wide, purplish: fruit globose, dry, about 8 mm. in diameter: seeds reniform, slightly rough and shining, about 2 mm. long. (*Ill.* Cact. Mex. Bound. t. 34)—Type, specimens of Wislizenus and Wright in Herb. Mo. Bot. Gard.

From the Pecos River, Texas, westward to El Paso and southward into Chihuahua.

Specimens examined: TEXAS (*Wright* of 1851, 1852; *Engelmann*): CHIHUAHUA (*Wislizenus* of 1846).

46. Echinocactus intertextus dasyacanthus Engelm. Syn. Cact. 277 (1856).

Ovate or conical, becoming 15 cm, high: spines slender, longer, more ashy; radials 19 to 25, setaceous and in many series, 12 to 16 mm. long, the 7 to 9 upper ones more slender, shorter, whitish, and fascicled: centrals scarcely stouter, 18 to 22 mm, long, the upper 3 exceeding the rest, the lowest one porrect and but little shorter. (*Ill.* (Cact. Mex. Bound. t. 35, figs. 1-5)—Type, specimens of Wright in Herb. Mo. Bot. Gard.

From the region about El Paso, Texas, and contiguous New Mexico, southward into Chihuahua awl San Luis Potosi.

Specimens examined: TEXAS (*Lindheimer* of 1814; *Wright* of 1851, 1852; *Engelmann*: *Lemmon* of 1881): NEW MEXICO (*Evans* of 1891, at Rincon; *Nealley* of 1891): CHIHUAHUA (*Evans* of 1891, at Juarez): SAN LUIS POTOSI (*Eschanzier* of 1891).

Very closely resembles *Cactus dasyacanthus* and might be mistaken for it.

47. Echinocactus erectocentrus, sp. nov.

Broadly ovate and simple, with very flat base, 8 cm. high: ribs 21, oblique, tuberculate-interrupted: spines terete, rigid, interwoven; radials 14, pectinate-appressed below, spreading above, bulbous at base, 10 to 12 mm. long, the 4 or 5 lower ones shorter, with white base and pink tips; the solitary central from the upper part of the areola, longer (20 mm.), erect and slightly curved, darker: flowers yellow (?) fruit unknown.—Type in Nat. Herb. and Herb. Coulter.

Near Benson, Arizona, and also near Saltillo, Coahuila.

Specimens examined: Arizona (*Evans* of 1891); Coahuila (*Weber* of 1869).

The plant is characterized by its very flat base, on which the spines are persistent even to the origin of the root, and by uniformly erect centrals. It is nearly related to *E. horripilus* Lem., to which the Webber plant has been referred, but judging by descriptions of that species, no such reference can be made on account of its much smaller spines, more numerous radials, strictly erect centrals, and always simple habit. It seems so unlikely that this species would be found at such widely-separated stations as Benson, Arizona, and Saltillo, Coahuila, that there must be a suspicion of shifted labels on the part of one of these collectors. Mr. Evans's only Mexican collections are from Chihuahua just across the Rio Grande from El Paso, and it is barely possible that this plant should bear a Chihuahua label, but this is only suggested by the location of the Webber station.

== *Tubercles distinct* (*as in* Cactus): *flowers yellowish or whitish* (*in No. 50 some times shading to purple*).

48. Echinocactus sileri Engelm. MSS.

Globose: ribs 13, prominent, densely crowded, with short rhomic-angled tubercles: radial spines 11 to 13, white; central 3, black with pale base, 18 mm. long, the upper one slightly longer: flowers scarcely 2.5 cm, long, straw-colored: fruit unknown.—Type, Siler of 1883 in Herb. Mo. Bot. Gard.

Cottonwood Springs and Pipe Springs, southern Utah.

Specimens examined: Utah (*A. L. Siler* of 1883).

49. Echinocactus papyracanthus Engelm. Trans. St. Louis Acad. ii, 202 (1863). *Mamillaria papyracantha* Engelm. Pl, Fendl. 49 (1849).

Ovate, about 5 cm. high and 3.5 cm. in diameter, proliferous; ribs 8, oblique, completely broken up into tubercles, of which the lower ones are proliferous: all the spines flat, chartaceous, flexible, and silky-white; radials 8, short (3 to 4 mm.), all directed laterally or downwards; centrals 3 or 4, much longer, the 2 or 3 upper ones curved upwards, 12 to 18 mm. long, the single lower one longer (20 to 28 mm.) and broader (2 to 2.5 mm.), turned downwards: flowers 2.4 to 2.6 cm. long and slightly broader, pearly white: fruit unknown.—Type, Fendler 279 of 18'7 in Herb. Mo. Bot, Gard.

"In a valley between the lower hills," near Santa Fe, New Mexico, "in loose red sandy though fertile soil."

Specimens examined: New Mexico (*Fendler* 279 of 1847; *Bandelier* of 1882)

Collected hot once by Fendler, and 35 years later, near the same station, by Bandelier; reported by Marcus E. Jones in *Zoe*, iii, 301 as "scarce everywhere," but with no further statement as to station. "Spines silky-white, shining, of the constituency of stiff paper." The generic relationship as yet rests only on the fact that the floral and spiniferous areolæ join at the apex of the young tubercles; otherwise the whole appearance of the plant is that of a *Cactus*.

50. Echinocactus simpsoni, Engelm. Trans. St. Louis Acad. ii. 197 (1863).

Subglobose or depressed, turbinate, at base, simple, often clustered, 7.5 to 12.5 cm. in diameter: ribs 8 to 13, only indicated by the spiral arrangement of the prominent tubercles, which are 12 to 16 mm, long somewhat quadrangular at base, and cylindric above: exterior spines 20 to 30, slender, rigid, straight, whitish, 8 to 12 mm. long, with 2 to 5 additional short setaceous ones above; interior spines 8 to 10, stouter, yellowish and reddish brown or black above, erect-spreading, 10 to 14 mm. long; no truly central spine: flowers 16 to 20 mm. long and nearly as broad, yellowish-green to pale-purple: fruit green and dry, 6 to 7 mm, long and almost as broad: seeds black, obliquely obovate tuberculate, 3 mm. long. (*Ill.* Cact. Simpson's Exped. t. 1, 2.)—Type, Engelmann of 1859 in Herb. Mo. Bot. Gard.

In high mountain valleys and on rocky ridges, from the eastern slope of the Rocky Mountains of Colorado westward through Utah and into the mountains of Nevada.

Specimens examined: Colorado (*Parry* of 1860, 1862; *Hall & Harbour* of 1862; unnamed collector in 1871; *Greene* 131; *Palmer* of 1877; *Martindale* of 1878; *Patterson* 211): Utah (*H. Engelmann* of 1859; *G. Engelmann* of 1874; *Johnson* of 1883).

51. Echinocactus simpsoni minor Engelmann. Trans. St. Louis Acad. ii, 197 (1863).

The whole plant, tubercles, spines, flowers, and seeds smaller.—Type, Hall & Harbor of 1862 in Herb. Mo. Bot. Gard.

Mountains of Colorado.

Specimens examined: Colorado (*Hall & Harbour* of 1862; *Wolf & Rothrock* 54 of 1873; *H. Engelmann* of 1874).

52. Echinocactus simpsoni robustior, var. nov.

Larger in every way: tubercles much larger: exterior spines 16 to 20, 18 to 23 mm, long interior spines about 10, 20 to 28 mm, long.— Type, Watson of 1868 in Herb. Mo. Bot. Gard.

From the Humboldt Mountains of Nevada, northward to Washington (?).

Specimens examined: Nevada (*Watson* of 1868): Washington (*Brandegee* 793; *Tweedy* of 1882).

While the specimens of Brandegee and Tweedy seem referable to this form, the occurrence of an *Echinocactus* so far north calls for a more careful inquiry as to the really indigenous character of the material.

A peculiar monstrosity of *E. simpsoni* and its varieties is that which is styled "snake cactus" or "brain cactus." So far as it has come to my observation it is found among the mountains of Colorado, and is a modification of *E. minor*. It consists

of a hemispherical mass 15 cm. or more in diameter, with brain-like convolutions formed by the winding of a single ridge, bearing no resemblance to the normal plant. It is usually proliferous about the border, and I have seen develop from it the normal forms. There are also all intermediate forms between this and the type form. There occurs also a cone-like form of this monstrosity 10 to 11 cm. high, found in the same region, but, apparently developed from regular *simpsoni*. I have seen, also, the same "brain" form assumed by *Cactus niveus aristatus* in specimen cultivated in Mo. Bot. Gard. It is wry probable that this curious habit is far more general among *Cacti* and *Echinocacti* than shown by this record.

Echinocactus californicus Monville, Cat. (1846), was described from seedlings whose identity and native country are so very uncertain that no further statement can be made concerning them.

ARTIFICIAL KEY TO THE SPECIES.

The following key, based upon spine characters, may be useful in case of incomplete material. Forms found within the boundaries of the United States are printed ill italics. The species and varieties are indicated only by their specific or varietal names, and the numbers refer to the serial numbers of the synoptical presentation.

* *Some of the spines hooked.*

+– *Central spines none.*

pubispinus (29).

+– +– *Central spines solitary.*

spine annulate.
emoryi (11).
Spines not annulate.
Some radials and the central hooked.
wrightii (23), *pubispinus* (29).
Only the central hooked
Muhlenpfordtii (32).

+– +– +– *Central spines 4.*

++ *Some or all of the spines annulate.*

Radials 8 to 11.
All the spines annulate.
peninsulæ (10).
Only the central annulate.
longihamatus (20), *brevispinus* (21).
Radials 12 to 14.
cylindraceus (9), *hamatocanthus* (19).
Radials 18 to 28.
wislizeni (14).

++ ++ *None of the spines annulate.*

Radials 7 or 8.
Only a central hooked.
whipplei (25).
Some radial and central hooked.
uncinatus (22), *sinuatus* (30)
Radials 9 to 11.
spinosior (20), *scheerii* (28), *sinuatus* (30).
Radials 12 to 18.
brevihamatus (27), *scheerii* (28), *sinuatus* (30).

+ + + + *Central spines 5 to 8.*

Radials 6 to 10: centrals annulate.
cornigerus (13).
Radials 12 to 14: centrals annulate.
hamatocanthus (19).
Radials 20: no annulate spines.
polyancistrus (24).

* * *None of the spines hooked.*

+ *Central spines none.*

Ribs 8 to 10, broad.
horizonthalonius (5).
Ribs 40 to 55, very thin and wavy.
phyllacanthus (33).

+ + *Central spines solitary.*

Radials 5 to 9.
Ribs 8 to 10, broad.
horizonthalonius (5), ingens (6).
Ribs 13 to 21.
texensis (4), *emoryi* (11), rectispinus (12).
Ribs 40, very thin and wavy.
lancifer (34).
Radials 14 to 22.
Ribs 13.
setispinus (31).
Ribs 21.
erectocentrus (47).
Ribs 36 to 40.
spinosus (35).

+ + + *Central spines 2 or 3.*

Radials none: ribs 10 to 15.
major (36).
Radials 8: ribs 8.
papyracanthus (49).
Radials 11 to 13: ribs 13.
sileri (48).
Radials 14 to 16: ribs 13.
setispinus (31).

+ + + + Central spines 4.

Ribs 8.
Radials 8 to 10.
hystrichacanthus (37), bicolor (38), *papyracanthus* (49).
Radials 11 to 17.
bicolor (38), *schottii* (39).
Ribs 13 to 21.
Spines all rigid and annulate.
polycephalus (1), *xeranthemoides* (2), parryi (3), *viridescens* (8),
At least some of the radials setaceous or bristly.
lecontei (15), jonesii (16).
Spines dissimilar (one or more flattened).
orcuttii (40), *limitus* (41).
Spines similar (all flat or all terete), closely interwoven.
johnsoni (42), *intertextus* (45), *dasyacanthus* (46).
Ribs 36 to 40.
spinosus (35).

+ + + + + *Central spines 5 to 7.*

Radials 3.
pilosus (17).
Radials 7 to 9.
pringlei (18).
Radials 21.
unguispinus (44).

+ + + + + + *Central spines 8 to 10.*

Radials 10 to 14.
octocentrus (43).
Radials 16 to 30.
simpsoni (50), *minor* (51), *robustior* (52).

* * * *spines entirely wanting.*

myriostigma (7).

GEOGRAPHICAL DISTRIBUTION.

The genus *Echinocactus* has a strong development within the United States, but has no such northern extension as *Cactus*, its extreme northern limit being in the southern borders of Colorado, Utah, and Nevada, unless we except the possible occurrence of *E. simpsoni robustior* in Washington. With more careful exploration, especially of the Great Basin region, other forms will be discovered, but as recognized in this revision, 36 are known within our borders, 15 of which are restricted to the United States. Owing to the insufficiency of knowledge no statement can be made concerning the distribution of Mexican forms, and nothing very satisfactory concerning those occurring within the United States.

No *Echinocactus* has such an east and west distribution along our borders as have some species of the genus *Cactus*, the only one approaching any such distribution being *cylindraceus*, which seems to be a Lower Californian form that has extended from south eastern California to southern Utah and southwestern Texas, although it may have an equally wide Mexican distribution. All the other species seem to have extended northward along comparatively narrow lines, and indicate in a general way their Mexican origin. Other Lower Californian forms which extend within our boundaries are: *peninsulæ*, which only reaches the southern borders of California; and *emoryi* and *lecontei*, which are also Sonoran, time former ranging northward in the lower basin of the Colorado (extreme southeastern California and adjacent southwestern Arizona), the latter extending farther northward to southern Nevada and southern Utah. The occurrence of forms in Lower California which seem best referred to *wislizeni* is somewhat puzzling, as otherwise that species has been found restricted to a much more eastern distribution, one of Chihuahuan origin. The only pure Sonoran form that reaches us, so far as recorded, is *polycephalus*, which extends northward through the lower basin of the Colorado to southern Nevada, and southern Utah, an extension resembling that of *Lecontei*. Types from Chihuahua and Coahuila have extended into Texas, usually ranging

eastward throughout its southern borders; *horizonthalonius*, *intertextus*, and *dasyacanthus* are confined to the very usual narrow northern extension between the Pecos in Texas and the Upper Rio Grande in New Mexico; *longihamatus*, *brevihamatus*, and *scheerii* are forms which belong to the region of the "Great Bend" of the Rio Grande; while *wrightii*, *muhlenpfordtii*, and *texensis* are found throughout the southern border of the State, the first extending from El Paso to the mouth of the Rio Grande, the second from El Paso to San Antonio, the third from the Pecos to the Colorado of Texas. The last three species, doubtless, have an equally wide east and west Mexican distribution. In opposition to this usually eastern extension of Chihuahuan and Coahuilan forms, the three following extend westward from the Pecos-El Paso region into Arizona, the first reaching southern Utah: *wislizeni*, *sinuatus*, and *erectocentrus*. From the low country of eastern Mexico *setispinus* and *schottii* reach the basin of the Lower Rio Grande, the former extending as far northward as the Brazos.

The fifteen forms said to be restricted to the United States doubtless include some that are Mexican, and the statements here made are simply based upon the present record. Naturally the region of highest northern extension shows the greatest number of these peculiar forms, and such extension has evidently been most favored by the conditions of the Colorado basin, Nevada, Utah, and Colorado, having been reached through this avenue. The most prominent northern type is *simpsoni* and its varieties *minor* and *robustior*, the species ranging through Colorado, Utah, and Nevada., *minor* being restricted to Colorado and *robustior* to Nevada, with a possible high northern extension. In the region comprising the southwestern corner of Colorado, southern Utah, southern Nevada, northern Arizona, and adjacent California, we find the largest display of form, that do not seem to have Mexican representation. In addition to the three already mentioned, there are *xeranthemoides, polyancistrus, whipplei, spinosior, pubispinus, johnsoni, octocentrus*, and *sileri*, making eleven of our fifteen forms. Of the remaining four, *Hamatocanthus* and *brevispinus* belong to the "Great Bend" region of Texas; *viridescens* is a form of extreme southern California, and the peculiar *papyracanthus*, restricted so far as known to New Mexico in the neighborhood of Santa Fé. The species *orcuttii* and *limitus* are as yet recorded only from the boundary between California and Lower California; but doubtless they with *viridescens* will be found to have a Lower Californian distribution.

5. CEREUS Mill. Gard. Dict. ed. 8 (1768).

Plants of various habit (globose to cylindrical, trailing, climbing, or erect), sometimes very large, with spine-bearing ribs: flower-bearing areolæ close above fully developed spine-bearing areolæ: ovary bearing scales which are naked or woolly and often spiny in the axils: fruit succulent: seeds almost without endosperm: embryo mostly hooked,

with short or foliaceous cotyledons.—*Echinopsis* Zucc. (1837); *Cephalocerei* Pfeiff. (1838). *Cephalophorus* Lem. (1838); *Pilocereus* Lem. (1839); *Echinonyctanthus* Lem. (1839); *Echinocereus* Engelm. (1848); *Cleistocactus* Lem. (1861).

It is often perplexing to distinguish between the low forms of *Cereus* and *Echinocactus* in the absence of complete material. But the fact that the flowers of *Echinocactus* are developed just above the nascent spine-bearing areolæ and those of *Cereus* just above the fully matured branches of spines, results in making the flowers of the one terminal and of the other lateral. Even in the absence of flowers it is very seldom that the position and age of flower-bearing areolæ can not be easily determined.

Our information with regard to the large species of *Cereus* even those which are of economic value throughout Mexico, is very scanty. In 1869 Dr. Engelmann visited Dr. Weber in Paris, who had collected Cacti extensively in central and southern Mexico, and had made large accumulation of notes. These notes are now to be found among those of Dr. Engelmann, and although often incomplete, end even incoherent, in the characterization of species, I have ventured to include them.

I. Echinocereus. *Stems oval or cylindrical: seeds tuberculate: embryo straight.*

* *Stems oval: ribs numerous (10 to 21): spines numerous (10 to 21), pectinate.*

+– *Flowers green: central spines 1 to 3 cm. long; radials not crowded..*

1. Cereus viridiflorus Engelm. Wisliz. Rep. 7 (1849).
Echinocereus viridiflorus Engelm. Wisliz. Rep. 7 (1848).

Subglobose, simple or sparingly branched, 2.5 to 7.5 cm. high: ribs 13, acute, scarcely interrupted: radial spines 12 to 18 (with 2 to 6 setaceous upper ones), straight and strictly radiant, 2 to 6 mm. long, laterals longest and reddish brown, the rest white (rarely purple); central none or a single stout, straight or curved (rarely a second more slender one) 12 to 14 mm. long, variegated purple and white: flowers 2.5 cm. long and wide, greenish-brown outside, yellowish-green within; petals obtuse: fruit elliptical and greenish, 10 to 12 mm. long: seeds 1 to 1.2 mm. long, tuberculate.—Type, Wislizenus 514 of 1846 in Herb. Mo. Bot. Gard.

From the Laramie Mountains of southern Wyoming, southward through Colorado to eastern New Mexico and the high plains of northwestern Texas. The most northern *Cereus*.

Specimens examined: Wyoming (*Hayden* of 1856, at base of Laramie Mts.): Colorado (*Hall & Harbour* 69 of 1861; *Scoville* of 1869; *Greene* 132; *Martindale* of 1879; *Jones* 103): New Mexico (*Fendler* 278; *Wright*, near Santa Fé; *Evans* of 1891): Texas (*Wislizenus* 514 of 1846; *Wright* of 1819; *Bigelow* of 1853): also specimens cultivated in Mo. Bot. Gard. in 1861; and growing in same garden in 1892 and 1893.

This and the following variety are exceedingly variable as to color of radial spines and presence of one or two centrals. Some clusters of spines may be all red, others all white, others variegated; and in the spring the bright purple and white spines are far more showy than the inconspicuous greenish flowers, the lines of color often

occurring in bands about the plant, in the Evans specimen, from Brewster County New Mexico, the ribs are 14, the radial spines as many as 20, and the centrals 3 or 4, a form which was also seen among the plants cultivated in the Missouri Botanical Garden.

2. Cereus viridiflorus tubulosus. nom. nud.
Cereus viridiflorus cylindricus Engelm. Syn. Cact. 278 (1856), not *C. cylindricus* Haw.

Larger and becoming cylindrical, 7.5 to 20 cm. high and 2.5 to 5 cm. in diameter: spines 4 to 12 mm. long; the central (when present) longer (12 to 20 mm.) and stouter: petals acute. (*Ill.* Cact. Mex. Bound. t 36)—Type, Wright of 1851 in Herb. Mo. Bot. Gard.

Southwestern Texas, from the Pecos to the region about El Paso.

Specimens examined: Texas (*Wright* of 1851; *Evans* of 1891): also numerous specimens in cultivation.

3. Cereus chloranthus Engelm. Syn. Cact. 278 (1856).

Cylindrical, simple or sparingly branching at base, 7.5 to 25 cm. high, 3.5 to 5 cm. in diameter: ribs 13 to 18, somewhat interrupted: radial, laxly radiant and pectinate, setiform and white, 4 to 10 mm. long, the lower laterals longest (8 to 10 mm.) and often purplish at apex, upper ones shortest, 5 to 10 additional shorter setaceous ones above; centrals 3 to 6 (none in young plants), the two upper shorter (12 mm), divergent upward and mostly purplish, the 1 to 3 lower ones longer (18 to 30 mm.), divergent and deflexed, white: flowers 2.5 cm. long, yellowish-green, always low down on the plant (usually below the middle): fruit subglobose, 1.2 cm. in diameter or less, spiny; seeds orbicular and compressed, 1.0 to 1.2 mm, in diameter, confluent-tuberculate. (*Ill.* Cact. Mex. Bound. t. 37 ad 38)—Type, Wright and Bigelow specimens in Herb. Mo. Bot. Gard.

Common on stony hills about El Paso, Texas, and in adjacent New Mexico.

Specimens examined: Texas (*Wright* of 1851 and 1852; *Bigelow* of 1852; *G. R. Vasey* of 1881, El Paso; *Le Conte* 12; *Briggs* of 1892; *Trelease* of 1892): New Mexico (*Evans* of 1891: *Nealley* of 1891): also growing in Missouri Botanic Garden in 1892 and 1893.

+– +– *Flowers yellow: central spines 5 to 6 mm. long: radials crowded.*

4. Cereus dasyacanthus Engelm. Pl. Fendl. 50 (1849).
Echinocereus dasyacanthus Engelm. Wisliz Rep. 46 (1848).

Ovate or subcylindric, 12.5 to 30 cm. high, 5 to 10 cm. in diameter, simple or sparingly branched at base, subcespitose: ribs 15 to 21, straight or oblique, somewhat interrupted, with eroded areolæ: spines 20 to 30, straight, rigid, stellately spreading, porrect in every direction and interlocked, ashy-gray or reddish (white in weaker plants); radials 16 to 24, laterals longest (12 to 14 mm.) and somewhat bulbous at base, upper shorter (6 to 8 mm.) and slender, lower about 10 mm, long and

stoutest; centrals 3 to 8, stouter, deflexed or porrect in every direction: flowers near the vertex, 7.5 cm. or more long, yellow: fruit subglobose and spiny, green or greenish-purple, 2.5 to 3.5 cm. in diameter: seeds subglobose, 1.2 long, strongly tuberculate. (*Ill.* Cact. Mex. Bound. t. 39, 40, 41, f. 1 and 2)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

Common about El Paso, Texas, thence down to the canyon of the Rio Grande, and west into Arizona.

Specimens examined: Texas (*Wislizenus* of 1846; *Wright* of 1849, 1850, 1851, 1852, and 1857; *Bigelow* of 1852; *Miller* of 1881; *G. R. Vasey* of 1881, El Paso; *Evans* of 1891; *Trelease* of 1892): Arizona (*Lemmon* of 1881; *Wilcox* of 1894, Ft. Huachuca): also growing in Missouri Botanical Garden in 1892 and 1893.

The whole plant is densely covered by the innumerable ashy-gray or reddish spines. When fully ripe the fruit is said to be "delicious to eat, much like a gooseberry."

5. Cereus dasyacanthus neo-mexicanus, var. nov.

Differs in the remote areolæ (1 to 1.5 cm. apart), fewer spines (11 radials and 4 centrals), which are much stouter, 10 to 12 mm. long, radiating, scarcely (if at all) pectinate, and larger seed (1.5 mm. in diameter).—Type, Wright 366 in Herb. Mo. Bot. Gard.

Southeastern New Mexico.

Specimens examined: New Mexico (*Wright* 366).

6. Cereus ctenoides Engelm. Cact. Mex. Bound. 31 (1859).

Ovate, subsimple, 5 to 10 cm. high, 3.5 to 6.5 cm. in diameter: ribs 15 or 16, usually oblique and somewhat interrupted, with crowded areolæ (2 mm, apart): spines rigid and interlocked., with bulbous base, whitish and at length ashy, 2 to 8 mm. long; radials 14 to 22, pectinate, laterally compressed and often recurved, lowest 2 to 4 mm., lateral 6 to 8 mm., uppermost 1 to 2 mm. long; centrals 2 or 3 (rarely 4), stout, in one longitudinal series, 2 to 6 mm. long: flowers 5.5 to 8 cm. long and broad, bright-yellow with a light-green center: ovary spiny, (*Ill*, l. c. t. 42)—Type, the Wright and Bigelow material in Herb. Mo. Bot. Gard.

From Eagle Pass, Texas, to the Pecos, and southward into Coahuila and Chihuahua.

Specimens examined: Texas (*Bigelow* of 1853, at Eagle Pass; *Wright*, at the Pecos): Coahuila (*Bigelow* of 1853, about Santa Rosa): Chihuahua (*Pringle* 254 of 1885, distributed as *dasyacanthus*.)

A specimen, probably from Oracle, Arizona (Evans of 1891), seems to belong with these forms, but is hardly referable to any of them. It is simple or proliferous ovate-cylindrical, 10 to 20 cm. high, with 10 tuberculate ribs, red-tipped spines, 10 to 12 radials 6 to 10 mm. long (the upper much shorter), mostly 3 darker-red centrals, the lower one stouter and slightly deflexed equaling the radials, the 2 upper usually much shorter. It is possibly a form of *ctenoides*, but the centrals are not in one longitudinal series. There is some uncertainty also as to its station, so that this possible western extension of *ctenoides* can not be affirmed.

+ + + *Flowers red: radial spines crowded.*
++ *Central spines very short* (*longer in* radians) *or none.*

7. Cereus cæspitosus Engelm. Pl. Lindh. 247 (1845).
Echinocereus cæspitosus Engelm. Wisliz. Rep. 26 (1848).
Cereus concolor Schott, Engelm. Pacif. R. Rep. iv, errata and notes, ii (1856).
Cereus cæspitosus minor and *major* Engelm. Syn. Cact. 280 (1856).

Ovate-globose to ovate-cylindrical, usually 2.5 to 5 cm. in height and diameter (rarely as much as 12.5 to 15 cm. high and 5 to 9 cm. in diameter), cespitose (often 5 to 12 heads) or sometimes almost or quite simple: ribs 12 or 13, straight, with confluent tubercles and approximate areolæ: spines white (sometimes rosy or brown), somewhat or not at all interlocked; radials 20 to 30, pectinate, straight or subrecurved, the upper and lower shorter, the lateral longer (4 to 8 mm.); centrals none, or rarely 1 or 2 very short ones: flowers rose-purple, 5 to 7.5 cm. long and broad, the tube with numerous extra-axillary pulvini bearing brown or black bristles: fruit green, ovate, 18 to 20 mm. long: seed obliquely obovate, strongly tuberculate, black, 1.2 to 1.4 mm, long, sometimes almost globose. (*Ill.* Cact. Mex. Bound. t. 43 and 44)—Type, Lindheimer 402 of 1845 in Herb. Mo. Bot. Gard.

From the Canadian and Arkansas rivers, in Indian Territory, southward through Texas east of the Pecos, and into the states of Mexico east of Chihuahua. Apparently the most eastern *Cereus*, with a western limit near the 100th meridian.

Specimens examined: Texas (Lindheimer 402 of 1845 and 1851; *Wright* of 1849 and 1850; *Smith* of 1856; *Hall* 235; *Miss Soulard* of 1883): Coahuila (Mo. Bot. Gard. of 1890): San Luis Potosi (*Eschanzier* of 1891): also cultivated in Harvard Botanic Garden in 1846 and 1849; and in Missouri Botanic Garden in 1845 and 1846.

This species is said by Prince Salm to be cultivated in Europe under the name *Echinopsis reichenbachiana*, and to be confused with *pectinatus*. The Eschanzier material front San Luis Potosi often has 3 central spines, but *cæspitosus* is distinguished from its allies by having several lower spines much shorter and weaker than the laterals.

8. Cereus cæspitosus castaneus Engelm. Pl. Lindh. 203 (1850).

Differs in having chestnut-brown or reddish spines.—Type, Lindheimer of 1847 in Herb. Mo. Bot. Gard.

Southeastern Colorado to eastern Texas.

Specimens examined: Texas (*Lindheimer* of 1847 and 1852; *Hall* 235 of 1875, near Austin; *Trelease* of 1892): Colorado (*Brandegee* of 1875): also cultivated in Harvard Botanic Garden in 1882.

9. Cereus pectinatus (Scheidw.) Engelm. Pl. Fendl. 50 (1849).
Echinocactus pectinatus Scheidw. Bull. Brux. v, 492 (1838).
Echinocactus pectiniferus Lem. Cact. Nov. 25 (1838).
Echinocereus pectinatus Engelm. Wisliz. Rep. 25 (1848).
Cereus pectiniferus Lab. Mon. Cact. 320 (1858).

Ovate-cylindrical, simple, 17 to 18 cm. high: ribs 18 to 23, tuberculate-interrupted, with approximate areolæ: radial spines 16 to 20, subrecurved, appressed-pectinate, white with rosy tip, upper and lower

shorter (4 mm.), lateral longer (8 mm.); centrals 2 to 5 (mostly 3), in a single longitudinal series, very short (1 to 2 mm): flowers purple, 7.5 cm. long and broad, with red or purple spiny bristles on tube: fruit ovato-globose, spiny: seed tuberculate. (*Ill.* Hook. Bot. Mag. t. 4190)—Type unknown.

Chihuahua, Coahuila, and southward.

Specimens examined: CHIHUAHUA (*Wislizenus* of 1847): COAHUILA (*Palmer* of 1880): NUEVO LEON (*Poselger* of 1850 and 1855).

It has been suggested that this is identical with its northern representative *cæspitosus*; but *pectinatus* is always a larger plant, generally much larger, is always simple, has more numerous ribs, fewer radial spines, and constant centrals.

10. Cereus pectinatus rigidissimus Engelm. Syn. Cact. 279 (1856).

Plant 10 to 20 cm. high, 5 cm. in diameter: ribs 20 to 22: radial spines 15 to 22, subulate from a bulbous base, very stout and rigid, variegated white, yellow, or reddish, interlocking, upper 3 to 6 setaceous, laterals 12 to 16 (6 to 9 mm. long), lowest one scarcely shorter (4 mm.); centrals none.—Type, Schott 6 in Herb. Mo. Bot. Gard.

From southwestern Texas west to Arizona and southward into Chihuahua and Sonora.

Specimens examined: TEXAS (*Nealley* of 1891; *Trelease* of 1892): ARIZONA (*G. R. Vasey* of 1881, Pantana; *Lemmon* of 1882, Huachuca Mts.; *Pringle* of 1884, distributed as *pectinatus*; *Palmer* 447 and 175 of 1890, Ft. Huachuca, the latter distributed as *cæspitosus*, and the former accompanied by seeds of *Echinocactus intertextus; J. W. Toumey* of 1892; *T. E. Wilcox* of 1894, Ft. Huachuca): CHIHUAHUA (*Wislizenus* 257 of 1847): SONORA (*Schott* 6): also growing in Mo. Bot. Gard. 1893.

Distinguished by the greater stoutness and rigidity of its radial spines and by the absence of centrals. Mr. Schott, who collected it in Sonora, in the Sierras of Pimeria Alta and westward, says that the local name is "cabeza del viejo." Apparently a very common form in southern Arizona. The spines are very variable in coloration. The plant always appears parti-colored, a pink and white, or red and yellow and white, or even dark red with areas of dark brown, or even jet black. Some of the forms look very much like *cæspitosus*, but the habit is different, and that species ranges much further east. Besides, *pectinatus rigdissimus* has stout radials, much interlocking with each other on the same rib, and with those of adjoining ribs. Pringle's Arizona specimens have remarkably long radials, the laterals reaching 15 mm., and the lowest 10 mm.

11. Cereus pectinatus centralis, var. nov.

Plant 6 to 8 cm. high: centrals usually 4, the lowest very short (3 to 4 mm.) and porrect, the upper two or three as long as the radials (sometimes longer), and recurved upward.—Type, Wilcox of 1894 in Nat. Herb.

Arizona, near Fort Huachuca.

Specimens examined: ARIZONA (*T. E. Wilcox* of 1891).

In a casual examination the short porrect central looks as if it were solitary. The variety *spinosus* has one long solitary central, and *centralis* seems to carry the same tendency further. It may be a good species. The centrals are not in a single vertical row, as usual in *pectinatus*, but are more after thee pattern of *dasyacanthus*, but otherwise unlike that species.

12. Cereus pectinatus spinosus, nom. nov.

Cereus pectinatus armatus Poselger, Allg. Gart. Zeit. xxi, 134 (1853), not *Cereus armatus* Otto.

Ribs 15 or 16: radial spines 16 to 20; central solitary and longer than the radials.—Type unknown.

Near Monterey, Nuevo Leon.

13. Cereus adustus Engelm. Pl. Fendl. 50 (1849).

Echinocereus adustus Engelm. Wisliz. Rep. 20 (1848).

Ovate, 4 to 10 cm. high, 2.5 to 5 cm. in diameter. ribs 13 to 15, with oval approximate areolæ: radial spines 16 to 20, appressed, white with dark tip, the 4 or 5 upper short (2 mm.) and setaceous, the lateral and lower longer (8 to 10 mm. and 4 mm.) and stouter; centrals none: flower and fruit unknown.—Type, Wislizenus of 1846, in Herb. Mo. Bot. Gard.

In the mountains of Chihuahua, in "Cosihuiriachi."

Specimens examined: CHIHUAHUA (*Wislizenus* of 1846 in part).

This species is distinguished frown its allies by its fewer ribs, broader areolæ, lowest spines much as in *pectinatus*, and no centrals.

14. Cereus adustus radians (Engelm.)

Echinocereus radians Engelm. Wisliz. Rep. 20 (1848).

Upper radials 2 to 4 mm. long, lateral 10 mm., lower 6 mm.; central solitary, much stouter, porrect, brown or black, 2.5 cm. long.—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

In the mountains of Chihuahua, in "Cosihuiriachi."

Specimens examined: CHIHUAHUA (Wislizenus of 1846 in part).

++ ++ Central spines 8 to 50 long.

15. Cereus roetteri Engelm. Cact. Mex. Bound. 33 (1859).

Cereus dasyacanthus minor Engelm. Syn. Cact. 279 (1856).

Ovate-cylindrical, 12.5 to 15 cm. high: ribs 10 to 13, tuberculately interrupted, with areolæ 8 to 12 mm. apart: spines subulate from a bulbous base, reddish with dark tip, at length ashy, 8 to 16 mm. long; radials 8 to 15 (often setaceous ones added above), lateral longer (lower 10 to 16 mm., upper 4 to 6 mm.), lowest spine shorter; centrals 2 to 5, stouter, often somewhat shorter, usually 8 to 12 mm. long (rarely one longer): flowers purplish-red, 6 to 7.5 cm. long: fruit subglobose, 16 to 20 mm. long: seed obliquely obovate, strongly and irregularly tuberculate, 1.4 mm. long. (*Ill.* Cact. Mex. Bound. t. 41, f. 3-5)—Type, Wright of 1851 and 1852 and Bigelow of 1852 in Herb. Mo. Bot. Gard.

From the region about El Paso, Texas, southward into Chihuahua and westward into Arizona.

Specimens examined: TEXAS (*Wright* of 1851 and 1852; *Briggs* of 1892): ARIZONA (*Lemmon* of 1881): CHIHUAHUA (*Bigelow* of 1852).

16. Cereus rufispinus Engelm. Pl. Fendl. 50 (1849).

Echinocereus rufispinus Engelm. Wisliz. Rep. 20 (1848).

Ovate-cylindrical, 10 cm. high and 5.5 cm. in diameter: ribs 11, with approximate areolæ: radial spines 16 to 18, interlocked and at length

appressed, 3 to 5 upper setaceous, short (2 to 4 mm.), white, lateral elongated (14 to 18 mm.), recurved and reddish, lower 8 mm. long; central solitary, much stouter, reddish and porrect, 2.5 cm. long: flowers red, with tube over 5 cm. long: fruit unknown.—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

In the mountains of Chihuahua, "Cosihuiriachi, mountains west of Chihuahua."

Specimens examined: CHIHUAHUA (*Wislizenus* of 1846).

17. Cereus longisetus Engelm. Syn. Cact. 280 (1856).

Ovate-cylindrical, subsimple, 15 to 22.5 cm. long and 5 to 7.5 cm. in diameter: ribs 11 to 14, distinctly tuberculate: spines setaceous, white, flexible and spreading; radials 18 to 20, straight, lower (10 to 14 mm. long) much longer than the upper (5 to 6 mm.) which are also more slender; centrals 5 to 7, the upper hardly longer than the radials, the 3 lower elongated (2.5 to 5.5 cm.), divaricate, often flexuose and deflexed: flowers said to be red: fruit unknown. (*Ill.* Cact. Mex. Bound. t. 45)— Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

Coahuila, "Santa Rosa, south of the Rio Grande."

Specimens examined: COAHUILA (*Bigelow* of 1853).

* * *Stems oval: ribs fewer* (*5 to 18*) *spines few* (*3 to 12*), *longer, not pectinate.*

+– *Flowers purple* (*yellow in* flaviflorus).

++ *Central spines usually 3 or 4.*

18. Cereus engelmanni Parry, Amer. Jour. Sci. ser. 2, xiv, 338 (1852).

Ovate-cylindrical, 12.5 to 30 cm. high (sometimes reaching 45 cm.), 5 to 7.5 cm. in diameter, simple or sparingly branched at base, loosely cespitose (4 to 8 stems together): ribs 10 to 13, tuberculate, with areolæ 4 to 8 mm. apart: radial spines 12 to 14 (usually 13), slender, 6 to 12 mm. long, white with dark tip, upper (about 4) setaceous and much shorter, lateral (6) and lower (3) longer and stouter, straight or a little incurved; centrals 4 (rarely 5), straight and angled, 2.5 to 5 cm. long, eruciate, the 3 upper yellow and erect, the lower one white, porrect or deflexed: flowers purple, 5 to 7.5 cm. long: fruit ovate, fleshy, spiny (at length naked), 4 cm. long, 2.5 cm. in diameter: seed obliquely obovate, black and tuberculate, 1.2 to 1.4 mm, long. (*Ill.* Cact. Mex. Bound. t. 57)—Type, Parry of 1850 in Herb. Mo. Bot. Gard.

From Salt Lake Desert, Utah, westward to the eastern slopes of the California Sierras, and southward into Sonora, and Lower California; also on Cedros Island.

Specimens examined: NEVADA (*Shockley* 313): ARIZONA (*Bischoff* of 1871; *Mrs. Thompson* of 1872; *Coues & Palmer* 303; *Palmer* of 1878): CALIFORNIA (*Parry* of 1850, "Mountains about San Felipe;" *Palmer* of 1870 and 1876; *Lemmon* of 1878; *Engelmann* a of 1880; *Perish Bros.* 105 of 1882, San Diego Co.): LOWER CALIFORNIA (*Gabb* 14 of 1867;

Palmer of 1870; *Brandegee* of 1889, San Julio): Sonora (*Schott* of 1855): also glowing in Missouri Botanic Garden in 1893.

Dr. Merriam reports that this is the "most widely-diffused *Cereus* over the deserts of southern Nevada and southeastern California." Mr. Brandegee reports it from San Julio and San Pablo, Lower California.

19. Cereus engelmanni variegatus Engelm. Syn. Cact. 283 (1856).

The 3 upper central spines recurved, divaricate, black and white mottled, the lower one longer, white and decurved: fruit 1.2 to 1.6 mm. long. (*Ill.* Pacif. R. Rep. iv, t. 5, f. 4-7)—Type, Bigelow of 1854 in Herb. Mo. Bot. Gard.

From Utah and Nevada, southward into Arizona and southeastern California.

Specimens examined: Utah (*Johnson* of 1870; *Mrs. Thompson* of 1872; *Parry* of 1871; *Palmer* of 1877): Nevada (*Gabb* of 1867): Arizona (*Bigelow* of 1854; *Coues and Palmer* of 1865): California (*G. R. Vasey* of 1880, San Diego Co.; *Coville & Funston* 187, Death Valley Exped.; *Trelease* of 1892).

20. Cereus engelmanni chrysocentrus Engelm. Syn. Cact. 283 (1856).

More cylindrical: areolæ 12 to 11 mm. apart: upper radial spines 6 to 10 mm. long, lateral 10 to 14 mm., lower 11 to 24 mm.; the three or four upper centrals 5 to 7.5 cm. long, very stout and erect, deep golden yellow, the lower one shorter (3.5 to 6 cm.), white, flattened and deflexed. (*Ill.* Pacif. R. Rep. iv, t. 5, f. 8-10)—Type not found in the Engelmann collection, and probably lost.

Deserts of southeastern California.

Specimens examined: California (*Coville & Funston* 154, Death Valley Exped.).

The whole series of *engelmanni* forms is exceedingly variable as to color, and relative length and stoutness of the central spines, and forms are frequently found intergrading between the three here recognized.

21. Cereus brandegei, sp. now.

Size, habit., and number of ribs unknown: ribs tuberculate, with areolæ 10 to 15 mm. apart: spines at first variegated, dark and reddish, becoming more or less ashy-black; radials 10 to 16, rigid, terete, radiant, mostly uniform, 8 to 12 mm. long; centrals almost always 4, very stout and prominent, 3 to 6 cm. long, cruciate, conspicuously angled and compressed, sometimes twisted, the lowest usually the most flattened and sword-like (2 to 3 mm. broad); flowers red, 4 to 5 cm. long, with conspicuous woolly and spine-bearing areolæ over the ovary and lower part of the calyx: ripe fruit not seen.—Type in Herb. Brandegee.

Lower California, El Campo Allemand and San Gregorio.

Specimens examined: Lower California (*Brandegee* of 1889).

22. Cereus stramineus Engelm. Syn. Cact. 282 (1856).

Ovate-cylindrical tapering toward apex, 12.5 to 22.5 cm. high and 5 to 7.5 cm. in diameter, cespitose-glomerate (often 100 to 200 heads in

one hemispherical mass) ribs 8 to 13, tuberculate, with areolæ 2 to 2.5 cm. apart: radial spines 7 to 14 (mostly 8), straight or curved, white, 2 to 3 cm. long; centrals 3 or 4, elongated (5 to 8.5 cm.) and angled, straight or variously twisted, often flexuous, straw-colored (often red or brown when young), the upper divergent upwards, the lower one broader, porrect or a little deflected: flowers bright-purple, 7.5 to 10 cm. long: fruit ovate-subglobose, red, 3.5 to 5 cm, long, with bunches of elongated spines, edible: seeds obliquely obovate, tuberculate, 1 to 1.4 mm. long. (*Ill.* Cact. Mex. Bound. t. 46, 47, and 48, f. 1)—Type, Wright of 1851 in Herb. Mo. Bot. Gard.

Abundant between the Pecos and El Paso, Texas, extending eastward in the Rio Grande region, westward to the Gila, and southward into Coahuila and San Luis Potosi.

Specimens examined: Texas (*Parry* of 1852; *Bigelow* of 1853; *Lemmon* 304; *Tweedy* of 1880; *Woodward* of 1889, Cultivated; *Trelease* of 1892): New Mexico (*Wright* of 1851; *Evans* of 1891, near Juno): Arizona (*G. R. Vasey* of 1881, Santa Catalina Mts.; *Rusby* 620 of 1883, Beaver Head; *T. E. Wilcox* of 1894): Coahuila (*Palmer* 368, 369, 370, 371, 372): San Luis Potosi (*Parry & Palmer* 277; *Palmer*; *Pringle* 3,495; *Eschanzier* of 1891).

A species remarkable on account of the immense masses it forms covered with long flexuous straw-colored spines. Locally, it is known as "pitahaya" and "strawberry cactus," and Dr. Havard says that the "fruit is equal or superior in quality and flavor to the best strawberry, the thin skin with low spines easily peeling off."

23. Cereus dubius Engelm. Syn. Cact. 282 (1856).

Ovate-cylindrical, cespitose, 12.5 to 20 cm. high, light-green: ribs 7 to 9, broad and tuberculate, with distant areolæ: spines white and somewhat translucent; radials 5 to 8, terete or subangular, 12 to 30 mm. long, upper often wanting; centrals 1 to 4, angled, 3.5 to 7.5 cm. long, straight or often curved: flowers pale-purple, 6 cm. long and wide: Fruit 2.5 to 3.5 cm. long, green or purplish, spiny: seed obliquely globose-ovoid, confluent-tuberculate, 1.2 to 1.4 mm. long. (*Ill.* Cact. Mex. Bound. t. 50)—Type, Wright 410 in Herb. Mo. Bot. Gard.

Sandy bottoms of the Rio Grande from El Paso, Texas, downward, and southward in Chihuahua, Coahuila, and San Luis Potosi.

Specimens examined: Texas (*Wright* 410; *Parry*): Chihuahua (*Pringle* 252): Coahuila (*Palmer* of 1880): San Luis Potosi (*Parry & Palmer* 277).

Closely allied to *stramineus*, but not so cespitose, and spines all white.

24. Cereus acifer Otto; Salm, Cact. Hort. Dyck. 189 (1850).

Plant about 12.5 cm. high and 5 cm. in diameter, branching at base and apex, bright-green: ribs 10, repand, with areolæ 8 mm. apart: spines rigid; radials 8 to 10, radiant, pale yellowish with, reddish base, lower longer, 10 to 20 mm. long; centrals 1, stouter, purplish-brown, the 3 upper erect, the lower one very stout and subdeflexed, about 3.5 cm. long.—Type unknown, unless that cultivated in Hort. Dyck. represents it.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Parry & Palmer* 278; *Parry* of 1878): also specimens cultivated in Hort. Jacoby in 1857; Hort. Dyck. in 1857; Missouri Botanic Garden i 1883.

25. Cereus flaviflorus Engelm. MSS.

Cylindrical, much branched at base and densely aggregated, forming clumps 3 to 9 dm. in diameter, branches about 30 cm. long or less and 2.5 to 5 cm. in diameter: ribs few, with areolæ far apart: spines very robust and rather irregular; radials about 10, strongly unequal; centrals 4, angled, compressed, straight, curved, or twisted: flowers yellow.—Type, Gabb 10 of 1867 in Herb. Mo. Bot. Gard.

In rocky ground, west of San Borgia, Lower California.

Specimens examined: Lower California (*Gabb* 10 of 1867).

This species closely resembles the next, and both are allied to *acifer*. The yellow flowers of this species, however, reported but not preserved by Mr. Gabb, are peculiar in the group. As the material is scanty, and the differences indicated may be specific, Dr. Engelmann's separation of the three species has been preserved.

26. Cereus sanborgianus, sp. nov.

Cylindrical, very much branched at base and densely aggregated, forming clumps 4 to 9 dm. in diameter, branches about 30 cm. long and 2.5 to 6 cm. in diameter: ribs tuberculate, with approximate areolæ: spines pale; radials 12 to 15, very slender but rigid, 7 to 20 mm. long, lower longer and stouter; centrals mostly 4 (rarely 5 to 7), cruciate, very stout, angled and straight, 3 to 6 cm. long, the lower one longest, flat (2.5 mm, broad) and deflexed.—Type, Gabb 9 of 1867 in Herb. Mo. Bot. Gard.

Rocky table lands south of San Borgia, Lower California.

Specimens examined: Lower California (Gabb 9 of 1867).

This species is indicated its new in Dr. Engelmann's notes, but with no name.

27. Cereus cinerascens DC. Rev. Cact. 116 (1828).

Cylindrical, simple, erect, 20 to 25 cm. high and more, 5 cm. in diameter: ribs 7 or 8, obtuse and tuberculate, with areolæ 10 to 12 mm. distant: spines about 14, white, slender but rigid; radials 10 (in young plants often 8), radiant, 12 to 18 mm. long; centrals 4 (in young plants often 1), erect-divergent, 2.5 cm. long, often somewhat brownish.—Type unknown.

Southern Mexico.

Specimens examined: S. Mexico (*Bourgeau* 303, "mountains above Guadalupe;" *Gregg* 662).

++ ++ *Central spine solitary, darker.*

28. Cereus fendleri Engelm. Pl. Fendl. 50 (1849).

Cereus fendleri pauperculus Engelm. I. c. 51.

Ovate or ovate-cylindrical, 7.5 to 20 cm. high, 5 to 7.5 cm. in diameter, simple or branching at base, cespitose, dark-green: ribs 9 to 12, straight or oblique, tuberculate, with areolæ 8 to 14 mm. apart: spines stout, very variable in length and color; radials 5 to 10 (mostly 7), straight

or curved, lowest stoutest, white and angular, 12 to 25 mm, long, next 2 almost as long (or longer), more terete, blackish above and white beneath or all blackish, then 2 white or dark or variegated, then 2 weaker, whiter, and shorter (6 to 14 mm.), often 2 more upper spines, and sometimes a slender or stout dark spine (24 to 30 mm. long) on upper edge of areola; central 1, stout and very bulbous at base, curved upward, reddish-black, teretish, 2.5 to 5 cm. long, rarely wanting: flowers deep violet-purple, 6 to 8.5 cm. broad: fruit ovate-globose, 2.5 to 3 cm. long, purplish-green, edible: seed curved, deeply and irregularly pitted, 1.4 mm. long.—Type, Fendler specimens in Herb. Mo Bot. Gard.

From Utah, southward through Arizona, New Mexico, and Southwestern Texas (extending eastward of the Pecos), into Sonora and Chihuahua.

Specimens examined: Utah (*Ward* of 1875, at Glenwood): Arizona (*Cones & Palmer* of 1865; *Pringle* of 1881; *Palmer* 137, Ft. Defiance; *Rusby* 619½; *Trelease* of 1892; *Toumey* of 1892, Tucson; *Wilcox* of 1894, Ft. Huachuca): New Mexico (*Fendler* 4, 62, 273, of 1846 and 1847; *Wright* 161 of 1849; *Thurber* of 1851; *Newberry* of 1858; *Palmer* 135, 137; *G. R. Vasey* of 1881, Socorro; *Rusby* 143, 144; *Evans* of 1891; *E. A. Mearns* 87 of 1892, Apache Mts.): Texas (*Wright* 71, 75, 228, of 1851; *Bigelow* of 1852 and 1853; *Trelease* of 1892; *Briggs* of 1892): Sonora (*Schott*): Chihuahua (*Wright* 161, 228; *Bigelow* of 1852 and 1853): also cultivated in Missouri Botanic Garden in 1853.

A plant so variable in its spines that to include all the variations in a specific description is impossible. The chief distinguishing characters are the dark central very bulbous at base and curved upward, and the stout quadrangular lower radial. Pringle of 1881 from Arizona has a lower radial 2.5 to 3.5 cm. long. In his Bibliographical Index Dr. Watson suggests *Mamillaria fasciculata* Engelm[1]., as a synonym; but as that is really a *nomen nudum* it should be dropped.

29. Cereus enneacanthus Engelm. Pl. Fendl. 50 (1849).

Echinocereus enneacanthus Engelm. Wisliz. Rep. 27 (1848).

Ovate-cylindrical, obtuse, 7.5 to 15 cm. high, 3.5 to 6 cm. in diameter, simple or densely cespitose, bright-green: ribs 7 to 10, obtuse and tuberculate, with areolæ 12 to 20 mm. apart: spines stout, straight, angled, translucent; radials 7 to 12 (mostly 8), white. upper 6 to 10 mm. long, lateral 10 to 24 mm., lower 16 to 32 mm.; central 1 (often 1 to 3 additional shorter or almost equal angular ones above and diverging upward), teretish or angular or flattened, white or straw-colored or even darker, 30 to 50 mm. long: flowers bright purplish-red, 5 to 7.5 cm. long: fruit subglobose, 2 to 2.5 cm. long, greenish or purplish, edible: seed obliquely obovate, prominently tuberculate, 1 mm, or less long. (*Ill.* Cact. Mex. Bound. t. 48, f 2-4, and t. 49)–Type, Wislizenus of 1847 and Gregg of 1847 in Herb. Mo. Bot. Gard.

From the lower Rio Grande, Texas, to El Paso, westward to Arizona and southward into Coahuila and Chihuahua.

Specimens examined: Texas (*Wislizenus* of 1817; *Wright* of 1851, and 1853, nos. 4, 5, 27, 28, 31, 97, 231; *Schott* 852; *Nealley* of 1891):

[1]In Emory, Rep. 156, f. 2.

Arizona (*Pringle* of 1881): Coahuila (*Wislizenus* of 1847; *Gregg* 400, 616, of 1847; *Poselger* of 1853): Chihuahua (*Wislizenus* 244 of 1847): also specimens cultivated in Hort. Schafer in 1857; and growing in Missouri Botanic Garden in 1893.

The species is very cespitose, with a wrinkled or withered appearance even in full growth. The central spine is very variable in size, color, and shape; the younger ones being generally terete, yellowish or brownish and at length ashy, while the mature ones are mostly triangular or flattened and white.

30. Cereus mojavensis Engelm. Syn. Cact. 281 (1856).

Ovate, glaucous, 5 to 7.5 cm. high, densely cespitose, forming large masses: ribs 8 to 12, rather obtuse and slightly tuberculate, with areolæ 12 mm. or more apart: spines stout, very bulbous at base, terete or angular, curved and interlocked, white with faintly dusky tips, becoming ashy-gray; radials 5 to 8, upper and lower weaker, 2 to 3 cm. long (upper occasionally much shorter), lateral stouter and 3 to 5 cm. long; central 1 (sometimes wanting), angular and dusky, curved upward, 3.5 to 6 cm. long: flowers deep rich crimson, 5 to 7 cm. long: fruit oblong, 2.5 to 3 cm. long: seed obliquely obovate, black and pitted, 2 mm. long. (*Ill.* Pacif. R. Rep. iv, t. 4, f. 8)}Type, Bigelow of 1854, in Herb. Mo. Bot. Gard.

From the Mohave region of California to Utah and the western border of New Mexico.

Specimens examined: California (*Bigelow* of 1854; *Parish Brothers* 1167, 1243; *Trelease* of 1892): Nevada (*Coville & Funston* 321, Lincoln Co.): Arizona (*Palmer* 136, Fort Defiance).

The species is easily distinguished from the nearly allied *fendleri* by the longer radial spines, the lowest of which is weakest, and the glaucous line. The long spines are so curved and interlocked as almost to hide the body of the plant. Mr. Coville, to whom we are indebted for a description of the flower, in the Death Valley Expedition measured one large clump in the Panamint mountains, which formed a dense oblong mat with the center elevated about 8 inches, with the greatest diameter 40 inches, the shortest 30 inches, and the unusually small and closely packed heads estimated to be about 600.

31. Cereus mojavensis zuniensis Engelm. Syn. Cact. 281 (1856).

Spines weaker, 4-angled, straight or flexuous, the younger ones straw-colored, older ones ashy; radials 8, lowest 12 to 18 mm. long, lateral 18 to 30 mm., uppermost almost as stout and long (2.5 to 3.5 cm.) as the central, which is straight or curved upward, and 3.5 to 5 cm. long. (*Ill.* Pacif. R. Rep. t. 4, f. 9)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

"Canyon Diablo, on the Colorado Chiquito", Arizona.

Specimens examined: Arizona (*Bigelow* of 1853).

Distinguished by the long and stout upper radial.

+– +– *Flowers scarlet.*

++ *Ribs 5 to 7: central spine 1* (*or wanting in* paucispinus).

32. Cereus paucispinus Engelm. Syn. Cact. 285 (1856).

Ovate or ovate-cylindrical, 12.5 to 22.5 cm. high, 5 to 10 cm. in diameter, simple or sparingly branched, deep-green: ribs 5 to 7,

tuberculate, with wide and shallow grooves, and areolæ 16 to 20 mm. apart: spines stout from a bulbous base, straight or somewhat recurved, radiant, 18 to 32 mm, long; radials 3 to 6 (rarely 7), reddish or dark, the lowest one paler, all at length blackish; central none, or very rarely a stout subangular one, 30 to 40 mm. long, reddish-black, turned upward or porrect: flowers purplish-red (when dry), broadly funnelform, 4 cm. long, with a flaring mouth 2.5 to 3 cm. across: fruit unknown: seeds obliquely obovate, tuberculate, 1.4 to 1.6 mm. long. (*Ill.* Cact. Mex. Bound. t. 56)—Type, Wright of 1849 in Herb. Mo. Bot. Gard.

On rocks and gravelly limestone hills, from the San Pedro, Texas, to the mouth of the Pecos; also found near Durango, Col.

Specimens examined: Texas (*Wright* of 1849): Colorado (*Alice Eastwood* of 1890, Durango): also cultivated in Missouri Botanic Garden in 1870.

Distinguished from its allies by its few ribs and few dark spines. The specimens of Miss Eastwood supplied the first flowers recorded.

33. Cereus gonacanthus Engelm. Syn. Cact. 282 (1856).

Ovate, 7.5 to 12.5 cm. high, simple or sparingly branched at base: ribs 7 (sometimes 9), tuberculate, with large areolæ 12 to 20 mm. apart: spines stout, angular, straight, or variously curved and flexuous; radials 3, lower 16 to 24 mm. long, the rest 20 to 30 mm, long, lower and lateral quandrangular, yellow at base and often dark-tipped, upper-most one much larger than the rest, about size and character of the central, which is solitary, very stout, 6- or 7-angled, and deeply furrowed, often flexuous, 3 to 6 cm. long, 2 mm. broad: flower scarlet, about 6 cm. long: fruit and seed unknown. (*Ill.* Pacif. R. Rep, iv, t. 5 f. 2 and 3)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

Southern Colorado and northern New Mexico; found originally on high sand bluffs, under cedars, near Zuñi.

Specimens examined: Colorado (*Greene* of 1873; *Engelmann* of 1874; *Brandegee* of 1874): New Mexico (*Bigelow* of 1853; *Palmer* 134, Ft. Defiance).

Distinguished from *triglochidiatus* by its stouter, longer, and more numerous Spines.

34. Cereus triglochidiatus Engelm. Pl. Fendl. 50 (1849).
Echinocereus triglochidiatus Engelm. Wisliz. Rep. 9 (1848).

Ovate-cylindrical or globose, 5 to 15 cm. high, 5 to 7.5 cm. in diameter, sparingly branched: ribs 6 or 7, undulate, sharp, with very shallow grooves, and areolæ often 3 cm. apart: spines 3 to 6 (mostly 3), stout, compressed and angular, loosely radiant, straight or curved, ashy-gray, the two laterals 16 to 28 mm. long, the other 12 by 16 mm. long mid bent downward: flowers deep-crimson, 3 to 7.5 cm. long: fruit unknown, but said to be edible. (*Ill.* Pacif. R. Rep. iv, t. 4, f. 6 and 7)—Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

Rocky canyons and mountains, from east of the Pecos, Texas, north-

ward into New Mexico, where it was originally discovered in the high mountains about Santa Fe.

Specimens examined: Texas (*Wislizenus* 510 of 1846): New Mexico (*Wislizenus* of 1846; *Fendler* 274 of 1847; *Bigelow* of 1853; *Rothrock* 39; *Broadhead* of 1880; *Engelmann* of 1881; *Lt. McCauley* 574, 575): also cultivated in Mo. Bot. Gard. in 1863.

35. Cereus hexaedrus Engelm. Syn. Cact. 285 (1856).

Ovate, 10 to 15 cm. high. 5 to 6 cm. in diameter, simple or sparingly branched at base: ribs 6, obtuse, somewhat interrupted, with wide shallow groove and areolæ 12 to 16 mm. apart: spines straight, angular, rigid from a bulbous base, but slender; radials 5 to 7 (mostly 6), yellowish-red, lower shorter (10 to 20 mm.), upper often stouter and darker, 16 to 30 mm. long; central solitary, a little stouter, acutely angled, 24 to 30 mm. long, often wanting: flowers and fruit unknown. (*Ill.* Pacif. R. Rep. iv, t. 5, f. 1)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

On sandy hills, under cedars, about 15 miles west of Zuñi. New Mexico; apparently not discovered since.

Specimens examined: New Mexico (*Bigelow* of 1853).

Allied to *paucispinus*, but distinguished by its slender and angular spines.

++ ++ *Ribs 8 to 18: central spines 2 to 7* (*1 in octacanthus*)

36. Cereus octacanthus (Muhlenpf.).

Echinopsis octacantha Muhlenpf. Allg. Gart. Zeit. xvi, 19 (1848).
Cereus roemeri Engelm. Pl. Fendl. 50 (1849), not Muhlenpf. (1848).

Ovate, bright-green, 7.5 to 10 cm. high, 3.5 to 6 cm. in diameter, densely cespitose (often 5 to 12 heads from the same base), sometimes simple: ribs 7 to 9, tuberculate, obtuse, with areolæ 8 to 16 mm. apart: spines stout, terete, white (or yellowish when young) at length ashy; radials 7 or 8, 10 to 24 mm. long, upper a little shorter, lateral longest; central solitary, stouter, porrect, 20 to 30 mm. long: flower red, 5 cm. long, and 2.5 cm. wide, red: fruit and seed unknown.—Type unknown.

From extreme southwestern Texas, northward and westward through New Mexico into Utah.

Specimens examined: Texas (*Evans* of 1891, about El Paso): New Mexico (Fendler 272 of 1846, in part): Utah (*Mrs. Thompson*): also cultivated in Mo. Bot. Gard. from Herb. Torr.

37. Cereus roemeri Muhlenpf. Allg. Gart. Zeit. xvi, 19 (1848), not Engelm. (1849).
Cereus phœniceus conoideus Engelm. Syn. Cact. 281 (1856).
Cereus conoideus Engelm. Pacif. R. Rep. iv, 36 (1856).

Ovate, conoid-acutish at apex, 7.5 to 10 cm. high, sparingly branched at base: ribs 9 to 11, obtuse, tuberculate, with areolæ 8 to 12 mm. apart: spines whitish or straw-color, translucent, with bulbous base; radials 8 to 12, slender and rigid, straightish, upper 4 to 10 mm. long, lateral 12 to 30 mm.; centrals 3 to 5 (usually 4), very bulbous, upper hardly longer than lateral radials, lowest quadrangular, often dusky

when young, 2.5 to 7.5 cm. long, porrect or deflexed: flower crimson, 8 to 10 cm. long, 3.5 to 5 cm. broad: fruit and seed unknown. (*Ill.* Pacif. R. Rep. iv, t. 4, f. 4 and 5)—Type unknown.

From the upper Pecos, New Mexico, westward through Arizona into southern California, and southward into Chihuahua.

Specimens examined: New Mexico (*Palmer* 73 of 1869; *E. A. Mearns* 88 of 1892, Big Hatchet Mts.): Arizona (*Newberry* of 1858; *Coues & Palmer* of 1865): *CALIFORNIA* (*Parish Bros.* of 1882): Chihuahua (*Pringle* 252 of 1885).

In most of the specimens I have seen the centrals are dark ashy-gray, contrasting strongly with the pale and much shorter radials.

38. Cereus aggregatus (Engelm.).

Mamillaria aggregata Engelm. Emory's Rep. 155 (1818).
Echinocereus coccineus Engelm. Wisliz. Rep. 9 (1848), not DC, or Salm.
Cereus coccineus Engelm. Pl. Fendl. 50 (1849).
Cereus phœniceus Engelm. Syn. Cact. 284 (1856).

Ovate or subglobose, obtuse, 3.5 to 7.5 cm. in height, 3 to 5 cm. in diameter, cespitose (mostly in dense hemispherical masses 30 to 100 cm. in diameter) ribs 8 to 11, tuberculate, with areolæ 6 to 8 mm. apart: spines slender, almost setaceous, straight, terete; radials 8 to 12. white, 6 to 12 mm. long, upper much the shorter; centrals 1 to 3, a little stouter, white or horny, 10 to 20 mm, long: flower deep-crimson, 3.5 to 6 cm. long, 2.5 to 3.5 cm. broad: fruit and seed unknown. (*Ill.* Emory's Rep. 155, f. 1; Pacif. R. Rep. iv, t. 4, f. 1-3)—Type not preserved, but Wislizenus of 1846, type of *coccineus* Engelm., and Bigelow of 1852 and 1853, type of *phœniceus* Engelm., are in Herb. Mo. Bot Gard.

From southern Colorado to Arizona and southwestern Texas, and southward into San Luis Potosi.

Specimens examined: Colorado (*Parry* of 1867; *Greene* of 1873): Arizona (*Bigelow* of 1853; *Newberry* of 1858; *Coues & Palmer* 193 of 1865; *Toumey* of 1892): New Mexico (*Wislizenus* of 1846; *Rusby* of 1881, Burro Mts.): Texas (Lindheimer of 1847; *Gregg* 662 of 1848; *Bigelow* of 1852 and 1853): San Luis Potosi (*Eschanzier* of 1891): also cultivated in Mo. Bot. Gard. in 1851.

The dense cespitose masses often contain 100 to 200 heads, and are "often the shape and size of a bushel basket." it is said generally to grow on naked rocks. The Eschanzier specimens, from San Luis Potosi, have uniformly 2 centrals and yellowish spines.

39. Cereus polyacanthus Engelm. PI. Fendl. 50 (1849).

Echinocereus polyacanthus Engelm. Wisliz. Rep, 20 (1848).

Ovate-cylindrical, 10 to 25 cm. high. 6 to 10 cm. in diameter, cespitose, pale-green or glaucous: ribs 9 to 13, obtuse, tuberculate, with areolæ 1 to 2.5 cm. apart: spines stout, rigid, terete, straight, white or ashy-red, all at length ashy, very variable; radials 8 to 12, spreading, but not strictly radiating, upper 12 mm. long, lateral and lower 18 to 25 mm.; centrals 3 or 4, stouter and bulbous at base, as long as or longer than the radials lower one sometimes 3 to 6 cm.), often variegated when

young, the 3 upper turned upward, the lower porrect or deflexed: flowers deep-red, 5 to 7.5 cm. long, profusely covering the plant: fruit subglobose, 2 to 3 cm. long, greenish-purple: seed oblique, irregularly tuberculate, 1.6 to 1.8 mm. long. (*Ill.* Cact. Mex. Bound. t. 54 and 55)— Type, Wislizenus of 1846 in Herb. Mo. Bot. Gard.

From time region about El Paso, Texas westward into Arizona, and southward into Lower California and the mountains of Chihuahua. Doubtless also in southern California.

Specimens examined: Texas (*Wright* 41, 222, of 1852; *Thurber* 191, 192; *Trelease* of 1892); New Mexico (*Wright* 41 of 1852; *G. R. Vasey* of 1881, Socorro; *Nealley* of 1891; *Evans* of 1891): Arizona (*Palmer* of 1876 and 1890; *Pringle* of 1881, Santa Rita Mts.; *Rusby* 620; *Evans* of 1891; *Wilcox* of 1894): *Chihuahua* (*Wislizenus* of 1846 and 1854; *Pringle* 253): Lower California (*Orcutt* of 1883; *Brandegee* of 1890, La Paz).

40. Cereus maritimus Jones, sp. nov.

Closely allied to *polyacanthus*, but with spines all reddish-brown at first, becoming ashy, 4 or 5 erect-spreading terete or somewhat angular stout centrals 20 to 35 mm. long, 8 to 12 much smaller and slender but rigid radiately spreading very unequal radials (upper and laterals 8 to 10 mm., lower 4 to 6 mm.), and red flowers 3 to 4 cm. Type in Herb. Jones.

Lower California.

Specimens examined: Lower California (*Jones* of 1889, Encenada; *Orcutt* of 1885, Todos Santos Bay; *Brandegee* of 1889, El Rosario).

41. Cereus pacificus (Engelm.).

Cereus phœniceus pacificus Engelm. West Amer. Sci. ii, 46 (1886).

Cylindrical, 15 to 25 cm. high, 5 to 6 cm. in diameter, cespitose in dense cushions 30 to 60 cm. in diameter (50 to 100 stems in each): ribs 10 to 12, obtuse, with shallow intervals: spines at first gray and more or less reddish-tinged, finally becoming ashy; radials 10 to 12, 5 to 10 mm. long, no upper ones (or occasionally a minute spine); centrals 4 or 5, widely divergent, the lowest largest, 20 to 25 mm. long: flowers deep-red, the floriferous areolæ spiniferous: fruit spinose.—Type, Orcutt specimens in Herb. Mo. Bot. Gard.

Lower California and adjacent islands.

Specimens examined: Lower California (*Orcutt* of 1883 and 1886, Todos Santos Bay; *Brandegee* of 1889, Magdalena Island and Comondu Cliffs, of 1890, Sierra de la Laguna, of 1893, San Pedro Martio).

But a few plants were found in bloom, January 26, 1883, by Mr. Orcutt whose notes concerning them were first published in *The West American Scientist*,[1] but since then abundant material has been collected by Mr. Brandegee. The spine we have called the uppermost central, by some might be considered an uppermost radial, the great irregularity of the spines in position making possible different interpretations.

[1] ii, 46

* * * *Stems short-cylindrical, 4- to 6-ribbed, jointed, procumbent: flowers purple.*

42. Cereus berlandieri Engelm. Syn. Cact. 286 (1856).

Subterete, jointed, very branching, spreading and procumbent, with erect branches, joints or branches 3.5 to 15 cm. long, 2 to 2.5 cm. in diameter: ribs 5 or 6, with distinct conical tubercles and areolæ 8 to 12 mm. apart: radial spines 6 to 8, setaceous, white, radiant, 8 to 10 mm. long; central solitary, yellowish-brown, 10 to 25 mm. long: flowers purple, 5 to 10 cm. long: fruit ovate, green, nearly dry, densely covered with mottled bristles, 18 mm. long seed obovate subglobose, strongly tuberculate, 1 mm. log. (*Ill.* Cact. Mex. Bound, t. 58)—Type, Berlandier 2423 in Herb. Mo. Bot. Gard.

Southeastern Texas; found originally on the Nueces.

Specimens examined: Texas (*Berlandier* 2423; *Wright* 993; *Haege* of 1866): also cultivated in Breslau Bot. Gard. in 1866; in Harvard Bot. Gard. in 1871 and 1882; in Mo. Bot. Gard. in 1845, and growing in same garden in 1892 and 1893.

Very closely allied to *C. pentalophus* DC., but Salm cultivated both species and considered them distinct.

43. Cereus procumbens Engelm. Pl. Fendl. 50 (1849).

Subterete or 4- or 5-angular, very branching and diffuse, joints or branches much contracted al base, 1.2 to 10 cm. long, 12 to 16 mm. in diameter: tubercles distinct, 8 to 10 mm. apart, in 4 or 5 rows: spines slender, rigid, dark-tipped; radials 4 to 6 (mostly 5), white, radiant, 2 to 4 mm, long; central solitary, stouter, dark, directed upward, 4 to 6 mm. long, often wanting: flower delicate purple, over 7.5 cm. long: fruit ovate, green, 12 to 16 mm. long: seed lenticular, lightly verrucose, 0.8 to 1.0 mm. in diameter. (*Ill.* Cact. Mex. Bound. t. 59, f. 1-11)— Type, "St. Louis Volunteers" of 1846 in Herb. Mo. Bot. Gard.

On the Rio Grande below Matamoras, Tamaulipas.

Specimens examined: Tamaulipas ("St. Louis Volunteers" of 1846): also cultivated in Harvard Bot. Gard. in 1848, 1871 and 1882; growing in Mo. Bot. Gard. in 1893.

* * * * Stems very slender-cylindrical, 8-ribbed, erect: flowers rose-color: roots tuberous.

44. Cereus poselgeri, nom. nov.

Cereus tuberosus Poselger, Allg. Gart. Zeit. xxi, 135 (1853), not Pfeiff. Enum. 102 (1837).

Very slender from a tuberous root, terete, woody below, thickened upward, sparsely branching, weak, erect or reclined, joints or branches 30 to 60 cm. long, 8 to 16 mm. in diameter: ribs 8, scarcely prominent, with small crowded areolæ: spines minute and setaceous; radials 9 to 12, white, straight and appressed, hardly 2 mm. long; central solitary whitish or brown-tipped or all brown or black, appressed upward, 4 to 6 mm. long: flowers rose or purple, 5 cm. long and broad: fruit nearly dry, covered with long wool and black and white bristles: seed obliquely obovate, confluently tuberculate, 0.8 mm, long. (*Ill.* Cact. Mex. Bound. t. 59, f. 12)—Type, Poselger of 1853 in Herb. Mo. Bot. Gard.

Dry, rocky ridges, among supporting shrubs, on both sides of the Lower Rio Grande.

Specimens examined: Texas (*Poselger* of 1853): Coahuila (*Siler* of 1889): also en cultivated in Goebel's Gard. in 1859; Mo. Bot. Gard. in 1863; Meehan's Gard. in 1869.

The most slender of the *Echinocerei*, connected with the globose and ovate forms through *berlandieri* and *procumbens*. Always grows among shrubs which support its weak and otherwise decumbent stem. The lower part of the stem is scarcely as thick as a quill, and the tuberous root is globular, 1 to 3 cm. in diameter.

II. Eucereus. *Stems cylindrical: seeds smooth or pitted: embryo curved.*

* *Not arborescent.*

+– *Tall* (*6 to 30 dm.*), *slender: ribs 3 to 7.*

++ *Flowers white.*

45. Cereus monoclonos DC. Prodr. iii, 164 (1828).

Stem columnar, 12 to 30 dm. high: ribs 6 to 8, obtuse, compressed: spines short and brownish, radiant, some of them very rigid and 3.5 cm. long: flowers white, 15 cm. long.—Type unknown.

A West Indian species, extending into Florida.

Specimens examined: Florida (*Curtiss* of 1882): also growing in Mo. Bot. Gard. in 1893.

In the Kew Index this species is referred to *C. peruvianus*,[1] but we have had no opportunity of comparing it with that species.

46. Cereus marginatus DC. Rev. Cact. 116 (1828), not Salm (1850).

Stem simple or branching at apex, erect, dark-green, 5 to 7.5 cm. in diameter: ribs 5 to 7, obtuse, with acute intervals, woolly through the whole length on account of the confluent areolæ: spines 7 to 9, short (4 to 6 mm.) and conical, rigid, grayish (younger ones purplish-black, the central scarcely distinct from the rest): flower brownish-purple, slender-tubular, 3.5 cm. long: fruit globular spiny.—Type unknown.

From San Luis Potosi southward throughout Mexico.

Specimens examined: San Luis Potosi (*Weber* of 1865; *Parry & Palmer* 275; *Parry* of 1878; *Pringle* 2678): also cultivated in Hort. Pfersdorff in 1869.

The stem is often covered with a woody crust, and the woolly confluent areolæ are often double. It is said to be frequently used for hedges in southern Mexico.

47. Cereus geometrizans Mart. Pfeiff. Enum. 90 (1837).

Stem erect, simple, bluish, 10 cm. in diameter: ribs 5 to 9 (mostly 5 or 6), obtuse, repand-tuberculate, with broad intervals and areolæ 3 to 3.5 cm. apart: spines 3 to 6, unequal, stout, blackish and at length ashy; lateral radials longest (8 to 10 mm.), lowest shorter (4 to 6 mm.), uppermost 1 or 2 (often wanting) very short (2 mm.) all very short; central solitary, very long and stout, often angular, sometimes

[1] Mill. Gard. Dict. ed. 8, no. 4.

wanting: flowers 2 cm. high, 3 cm. broad, pinkish-white (in dried specimens).—Type unknowns.

From San Luis Potosi southward throughout Mexico.

Specimens examined: San Luis Potosi (*Poselger* of 1850; *Parry & Palmer* 274; *Parry* of 1878; *Pringle* 3743): also cultivated in Hort. Pfersdorff in 1869.

Pringle's specimens are in flower, and from them the above description of the flower is taken. The radials are also shorter than in the original description as given above, varying from 3 to 5 mm. in length, with time stout central about 3 cm. long. The radials are always 5 in the specimens examined, their broad bases in contact, forming a regular hexagon, with the spine that would form the uppermost angle wanting and replaced by the floriferous areola. The broad base of the very stout solitary central is in contact with the bases of all the radials, completely filling up the space. In one case observed the central was but 8 mm. long and the radials very minute.

48. Cereus greggii Engelm. Wisliz. Rep. 18 (1848).
Cereus pottsii Salm, Cact. Hort. Dyck. 208 (1850).
Cereus greggii transmontanus Engelm. Syn. Cact. 287 (1856).

Stem slender, erect, 6 to 12 cm. high, 18 to 25 mm. in diameter, from a very large tuberous root (often 15 to 25 cm. long and 10 to 15 cm. in diameter); branches erect, reddish or dark-green; ribs 3 to 6 (usually 4 or 5), acute, with crowded areolæ: spines abruptly subulate from a bulbous base, very short (1 to 2 mm.) and sharp, blackish at length ashy; radials 6 to 9 subrecurved, the lowest slenderer and longer; centrals 1 or 2 (when 2 they are in the same vertical plane and divergent upward and downward): flowers whitish or ochroleucous, 15 to 20 cm. long, 5 to 6 cm. broad: fruit ovate, attenuate at base and acuminate, 2.5 to 3.5 cm. long, 2.5 cm. in diameter, bright-scarlet, fleshy and edible: seeds obliquely obovate, rugose, black, 2.5 to 3 mm. long. (*Ill.* Cact. Mex. Bound. t. 63-65)—Type, Gregg 222 and 599 in Herb. Mo. Bot. Gard.

From southwestern Texas (Pecos and westward), westward through southern New Mexico into Arizona, and southward into Chihuahua and Sonora. In gravelly or hard clayey soil.

Specimens examined: Texas (*Wright* 347, 513, of 1852; *Bigelow* of 1852; *Parry* of 1853; no date or collector, foothills near Alpine): New Mexico (*Evans* of 1891): Arizona (*Bendre* of 1872; *Engelmann* of 1880; *Pringle* 10; *Toumey* of 1892, Tucson; *Trelease* of 1892): Chihuahua (*Gregg* 992, 599).

This very characteristic species seems to be scattered and rare throughout its range. A single slender stem usually arises from the enormous root, but sometimes there may be many stems.

49. Cereus pitajaya (Jacq.) DC. Prodr. iii, 466 (1828).
Cereus pitajaya Jacq. Enum. Pl. Carib. 23 (1763).
Cereus undulosus DC. Rev. Cact. 46 (1829).
Cereus lætevirens Salm, Cact. Hort. Dyck. 336 (1834).
Cereus variabilis Pfeiff. Enum. 105 (1837), not Engelm. (1850).

Stem simple or branching at base, suberect, green or glaucescent, 3.5 to 7.5 cm. in diameter: ribs 3 to 5, obtuse and repand, with areolæ 18 to 16

mm. apart: spines straight and rigid; radials 6 to 8, white, yellowish or blackish, the 3 highest more rigid, 16 to 20 mm. long, the lower 4 or 5 more slender, 6 to 8 mm. long; centrals 1 or 2, 12 to 25 mm. long.—Type unknown.

A common and widely distributed species of the West Indies, southern Mexico, Central America, Peru, and Brazil.

Specimens examined: Cuba (*Wright* 2624).

A very variable species, the joints being very long and quandrangular, and ovate and triangular on the same plant; the areolæ sometimes with whitish and sometimes with brownish tomentum; the spines sometimes short and white, and sometimes elongated, rigid and fuscous. The north Mexican form referred to this species by Dr. Engelmann is *Cereus princeps* Pfeiff.

50. Cereus princeps Hort. Wuerzb.; Pfeiff. Enum. 108 (1837).
Cereus variabilis Engelm. Pl. Lindh. 205 (1850), not Pfeiff. (1837).

Stems erect, 9 to 30 dm. high, 5 cm. in diameter, 3- or 4-angular, and with distant areolæ: spines 4 to 6, stout and radiant, unequal, the larger 25 to 35 mm. long, the central deflexed: flower long-tubular, 17.5 to 20 cm. long, 13.5 to 15 cm. broad: fruit oval, spiny, 5 to 7.5 cm. long, 5 cm. in diameter, scarlet and with luscious red pulp: seeds obliquely obovate, smooth and shining, 3 to 3.4 mm. long. (*Ill.* Cact. Mex. Bound. t. 60. f. 5 and 6)—Type unknown.

On the Mexican side of the lower Rio Grande.

Specimens examined: Tamaulipas (*St. Louis Volvunteers* of 1846; *Poselger* of 1850; *Schott* of 1853): also cultivated in Mo. Bot. Gard. in 1849, 1859, 1867, 1870, 1871, and 1873; also in Harvard Bot. Gard. in 1872.

Probably to be found on the Texan side of the lower Rio Grande. The young shoots are said to have 8 ribs and more numerous slender spines; and in some of the cultivated specimens the spines become much longer than in the description.

51. Cereus palmeri Engelm. MSS.

Stems branching, 3- or 4-angled, 12 to 15 dm. high: spines in greenish-brown bunches: fruit greenish-yellow, its areolæ bearing 5 to 8 short stout spines.—Type, Palmer 70 of 1869 in Herb. Mo. Bot. Gard.

Sonora.

Specimens examined: Sonora (*Palmer* 70 of 1869).

This very brief and unsatisfactory diagnosis was drawn by Dr. Engelmann from a few scraps and notes, a diagnosis that I have no means of supplementing. Dr. Palmer's notes further state that the "branching plant is weighed down by the heavy fruit."

++ ++ Flowers purple.

52. Cereus striatus Brandegee, Zoe, ii, 19 (1891).

Stems weak, quadrangular, becoming terete, very sparingly branched above, ash-color, about 10 dm. high and 2 to 6 mm. in diameter. ribs or striations 9, flat and slightly raised above the flat greener intervals, with areolæ about 6 mm. apart: spines about 9, soft, closely appressed, either light-colored or brown; sometimes perfectly black, 1 to 3 mm. long: flowers purple, 10 to 12 cm. long, the elongated tube bristly: fruit

obpyriform, 3 to 4 cm. long, 2 to 2.5 cm. in diameter, bright-scarlet and Spiny: seeds angular, black, minutely pitted.—Type, Brandegee 243 in Herb. Brandegee.

San Jose del Cabo, Lower California, and northward beyond San Ignacio; also on Carmen, Magdalena, and Santa Margarita Islands.

Specimens examined: Lower California (*Brandegee* of 1889, San Joaquin, Magdalena Bay, Santa Margarita Island; also 243 of 1890, San Jose del Cabo; *Palmer* of 1890, Carmen Island).

Mr. Brandegee says that the weak stems, no thicker than straws, are supported by bushes, and being of the same ashen hue as the bushes are concealed until in flower or fruit; and that the spines are so soft that the plant can lie easily handled. The local name is "pitahayita," from the resemblance of the flowers and fruits to those of *gummosus*, which is "*Pitahaya*."

53. Cereus cochal Orcutt, West Amer. Sci, vi, 29 (1889).

Trunk stout, 3 dm, or more high before dividing into numerous stout branches, these repeatedly forking so as to give to the whole plant (growing 19 to 30 dm, high) a graceful "candelabra shape": ribs 4 to 8, obtuse, with wide shallow intervals mid areolæ, 2 to 2.5 cm. apart: spines few, stout, straight and compressed, grayish or black; radials mostly 5, 15 to 20 mm. long; central solitary, more robust, laterally compressed, about 18 to 25 mm. long: flowers purplish-green, 2 to 3 cm. long: fruit the shape and size of an olive, not spiny, red (frequently grayish or yellowish-brown).—Type, in Herb. Orcutt.

Lower California.

Specimens examined: Lower California (*Gabb* 8 of 1867; *Brandegee* of 1889, Comondu and San Pablo).

This species was collected by Gabb in 1867, and is described as a new species in Dr. Engelmann's manuscript notes as *C. gabbi*. In 1886, however, Mr. Orcutt discovered it and published the name as above, being the Mexican and Indian name of the plant. Mr. Orcutt says that it is "abundant among the hills of Lower California, from Todos Santos Bay southward to the Rosario and San Fernando missions or further." The short woody trunk is said to be often 3 m. in diameter, the long branches 6 to 20 cm, in diameter.

54. Cereus eburneus (Link) Salm, Observ. Botan. 6 (1822).
Cactus eburneus Link, Ennui. ii, 22 (1822).

Stem erect, simple, glaucous: ribs 7 to 10, obtuse and very glabrous, with ashy, naked, somewhat remote areolæ: spines subulate, rigid, ivory-white with black tip (purplish when young); radials 8 to 10, radiant, 8 to 10 mm. long, lowest smallest; central 1 (rarely 3 or 4), 18 to 22 mm, long: flowers purplish: fruit unknown.—Type unknown.

In the West Indies, and from San Luis Potosi southward through Mexico and Central America into Chile. Reported originally from Mexico in "22° lat., at altitude of 6-8000 ft."

Specimens examined: Cuba (*Wright* 2620): San Luis Potosi (*Parry & Palmer* 276).

+– +– *Procumbent, 3 to 12 dm, long.*

++ *Ribs 3.*

55. Cereus grandiflorus (L.) Mill. Dict. ed. 8, no. 11 (1768).

Cactus grandiflorus L. Sp. Pl. i, 467 (1753).

Creeping, diffuse, pale-green, with very long and flexuous climbing 5- to 7-angled branches 12 to 20 mm. in diameter, with white bristly areolæ 10 to 15 mm, apart: spines short, 4 to 6 mm long; radials 4 to 8, scarcely pungent, yellowish or white; centrals 1 to 4, equaling in length the white bristles: flowers white and fragrant, 15 to 20 cm. broad.—Type unknown.

In the West Indies and Sonora, though doubtless with a much more southern Mexican extension. On rocks and decayed trees.

Specimens examined: SONORA (*Schott* of 1859 and 1865): also cultivated in Hort. Francofurt. in 1825; in Hort. Genève in 1859; in Goebel's Gard, in 1860; in Harvard Bot. Gard, in 1864, 1865, 1882.

Long cultivated in gardens as the "night-blooming cereus," and made to vary widely.

56. Cereus nycticalus Link, Verh. Preuss. Gartenb. Ver, x, 373 (1834).

Cereus pteranthus Link, Otto & Diet. Allg. Gart. Zeit. ii, 209 (1834).

Suberect, very long-jointed, radicant, 15 to 25 mm. in diameter; joints various, sonic subcylindrical with 4 or 5 series of areolæ, others 4- to 6-angular: ribs when young acute, later obtuse, with areolæ 8 to 20 mm. apart: spines 1 to 4, very small (2 to 4 mm.) and rigid, sometimes with white setæ 4 to 6 mm. long, often deciduous: flowers white and fragrant, 17.5 cm. long. (*Ill.* l. c. t. 4)—Type unknown.

Credited in general to Mexico, but no definite station known.

Specimens examined: cultivated in Greeve's Gard. in 1859: in Goebel's Gard. in 1860; in Harvard Bot. Gard. in 1871; in Mo. Bot. Gard, in 1862, and growing in same garden in 1893.

57. Cereus napoleonis Graham in Hook. Bot. Mag. t. 3458 (1836).

Cactus napoleonis Hort. ex Graham, l. c.

Cereus triangularis major Pfeiff. Enum. 117 (1837).

Suberect, long-jointed; joints triquetrous with flat sides, slender, 30 cm. or more long, 20 to 25 mm. in diameter: ribs acute, undulate, with areolæ 12 to 16 mm. apart and scarcely tomentose: spines 3 or 4, subulate, unequal, straight, black, 8 to 16 mm. long, the lowest, mostly longest; sometimes a few white setæ: flowers snowy white, 20 cm. long and 15 cm. broad fruit bluish, spiny, 10 cm, long and 8 cm. in diameter. (*Ill.* l. c.)—Type unknown.

Tamaulipas and southward in Mexico, and in the West Indies.

Specimens examined: TAMAULIPAS (*Poselger* of 1850, at Tampico): also cultivated in Harvard Bot. Gard. in 1882.

58. Cereus compressus Mill. Gard. Dict. ed. 8, no. 10 (1768).

Cereus triangularis Haw. Syn. 180 (1812), not (L.) Mill. (1768).

Suberect, bright-green, branching, the branches scandent, radicant, triquetrous with one face nearly flat and the other two deeply sulcate;

joints broad, over 30 cm. long, 5 to 7.5 cm. broad, sometimes twisted, the younger ribs compressed as if winged, with almost naked areolæ 2.5 cm. apart: spines 2 to 4, blackish, rigid, subrecurved, 2 to 4 mm. long, lowest longest: flowers white, 20 cm. broad: fruit naked, scarlet, "size and form of a goose's egg."—Type unknown.

in Key West and the West Indies, and extending in Mexico from Vera Cruz to the Isthmus of Darien.

Specimens examined: Vera Cruz (*Bourgeau* 2488, region of Orizaba): Isthmus of Darien (*Schott* of 1858): also cultivated in Hort. Monaco in 1857 and 1858 in Koenig's Gard. in 1866; in Harvard Bot. Gard. in 1871, 1873, 1882; growing in Mo. Bot. Gard. in 1893.

Climbing over bushes and rooting at the joints. The surface of the older joints is often covered with a woody crust, and the very old ones become altogether woody.

++ ++Ribs 7 to 12: spines few (8 to 12).

59. Cereus boeckmanni Otto; Salm, Cact. Hort. Dyck. 217 (1850).

Tall, bright-green, subcylindrical, 18 to 20 mm. in diameter, with elongated flexuous and radicant branches: ribs 7, sinuate-repand, with areolæ 12 to 16 mm. apart: spines very small (scarcely 1 mm.) and rigid, the 3 upper brown, 3 lower gray, and the solitary central brown: flower and fruit unknown.—Type unknown.

"Northern Mexico"

Specimens examined: Northern Mexico (*Lindheimer* of 1873).

60. Cereus gummosus Engelm. Zoe, ii, 20 (1891).

Prostrate and assurgent, 3 to 12 dm. long, 7.5 to 10 cm. in diameter, dull purplish-green: ribs (in young branch:) 7 to 9, tuberculate, with sharp narrow intervals and prominent areolæ 18 to 20 mm. apart: spines stout and rigid, from a strongly bulbous base, black; radials about 12, the laterals longest (6 to 12 mm.) the lowest smallest; centrals 3 to 6, stout, angled and compressed (sometimes quite flat), 18 to 35 mm. long, often with 2 very small additional ones above: flowers 10 to 12.5 cm. long, purple: fruit subglobose, 6 to 8 cm. in diameter, spiny, bright-scarlet with purple pulp ("color of ripe watermelon"), acid and pleasant: seeds obliquely obovate, compressed and keeled, rugose and pitted, 2.5 mm. long.—Type, Parry specimens in Herb. Mo. Bot. Gard.

Lower California, especially abundant in the "Cape Region."

Specimens examined: Lower California (*Parry*, with no date or station; *Miss Fish*, of 1882, Sanzal; *Brandegee* of 1889, San Pablo and Magdalena Island, also of 1890, San José del Cabo).

This species seems to have been noted first by Brandegee in his Plants of Baja California, 162 (1889), where it is said to be the "pitahaya" of southern Lower California, the fruit of which is held in high esteem. It is also said that the bruised stems are used for stupefying fish. Dr. Parry's notes, with the original specimens (described by Engelmann in a manuscript in 1882), state that "the internal cellular tissue is bright-yellow in dried-up trunks, changing to a dense resinous gum, which is ground up and mixed with oil for varnish; also used as pitch for calking boats." This fact suggested the specific name.

61. Cereus flagelliformis (L.) Mill. Dict. ed. 8, no, 12 (1768).
Cactus flagelliformis L. Sp. Pl. i, 467 (1753).

Creeping or pendent, slender and very branching, cylindrical, 16 to 20 mm. in diameter, branches 3 dm. long or more: ribs 10 to 12, tuberculate, with areolæ scarcely tomentose and 6 to 8 mm. apart: spines short (4 to 6 mm.) and rather rigid; radials 8 to 12, stellate and reddish-brown; centrals 3 or 4, a little larger, brown with golden tip; young spines all red: flowers funnelform, crimson, 6 to 7.5 cm. long: fruit globose, 12 mm. in diameter, reddish and bristly, the pulp greenish-yellow ("with the taste of a prune").—Type unknown.

From Chihuahua and the West Indies southward; widely distributed in Tropical America, and frequently seen as an ornamental plant.

Specimens examined: Chihuahua (*Wislizenus* 227 and 248): also cultivated in Mo. Bot. Gard. in 1854; in Goebel's Gard. in 1863; in Harvard Bot. Gard. in 1867.

++ ++ ++ *Ribs many* (*15 to 21*)*: spines numerous* (*20 to 50*).

62. Cereus emoryi Engelm. Amer. Jour. Sci. ser. 2, xiv, 338 (1852).

Prostrate, cylindrical, 6 to 12 dm. long, with ascending or erect branches 15 to 25 cm. high and 3.5 to 5 cm. in diameter: ribs 15, tuberculate, with acute intervals and areolæ 6 to 8 mm. apart: spines straight, slender and rigid, yellow, interlocked; radials 40 to 50, very slender and stellately porrect; central solitary, stouter and much larger: flowers greenish-yellow, 3 to 6 cm. broad: fruit globose, very spiny, 3.5 cm. in diameter: seeds obovate, acutely keeled, shining and very minutely tuberculate, 2.4 to 2.8 mm. long. (*Ill.* Cact. Mex. Bound. t 60, f. 1-4)—Type, Parry of 1850 in Herb. Mo. Bot. Gard.

On rocky hills, etc., from southern California (about Los Angeles and San Diego) southward into Lower California, and on the adjacent islands (San Clemente, Santa Catalina, Cedros).

Specimens examined: California (*Parry* of 1850; *Cooper* of 1862; *Childs* of 1862; *Brewer* 248; *Agassiz* of 1872; *Hitchcock* of 1875; near San Diego, no collector noted, in 1876); Lower California (*Gabb* 4 of 1867; *Pringle* of 1882; *Brandegee* of 1889, El Rosario).

Grows in thick masses, covering patches 30 to 60 dm. square. The Gabb specimens show four central spines, but only the lower one is long.

63. Cereus mamillatus Engelm. MSS.

Stems aggregated, branching at base, the branches cylindrical, 25 to 30 cm. long and 3.5 to 6 cm. in diameter: ribs 20 to 25, oblique, strongly compressed, broken up into hemispherical tubercles: spines short and bulbous at base; radials 10 to 25, 3 to 12 mm. long, the lower ones the more robust and longer; centrals 3 or 4, 10 to 25 mm, long, the lowest longest and deflexed: flower and fruit unknown.—Type, Gabb 16 in Herb. Mo. Bot. Gard.

"On mountain sides in gravelly loam, south of Moleje" Lower California.

Specimens examined: Lower California (*Gabb* 16 of 1867).

Branching form a common base, but rarely more than a dozen stems together; never so crowded as many of its allies.

64. Cereus alamosensis, sp. nov.

Cylindrical, height and habit not known, with sharp irregular ribs and a solid woody axis: areolæ prominent, about 2 cm. apart, hemispherical and densely covered with short reddish-brown wool (like pile on velvet), from which arise the ashy spines: radials 15 to 18 slender but rigid, rather unequal, radiantly spreading, straight or curved, 10 to 20 mm. long; centrals usually 4, much stouter and longer, the 3 upper erect or divergent, the lowest (usually largest and often somewhat flattened) porrect to deflexed, all more or less angular, sometimes teretish, 2.5 to 3.5 cm. long: flowers red, funnelform, about 4 cm. long: fruit unknown.—Type, Palmer 335 in Nat. Herb.

Near Alamos, Sonora.

Specimens examined: Sonora (*Palmer* 335 of 1890).

65. Cereus bradtianus, sp. nov.

Cylindrical, becoming 12 dm, high, the branches about 12 cm. long and 4 cm. in diameter: ribs 9, obtuse, slightly if at all tuberculate, with circular areolæ 10 to 15 mm. apart and bearing more or less persistent grayish tomentum: spines numerous, white and translucent, rigid and spreading in every direction; radials 15 to 18, slender, somewhat unequal, more or less radiant, 10 to 12 mm. long; centrals 5 to 7, stouter, often subangular, quite unequal (usually 1 or 2 especially prominent), 15 to 30 mm, long: flowers yellow: fruit spiny.—Type in Herb. Coulter.

Plains at Coahuila.

Specimens examined: Coahuila (*Anna B. Nickels* of 1895).

The bright white spines on the vivid green body give the plant a striking appearance. Mrs. Nickels writes that the plant "sometimes covers a half-acre of ground, and seems to propagate by falling over on the ground and rooting all along the stem from which new plants sprout." Mrs. Nickels requests that the species he named for Mr. Geo. N. Bradt, editor of "The Southern Florist and Gardener," of Louisville, Kentucky.

66. Cereus eruca Brandegee, Pl. Baja Calif. 163 (1889).

Prostrate, stout, simple or slightly branched, 6 to 12 dm. long, 7.5 to 16 cm. in diameter, rooting from the under surface of the older growth, generally in patches of 20 to 30: ribs 13 to 21, with prominently pulvinate areolæ 4 to 15 mm. apart: spines stout, straight, ashy, stellate and interlocked; radials 1 to 3 cm. long, terete: centrals 5 to 8, stouter, angled and somewhat flattened, the lowest one much flattened (often 3 mm. wide at base), keeled beneath, longer (3 cm. or more), and strongly deflexed: flowers 10 to 12.5 cm. long, said to be yellow: fruit globular, 5 cm. in diameter, somewhat spiny, dull-red, acid and pleasant, with purple pulp: seeds very rough. (*Ill.* l. c. t. 7)—Type, Brandegee of 1889 in Herb. Brandegee.

On sandy plains along the coasts of Lower California., and on adjacent islands, but perhaps not in the Cape Region.

Specimens examined: Lower California (Gabb 6 of 1867, on west coast, "from Soledad to Ballenos Bay;" *Brandegee* of 1889, Magdalena Bay, also of 1890, Soledad and Todos Santos).

A plant of very curious and uncouth habit, densely covered with rigid, ash-colored interlacing spines, continually dying at the harder end and rooting on the under surface, creeping over and accommodating itself to every obstacle, often in large masses covering many square yards. Gabb says it "hooks from a distance like a lot of firewood thrown at random on the ground;" and Brandegee, that "the manner of growth, with uplifted heads and prominent reflexed spines, gives the plants a resemblance to huge caterpillars." Brandegee reports it as occurring from San Gregorio to below Santa Margarita Island, and as common on Magdalena Island and about San Jorge. The local name is "chilenola" or "chirinole," and the latter appears as the specific name given to Gabb's specimens in Engelmann's manuscript notes. The fruit much resembles in form and color that of *gummosus*, the well-known "pitahaya" of Lower California.

* * Arborescent, 3 to 18 m. high..

+– Simple (it base.

67. Cereus giganteus Engelm. Emory's Rep. 159 (1848).
Pilocereus engelmanni Lem. Ill. Hort. 9, Misc. 97 (1872).

Erect, cylindrical, attenuate toward base and apex, 7.5 to 18 m. high, 3 to 6 dm. in diameter, simple, or with a few erect branches shorter than the main stem (candelabriform): ribs 12 to 15 below, 18 to 21 above, triangular, with obtusish edge and with deep triangular acute intervals, straight, often almost obliterated in older parts, and generally spineless, with prominent areolæ about 2.5 cm. apart: spines straight, very bulbous at base, lightly sulcate or subangular, white or straw-color, at length ashy (or dark); radials 11 to 17, setaceous and white, the lower and upper shorter (12 to 25 mm.), the laterals (especially the lower) stouter and longer (25 to 35 sometimes a few additional setaceous ones at upper edge; centrals 6, stout, whitish, with blackish base and reddish tip, the 4 lower ones cruciate, straight or decurved, 4 to 6 cm. long (the lowest one very long and stout and usually deflexed), the 2 upper shorter (30 to 35 mm.) and divergent upward; flowers ochroleucous or whitish, 7.5 to 12.5 cm. long, 7.5 to 10 cm. broad: fruit oval or pyriform, 6 to 7.5 cm. long and 3.5 to 5 cm. in diameter, green and reddish tinged, with crimson pulp, at length 3- or 4-valved: seeds obliquely obovate, black, smooth and shining, 1.4 to 1.8 mm. long (*Ill.* Cact. Mex. Bound. frontispiece and t. 61, 62; Rep. Bot. U. S. Dept. Agr., 1891, t. 7). Type not found in the Engelmann collection.

In rocky valleys and on mountain sides, from the middle Gila (Emory), Arizona, southward through the Lower Colorado region into Sonora (back of Guaymas).

Specimens examined: Arizona (*Giles* of 1850; *Thurber* 1, 689, of 1852; *Bigelow* of 1853; *Palmer* of 1867 and 1871: *Pringle* of 1881 and 1884; *Wright* of 1882; *Evans* of 1891; *Trelease* of 1892): California (*Wright* 149): Sonora (*Schott* 1; *Parry* of 1852).

The best known of the arborescent forms. The young plants are globose for several years. Called "pitahaya" by the Californians; but this name seems to he applied to all large columnar *Cacti* with edible fruit. Known by the natives as "suwarrow" or "saguaro." The hard pericarp of the fruit bursts into three or four irregular valves, which spread and become recurved, and being lined with crimson pulp, look like red flowers. Preserves and molasses are made from the fruit.

The specimens of Evans from Casa Grande, Arizona, were at first thought to represent a new species, but were finally referred to *giganteus*. The ribs are 15, the spines are dark (almost black) and unusually slender, the radials 8 or 9, and the centrals 4 or 5.

68. Cereus pecten-aboriginum Engelm. Watson, Proc. Amer. Acad. xxi, 129 (1886).

Erect, solitary, becoming 6 to 9 m. high and 3 dm. or more in diameter, with erect branches ribs 10 or 11, with densely tomentose finally glabrate areolæ: spines 8 to 12 (mostly 10), very stout, straight, ash-color tipped with black; radials spreading or reflexed (12 mm. long or less); the solitary central (rarely 2 or 3) and sometimes the 2 uppermost radials larger (12 to 35 mm.) and erect or ascending or porrect, compressed or angular: flowers white, 5 to 7.5 cm. long: fruit globose, 6 to 7.5 cm. in diameter, dry and densely hairy and spiny: seeds 4 mm. long, black and shining.—Type, the Palmer specimens in Herb. Mo. Bot. Gard.

Stony mountain sides, from southwestern Chihuahua westward through Sonora and common throughout the Cape region of Lower California and adjacent islands.

Specimens examined: Chihuahua (*Palmer* of 1885): Sonora (*Palmer* of 1809, 1874, and 1890): Lower California (*Brandegee* 244): also cultivated in Hort. Berol. in 1880, and in Kew Gard.

The plant was first made known to Dr. Engelmann by a specimen of the brushes made from the fruit, obtained by Dr. Palmer in 1869 from the Papajo Indians at Hernosillo in Sonora. and hence the specific name. The fruit is covered with still' yellow spines and forms balls 15 cm. in diameter, often many of them growing close together and crowding the tops of the branches. The Indians, who call the plant "cardon" or "hecho," grind the seed to mix with meal, and use the bristly covering of the fruit as a hair-brush. This and *pringlei* are both known as "cardon" and form characteristic forests in the Cape region of Lower California. The *pecten-aboriginum* is more graceful than *pringlei*, has sharper ribs, and the whole plant has a purplish tinge.

69. Cereus pringlei Watson, Proc. Amer. Acad. xx, 368 (1885).

Erect, very stout, becoming 6 to 15 m. high, 6 to 12 dm. in diameter, irregularly branching above the base: ribs 13 (rarely more), with contiguous areolæ, which become spineless on older portions: spines on younger areolæ terete, the radials nearly erect, more or less unequal (12 to 18 mm.) and as-color, the solitary central (sometimes 2 or even more) twice longer; on older areolæ about 15, dark, flattened, mostly wide-spreading, about 2.5 to 5.5 cm. long and deciduous: flowers white, tinged with green or purple, 6 to 8 cm. long: fruit globose, 5 cm. in diameter, densely tomentose and spiny: seeds obliquely oblong-ovate, black and shining, 3 mm, long.—Type, Pringle of 1884 in Herb. Gray.

Northwestern Sonora and Lower California (especially abundant in the Cape region) and adjacent islands.

Specimens examined: Sonora (*Pringle* of 1884): Lower California (*Palmer* 418, on San Pedro island; *Brandegee* of 1880, San Gregorio, San Luis, Santa Margarita Island).

Stouter, but not so high as *giganteus*, with numerous branches starting within 6 to 9 dm, of the ground. The flowers are not clustered at summit, but are scattered along the ribs for 6 to 9 dm, below the top. The average height is about 7.5 m., with a circumference of 18 to 21 dm. below the branches. This species and *C. pecten-aboriginum* form the great "cardon" forests of Lower California. Brandegee describes one of these forests, made up chiefly of *C. pringlei*, that "covered the ground almost entirely for miles, so that when looking down upon it not even a bush is visible." The dead wood is much used for fuel and other purposes, and the seedy fruit is an article of food.

70. Cereus tetazo Weber, MSS.

Stout, branching, 10 to 15 m. high: flowers greenish-white, 6 cm. long, in clusters of 10 to 20 from the youngest areolæ and without any wool: fruit irregularly dehiscent, exposing the ripe pulp.—Type, Weber specimens in Herb. Mo. Bot, Gard.

At Zapatalan, Jalisco.

Specimens examined: Jalisco (Weber of 18§4 and 1869).

Dr. Weber's manuscript notes are among those of Dr. Engelmann, but neither they nor the material are sufficient for any fuller diagnosis than that given above. Both Weber and Engelmann indicated their belief that this was a new species. Weber further remarks that the flowers are eaten as a salad, and the fruit is dried in large quantities. The specific name probably represents the local name. The species is closely related to if not identical with *C. pecten-aboriginum*.

71. Cereus calvus Engelm. MSS.

Erect and spreading, simple or more or less branched, the branches ascending or erect: ribs 20 or more (younger ones obtuse and almost naked), with areolæ acute at both ends, densely woolly, about 10 mm. apart and connected by a broad woolly groove: spines all erect, short (2 to 12 mm.) and sharp, irregularly arranged and numerous; radials 12 to 15, especially the upper ones weak; centrals 3 to 6, somewhat stouter and longer; all at length deciduous: flowers short, lateral near the apex: fruit globose, 2.5 cm. in diameter, loosely covered with light yellowish-red spines.—Type, Gabb 2 in Herb. Mo. Bot. Gard.

Sandy soil, from Cape San Lucas, Lower California, northward.

Specimens examined: Lower California (*Gabb* 2 of 1867).

The spines are very soon deciduous, never persisting longer than the second year, whence the popular flame "cardon polon" or "bald cereus." It may be a form of *pringlei*, and at any rate, with the next species, it forms a part of the "cardon" flora so characteristic of the cape region of Lower California.

72. Cereus titan Engelm. MSS.

Erect, simple or more or less branched, branches ascending or erect, 6 to 15 m. high, and sometimes 6 dm. in diameter: ribs 20 or more, the younger acute, with approximate areolæ connected by a woolly groove: spines sharp and rigid, bulbous at base; radials about 12 and radiant;

centrals 3 or 4, stouter but hardly longer: flowers short, lateral toward the apex: fruit globular, large ("size of an orange"), red and armed with numerous reddish-brown spines, bursting into 4 segments when ripe.—Type, Gabb 1 in Herb. Mo. Bot, Gard.

In sandy soil, from Cape San Lucas to San Quintin, Lower California.

Specimens examined: Lower California (*Gabb* 1 of 1867).

This may be a form of *pecten-aboriginum*, but with our present information they are sufficiently kept apart. Another "cardon."

73. Cereus weberi, sp. nov.

Plant about 10 m. high, with a regular candelabra form of branching (two main branches each producing near the base, two other branches, all a ascending), branches and main stem of same diameter, angled and glaucous: areolæ 3 to 5 cm. apart: spines stout, bulbous at base; radials 10 or 11, 2 to 5 cm. long; central solitary, 6 to 10 cm. long, laterally compressed, sometimes a little deflexed: flowers lateral, white, 8 to 10 cm. long: fruit "as large as a small orange," covered with small scales bearing axillary wool and spines.—Type, Weber material in Herb. Mo. Bot. Gard.

"A few miles south of Tehuacan," Puebla, Mexico.

Specimens examined: Puebla (*Weber* of 1864).

The specific name originally proposed by Dr. Weber was *candelaber*, but there is a *Cereus candelabrinus* in the European gardens, described at sometime before 1840. Dr. Engelmann notes this as "a most peculiar plant." The seed is sold in market in Tehuacan, etc., and is ground and mixed with tortillas.

74. Cereus queretarensis Weber, MSS.

Tree-like, much branched, 6 to 8 m. high: flowers 10 to 12 cm. long: ovary covered with triangular fleshy scales which arise from a tubercle and bear axillary wool and spines: fruit densely covered with bunches of dark-yellowish or brownish spines bulbous at base.—Type, Weber specimens in Herb. Mo. Bot. Gard.

In the vicinity of Queretaro, Mexico, and cultivated along roadsides and fence rows.

Specimens examined: Queretaro (*Weber* of 1864).

While our information concerning this species is scanty it may be sufficient to lead to its recognition in the original locality.

+– +– Branched a! base.

++ Spines similar.

75. Cereus thurberi Engelm. Amer. Jour. Sci. ser. 2, xvii, 234 (1854).

Erect or ascending, fasciculate-jointed, 5 to 15 stems from same root, becoming 3 to 4.5 m. high, lower joints 6 to 9 dm. long, upper joints 15 to 18 dm, long and 10 to 15 cm. in diameter, branches curved inward; ribs 13 or 16, very slightly prominent, with shallow intervals and areolæ 25 to 30 mm. apart: spines 7 to 16, slender and rigid or almost setaceous, straight or flexuous, reddish-black at length ashy, very unequal (10 to 36 mm. in same bunch), irregularly fascicled; radials 8 to 10 (5 to

20 mm.), sometimes wanting above; centrals 3 to 6, larger and longer (2 to 3 cm.): flowers greenish-white, 6.5 to 7.5 cm. long: fruit globose, 3.5 to 7.5 cm. in diameter, spiny at length naked, olive-color with crimson pulp ("like a large orange and of delicious taste"): seeds obliquely obovate, keeled on back, shining and minutely tuberculate, 1.8 to 2 mm. long. (*Ill.* Cact. Mex. Bound. t. 74, f. 15)—Type, Thurber 2 and 367 in Herb. Mo. Bot. Gard.

From southwestern Arizona southward throughout Sonora and Lower California (especially in the Cape region).

Specimens examined: Arizona (*Vasey* of 1875; *Evans* of 1891, at Casa Grande): Sonora (*Thurber* 2 and 367; *Schott* 2; *Palmer* of 1869; *Pringle* of 1884): Lower California (*Gabb* 3 of 1867; *Brandegee* of 1889, Purissima and San Estaban).

The "pitahaya dulce" of the natives.

76. Cereus hollianus Weber, MSS.

Branching from base, 4 to 5 m. high and stout, dark-green: ribs 10 to 1é, acute, often oblique, with areolæ 2 to 3 cm. apart: radial spines about 12, irregular, 1 to 1.5 cm, long; centrals 3, the lower one 5 to 10 cm. long and deflexed: flowers near the summit, white, 10 cm. long: fruit "as large as a goose egg," dark purplish-red, bearing wool and spines.—Type, Weber specimens in Herb. Mo. Bot. Gard.

Common about Tehuacan, Puebla.

Specimens examined: Puebla (Weber of 1864).

Important for its wood, which forms long straight rods used for poles in hedges and vineyards.

77. Cereus flexuosus Engelm. MSS.

Rather large, branched at base and straggling, the branches elongate (12 to 23 dm. and 7.5 to 10 cm. in diameter), flexuous (often deflexed), and diffusely branched: ribs 6 to 8, with deep intervals and remote areolæ: spines stout and angular, black at length ashy, annulate; radials usually 8 to 10 and radiant, 1 to 2 cm. long, the lowest slenderer; centrals 1 to 4, much stouter and erect, 2.5 to 4.5 cm. long: flower unknown: fruit globose: 2.5 to 5 cm. in diameter, dark-red and spinose, acid.—Type, Gabb 5 in Herb. Mo. Bot. Gard.

Rocky or sandy ground, from Cape San Lucas to near Rosario, Lower California.

Specimens examined: Lower California (Gabb 5 of 1867).

The plant is large, dark-green, and very struggling, the elongated branches arising from the base and afterward sending off lateral branchlets, often forming impenetrable thickets. The local name is "pitahaya agre."

++ ++ *Spines on fertile branches long-setaceous or hair-like.*

78. Cereus schottii Engelm. Syn. Cact. 285 (1856).

Erect or ascending, with numerous stems from the same base, often forming dense thickets, yellowish-green, 24 to 30 dm. high, with 2 to

4 joints 10 to 12.5 cm. in diameter, ascending at base and curved outward at top when mature: ribs 4 to 7 (mostly 5), with areolæ remote on sterile joints and crowded on floriferous ones: spines on sterile joints stout and short (6 to 8 mm.), consisting of 4 to 6 dusky radials and a single shorter dusky central; on floriferous joints 10 to 25, setaceous and flexuous, declinate and as if pendulous (forming a reddish-gray beard), the longer 2.5 to 10 cm.: flowers somewhat hidden in the beard, 3.5 to 4 cm. long: fruit globose, 6 to 8 mm, in diameter, with scarlet pulp: seed obliquely obovate, shining, 2 to 2.4 mm. long. (*Ill.* Cact. Mex. Bound. t. 71, f. 16)—Type, Schott 855 in Herb. Mo. Bot. Gard.

From southern Arizona to the Cape region of Lower California, Sonora, and San Luis Potosi,

Specimens examined: Arizona (*Schott* of 1856): Sonora (*Schott* 855; *Pringle* of 1884): Lower California (*Gabb* 7 of 1867; *Palmer* of 1870; *Brandegee* of 1889, San Gregorio and Comondu): San Luis Potosi (*Eschanzier* of 1891).

A variety of local names are reported, such as "zina" "sina" "sinita," "hombre viejo," "cabeza viejo," the latter names referring to the resemblance of the long fine white spines at the top of the plant to a gray head. Often used to make fences,

79. Cereus sargentianus Orcutt, Garden and Forest, iv, 136 (1891).

Closely related to *schottii* and possibly a form of it: stems in clumps of 8 or more, the sterile ones 6 to 15 dm. high and 5- or 6-angled, the fertile ones 30 to 45 dm. high and erect: spines in sterile stems munch longer (6 to 18 mm.) and stouter, more numerous (10 or more), and areolæ closer together; the long flexuous spines of the fertile stems about 50 in a cluster: flowers 2.5 cm. long: fruit red, spineless, edible, much larger than in *schottii*. (*Ill.* l. c. 437)—Type in Herb. Orcutt.

Lower California.

Specimens examined: Lower California (Brandegee of 1890, Cedro).

Mr. Orcutt reports it also from San Quintin. Confused with *schottii* and called. by the same local names.

The following West Indian species were examined, and are added as likely to be found in Mexico.

80. Cereus royeni armatus Otto; Salm, Cact. Hort. Dyck. 46 (1850).
Cereus armatus Otto; Pfeiff. Enum. 81 (1537),

Erect, pale-green, and scarcely glaucescent, 5 to 7.5 cm. in diameter, with 7 or 8 subcompressed ribs, broad intervals, approximate woolly areolæ, and 8 to 17 unequal, divergent, yellowish, rigid, and slender spines, 6 to 10 mm. long, in an erect-spreading cluster: flowers about 3 cm. log.

Specimens examined: Cuba (*Wright* 2621).

81. Cereus pellucidus Pfeiff. Enum. 108 (1837).

Suberect, 20 to 30 dm. high, 2.5 to 3.5 cm. in diameter, branching at base, pellucidly green, 5-angled, with younger ribs acute (almost membranaceous), older ribs obtuse and inflated below areolæ which are 8 to

10 mm. apart, straight yellow spines, of which 7 to 9 are radiant (6 to 8 mm.) and 1 central (10 to 25 mm.), and elongated flowers (17 to 20 cm.).

Specimens examined: Cuba (Wright 2623).

82. Cereus eriophorus Hort. Berol. in Pfeiff. Enum. 94 (1837).

Stem simple, erect and columnar (becoming 6 m. high and 3.5 cm. in diameter), tapering at summit and jointed, with 8 to 10 obtuse and repand ribs, acute intervals at length obsolete, areolæ 24 to 28 mm. apart, 9 to 12 needle-shaped white and black-tipped spines (8 to 16 mm. long), of which 8 to 10 are radial and spreading and 1 or 2 central, and large white funnel-form flowers (15 to 22.5 cm, long) with calyx-tube covered with long wool.

Specimens examined: Cuba (*Wright* 207, 2624, of 1865): also cultivated in Haege & Schmidt Gard. in 1873; and in Harv. Bot. Gard. in 1882.

ARTIFICIAL KEY TO THE SPECIES.

The following key is based upon spine characters and may be of service in case of incomplete material. Forms found within the United States are italicized; the species and varieties are indicated only by their specific or varietal names, and the numbers refer to the serial numbers of the synoptical presentation.

* Central spines none.

+ *Radial spines 3 to 6* (*12 to 35 mm. long*).

Paucispinus (32), *triglochidiatus* (34).

+ + *Radial spines 12 to 20* (*2 to 12 mm. long*).

viridiflorus (1), *tubulosus* (2), *rigidissimus* (10), *adustus* (13).

+ + + *Radial spines 20 to 30* (*4 to 9 mm. long*).

cæspitosus (7), *castaneus* (8), *rigidissimus* (10).

* * *Central spine solitary.*

+ *Radial spines 2 to 10.*

Radials 1 to 2 mm. long.
poselgeri (44), *greggi* (48), striatus (52), boeckmanni (59).
Radials 2 to 4 mm. long.
procumbens (43), nycticalus (56), compressus (58).
Longest radials from 6 to 10 mm.
Central spine 4 to 10 mm. long.
marginatus (46), grandiflorus (55), armatus (80).
Central spine 10 to 25 mm. long.
berlandieri (42), geometrizans (47), eburneus (54), pellucidus (81).
Longest radials from 12 to 16 mm.
aggregatus (38), napoleonis (57), pecten-aboriginum (68), tetazo (70).
Longest radials from 16 to 20 mm.
pitajaya (49), cochal (53), flexuosus (77), eriophorus (82).

Longest radials 25 to 100 mm.
Spines white.
dubius (23), *enneacanthus* (29), *mojavensis* (30), *octacanthus* (36).
Spines straw-color or yellow.
zuniensis (31), *gonacanthus* (33), *hexaedrus* (35).
Spines dusky or variegated.
fendleri (28), princeps (50), *schottii* (78), *sargentianus* (79).

+– +– *Radial spines from 10 to 15.*

Radials 2 to 6 mm. bug.
viridiflorus (1), *poselgeri* (44).
Longest radials 10 to 12 mm.
tubulosus (2), *aggregatus* (38), pecten-aboriginum (68), tetazo (70).
Longest radials 15 to 18 mm.
pringlei (69).
Longest radials 25 to 100 mm.
enneacanthus (29), weberi (73), *schottii* (78), sargentianus (79).

+– +– +– *Radial spines from 15 to 20.*

Longest radials 6 to 10 mm.
viridiflorus (1), spinosus (12), radians (14).
Longest radials 12 to 18 mm.
tubulosus (2), rufispinus (16).
Longest radials over 20 mm.
schotti (78), sargentianus (79).

+– +– +– +– *Radial spines more than 20.*

emoryi (62), *schottii* (78), sargentianus (79).

* * * *Central spines 2 to 4.*

+– *Radial spines 10 or less.*

Radial spines 1 to 2 mm. long.
greggii (48).
Radial spines 4 to 12 mm. long.
aggregatus (38), maritimus (40), grandiflorus (55), flagelliformis (61).
Longest radials 16 to 20 mm.
roetteri (15), acifer (24), flaviflorus (25), cinerascens (27), pitajaya (49), *thurberi* (75), flexuosus (77), eriophorus (82).
Longest radials 25 to 30 mm.
stramineus (22), *dubius* (23), *roemeri* (37), *polyacanthus* (39).

+– +– *Radial spines 10 to 15.*

Radial spines 5 to 10 mm. long.
chloranthus (3), brandegei (21), maritimus (40), pacificus (41), flagelliformis (61).
Radial spines 10 to 15 mm. long.
neo-mexicanus (5), *engelmanni* (18), *variegatus* (19), *chrysocentrus* (20), brandegei (21), *aggregatus* (38), mamillatus (63), hollianus (76).
Radial spines 15 to 20 mm. long.
roetteri (15), sanborgianus (26).
Radial spines more than 20 mm. long.
stramineus (32), *roemeri* (37), *polyacanthus* (39).

+– +– +– Rad4al spines 15 10 20.

Radial spines 5 to 10 mm, long.
chloranthus (3), *ctenoides* (6), pectinatus (9), *centralis* (11), brandegei (21).

Radial spines 10 to 20 mm. long.
dasyacanthus (4), brandegei (21), mamillatus (63), alamosensis (64).

+ + + + *Radial spines more than 20.*

dasyacanthus (4), *ctenoides* (6), mamillatus (63).

* * * * *Central spines more than 4.*

+ *Radial spines 10 or less.*

roetteri (15), *roemeri* (37), maritimus (40), *thurberi* (75).

+ + *Radial spines 10 to 15.*

Radial spines 5 to 10 mm. long.
chloranthus (3), maritimus (40), pacificus (41).
Radial spines 10 to 20 mm. long.
roetteri (15), sanborgianus (26), gummosus (60).
Radial spines more than 20 mm, long.
roemeri (37), *giganteus* (67).

+ + + Radial spines 15 to 20.

Radial spines 5 to 10 mm, long.
chloranthus (3), pectinatus (9), *centralis* (11).
Radial spines 10 to 15 mm. long.
dasyacanthus (4), longisetus (17), bradtianus (65).
Radial spines more than 20 mm. long.
giganteus (67).

+ + + + *Radial spines more than 20.*

dasyacanthus (4), eruca (66).

GEOGRAPHICAL DISTRIBUTION.

So far as now known there are twenty-nine species of the genus *Cereus* represented within the borders of the United States, one of which is a West Indian form extending into Florida, and ten are peculiar to our flora. The genus is a very large and diversified one in Mexico, ranging in habit from small globose forms through cylindrical ones and climbers to the huge arborescent forms of the "cardon" forests of Sonora and Lower California. In the United States the genus is not represented north of the mountains of southern Wyoming or east of Indian Territory, except in the case of the Florida species referred to. As in the case of the genera already considered, our species appear but as outliers of the large Mexican flora. So uncertain is one knowledge of the latter that no attempt is made to include its species in this discussion.

Omitting *monoclonos*, a West Indian species of EUCEREUS which occurs in Florida, the two great groups of the genus are represented in the United States by twenty-eight species, twenty-three belonging to ECHINOCEREUS, and five to EUCEREUS. The EUCEREUS group is

eminently Sonoran, and its arborescent forms, three in number (giganteus, *thurberi*, and *schottii*), are strictly confined to the desert region of the Lower Colorado, chiefly upon the Arizona side in the region of the Gila River; but they are merely the northern representatives of the large display of giant forms found in Sonora and Lower California. Of the nonarborescent forms of Eucereus, but two are included in our flora, one (*emoryi*) being a Lower Californian type extending into southern California, and the other (*greggii*) a Sonoran and Chihuahuan type extending into Arizona and as far east as the Pecos River in Texas, by far the most eastern of our Eucerei. It will be seen that there are no species of Eucereus peculiar to the United States.

The relatively larger display of the Echinocerei in the United States is probably to be partially explained by their low compact forms, simulating in a perplexing way those of *Cactus* and *Echinocactus*. Out of the twenty-three species of our flora but two are really cylindrical, one (*poselgeri*) a form occurring on both sides of the Lower Rio Grande and so weak and slender that it uses shrubs for a support; the other (*berlandieri*) also a form of southeastern Texas, originally found on the Nueces, apparently peculiar to the United States, and with its short cylindrical body forming a transition between the cylindrical and more compact forms. The remaining twenty-one species form our dominant *Cereus* flora, and of these but nine are peculiar, so far as now known, to the United States. These twenty-one species are easily thrown into three groups: (1) the pectinate forms; (2) the purple-flowered nonpectinate forms; and (3) the scarlet-flowered nonpectinate forms. The first contains seven species, the second six species, the third eight species.

The pectinate forms are characteristically eastern in their display and have the greatest northern extension, *viridiflorus* reaching the mountains of southern Wyoming. Their Mexican origin is also more in the direction of Coahuila and Chihuahua than of Sonora. Of the seven species represented, three are peculiar to the United States (*viridiflorus*, *chloranthus*, and *dasyacanthus*). Of these three forms only *viridiflorus* has a northern range, extending from the mountains of southern Wyoming through Colorado to the borders of eastern New Mexico and northwestern Texas, but it is represented in the El Paso region by its cylindrical variety, *tubulosus*. In the case of time two other species, *chloranthus* has a very restricted range, being confined to the El Paso region, while *dasyacanthus*, occurring in the same region, extends westward to Arizona. It is more than probable that both of these species will be found in Mexico. The closely associated *ctenoides* is also a form of southwestern Texas, which has come from Coahuila and Chihuahua. Another species of Chihuahuan origin, occurring in the El Paso region but extending westward to Arizona, is *roetteri*. The strongest pectinate type, however, is exhibited by the species *pectinatus*, which is common to Chihuahua and Sonora, but

is represented in our flora by its variety *rigidissimus*, one of the most common of Arizona forms and extending to southwestern Texas, and the variety *centralis*, also an Arizona form. This same *pectinatus* type is represented at the east by *cæspitosus*, the most eastern of our Cerei, reaching the Canadian and Arkansas Rivers in Indian Territory, and apparently not occurring west of the Pecos, its Mexican extension being in the States east of Chihuahua.

The purple-flowered nonpectinate species, six in number, range from the Salt Lake Desert of Utah on the north to the eastern slopes of the Californian Sierras and the middle Rio Grande on the south, their Mexican connections extending from Lower California to Coahuila. But one of them (*mojavensis*) is peculiar to our flora, occurring in the desert regions of southeastern California, Arizona, and southern Utah. Four of the species reach Texas: *dubius* in the Rio Grande bottoms from El Paso downward, with no western extension, but with a Mexican extension into Chihuahua and Coahuila; *enneacanthus* all along the Lower Rio Grande and to El Paso, with a similar Mexican extension, but reaching Arizona on the west; *stramineus*, common in the Pecos and El Paso region, extending down the Rio Grande, west to Arizona, and south into Coahuila; and *fendleri*, a Sonoran and Chihuahuan type, which stretches through Arizona to Utah and east to southwestern Texas. The dominant species of the group, however, *engelmanni*, is far western in its distribution, extending from Lower California and Sonora along the eastern slopes of the Californian Sierras and through Arizona and Nevada to the Salt Lake Desert of Utah. Two strong varieties of this species are peculiar to our flora: *variegatus*, occurring with the species within our borders, and *chrysocentrus*, confined to the deserts of southeastern California.

The scarlet-flowered nonpectinate species, eight in number, contain five peculiar to our flora, but these five are species of no great abundance, and one of them (*hexaedrus*) has never been rediscovered. The three remaining species, which are the dominant ones, are all common to the Chihuahua region, and extend from the El Paso region to southern California. Of the five species restricted to the United States, *gonacanthus* is the most northern and the most removed from the Mexican flora, occurring in southern Colorado and northern New Mexico; *hexaedrus* is the least known, having been found but once, and then near Zuni, New Mexico; *paucispinus* inhabits the narrow belt between the San Pedro and Pecos rivers of Texas, a range, however, which specimens recently received from Durango, Colorado, will modify; *triglochidiatus* ranges from east of the Pecos in Texas northward into New Mexico; while *octacanthus* has the most extended range, reaching from the El Paso and Pecos region of Texas northwestward through New Mexico into Utah. The three species of wide range and Mexican representation are: *aggregatus*, extending from southern Colorado through eastern Arizona and southwestern Texas to San Luis Potosi; *roemeri*,

ranging from the Upper Pecos in New Mexico to southern California, and extending southward into Chihuahua; and *polyacanthus*, most abundant of all the group, extending from El Paso to southern California and southward into the mountains of Chihuahua on the east and Lower California on the west.

Taking our species of *Cereus* as a whole, therefore, they may be broadly thrown into two geographical groups, the El Paso forms and the Arizona forms, the former, containing about two-thirds of the species, and of Chihuahua origin, the latter of Sonoran origin.

6. OPUNTIA Mill. Gard. Dict. ed. 7 (1759).

Plants with that or cylindrical more or less tuberculate joints: leaves conspicuous but caducous, each with an axillary "pulvinus" which is usually clothed with soft wool intermixed with barbed bristles at the upper edge and usually bearing spines at the lower edge: flowers developed from the bristle-bearing part of the pulvinus, with rotate corollas: ovary covered with the caducous leaves bearing axillary wool and often bristles and spines: fruit dry or succulent: seeds large, usually flattened and discoid, often margined: cotyledons foliaceous, carved about the endosperm. *Consolea* Lem. (1862); *Tephrocactus* Lem, (1868); *Ficindica* St. Lag. (1880).

The most difficult of our genera on account of its exceedingly ill-defined specific lines. Little more is attempted in the following pages than a tentative presentation of our material, and little more can be done until numerous forms have been studied under cultivation.

I. Platopuntia. *Joints flat, more or less round: spines never sheathed: seeds with prominent margin.*

* *Petals small, subulate, suberect: stigmas 1 to 3 acute.*

1. Opuntia stenopetala Engelm. Syn. Cact. 289 (1856).

Prostrate, with large thick joints 15 to 20 cm, broad: pulvini 3 to 3.5 cm. apart on surface of joint, but very crowded at margin, with much dirty-white wool and short dark-brown bristles: spines 1 to 3 (often with 1 to 3 smaller ones added), 3.5 to 5 cm. long, curved deflexed or spreading, compressed, reddish-black with lighter tip: flowers orange, its pulvini very woolly: sepals and petals numerous, linear-subulate and suberect: style undivided at apex: ovary 18 mm. long: fruit unknown. (*Ill.* Cact. Mex. Bound. t. 66)—Type, Gregg 295 in Herb. Mo. Bot. Gard.

"Battlefield of Buena Vista, south of Saltillo" (Gregg).

Specimens examined: Coahuila (Gregg 295 of 1848; *Weber* of 1865-1866).

The Mexican *O. grandis* has similar flowers, but is an erect plant, with few white spines and two or three acute stigmas.

** * Petals broad, obovate or obcordate: stigmas usually 5 to 10, obtuse.*

+– Fruit succulent: margin of seed mostly narrow.

++ Joints glabrous

(1) *Suberect: spines numerous, colored: fruit small, subglobose.*

2. Opuntia strigil Engelm. Syn. Cact. 290 (1856).

Suberect, pale-green, about 6 dm. high, with the obtuse or subacute joints ovate, obovate, or orbicular, 10 to 12.5 cm. long and 8.5 to 10 cm. broad: pulvini prominent, crowded (8 to 12 mm. apart), whitish-woolly when young, soon with pale-yellow bristles, all spiniferous: spines 5 to 8, radiant, red or reddish-brown, yellowish toward tip, 6 to 16 mm. long, toward margin of joint, with 1 or 2 stouter longer (nearly 2.5 cm.) erect, spreading, or deflexed ones (deep-brown to light reddish-brown to yellow): fruit subglobose, about 12 mm. in diameter, red: seeds thick, obtusely and narrowly margined, 3 mm. in diameter. (*Ill.* Cact. Mex. Bound. t. 67)—Type, Wright 374 in Herb. Mo. Bot. Gard.

In crevices of limestone rocks, between the Pecos and El Paso, Texas.

Specimens examined: Texas (*Wright* 374 of 1851, 1852; *Nealley* of 1891).

(2) Erect or procumbent: joints large: spines (when present) few, stout, compressed, mostly colored: fruit large, mostly ovate.

A. Unarmed.

3. Opuntia ficus-indica (L.) Mill. Dict. ed. 8, no. 2 (1768).

Cactus ficus-indicus L. Sp. Pl. i, 468 (1753).

Erect and proliferous, 12 to 18 dm, high, with cylindrical trunk which becomes woody with age: joints thickish, elliptical or obovate, 10 to 45 cm. long: pulvini immersed, distant, not spinose or rarely with a minute solitary spine: Flowers yellow, 7.5 to 10 cm. in diameter: fruit bristly, obovate, red within, edible.—Type unknown.

Throughout the West Indies (extending into southern Florida) and Tropical America, and cultivated south of the Rio Grande under the name "nopal castillano."

Specimens examined: Cuba (*Wright*, 1860-64): *CANARY ISLANDS* (*Bourgeau* 1239).

Probably the most ancient cactus in gardens. In the Kew Index it is suggested that this species is identical with *O. tuna*, which seems to be very probable.

4. Opuntia lævis, sp. nov.

Joints light-green, elongate-obovate, 30 cm. long and 10 cm. wide, gradually narrowed below, obtusely pointed above: pulvini small, oval (3 to 4 mm. long), 2,5 to 3.5 cm. apart, gray-tomentose, with numerous short pale bristles, unarmed: flowers yellow, tinged with red, about 6 cm. broad: stigmas slender, 8: fruit somewhat pyriform, 5 to 6 cm, long, deeply umbilicate, bearing about 40 pulvilli : seed very irregular, 4 to 5 mm. in diameter, with thick acute undulate margin.—Type, Pringle of 1881 (distributed as *O. angustata*) in Herb. Coulter.

Arizona.

Specimens examined: Arizona (*Pringle* of 1881; *Palmer* 93, 95; *Coues & Palmer* 247; *Vasey* 247).

Besides the spineless character, the seeds are about half as large as those of *O. angustata*, to which species it has been referred.

B. Spines yellow (*sometimes red in* O. lindheimeri).

i. *Stem erect.*

5. Opuntia tuna (L.) Mill. Dict. ed. 8, no. 3 (1768).
Cactus tuna L. Sp. Pl. i, 468 (1753).
Opuntia bonplandii H. B. K. Nov. Gen. & Sp. vi, 69 (1823).

Erect and proliferous, 9 to 12 dm. high, with oval or elliptical joints 10 to 20 cm. long: pulvini distant, with a grayish tomentum, bearing above a fascicle of brownish-yellow bristles and below 4 to 6 rigid stout or subulate unequal spreading yellow spines (longest 2.5 to 3.5 cm. long): flowers yellow or reddish-yellow, 7.5 to 10 cm. in diameter: fruit somewhat pyriform, large and edible.—Type unknown.

Throughout tropical America, and extensively cultivated.

Specimens examined: Florida Keys (*Binmar; Canby* of 1869): Cuba (*Wright* of 1860-64): San Luis Potosi (*Parry & Palmer* 279; *Weber* of 1866): Vera Cruz (*Parry* of 1877): Nicaragua (*Wright* of 1853-56): Panama (*Schott* 3): Canary Islands (*Bourgeau* 263): also specimens cultivated in Mo. Bot. Gard. in 1862, 1870, 1876, and growing in 1893; also specimens from South Carolina (*Tourney* of 1846; *Mellichamp* of 1871), presumably cultivated; also Hort. Vindob. 837.

This species is so extensively cultivated and naturalized that it seems impossible to define its natural range. In Southern California it is cultivated for fences and naturalized about the old missions, where it is called "tuña." In Lower California and Mexico it is also extensively cultivated.

6. Opuntia triacantha (Willd.) DC. Prod.. iii, 473 (1828), not Sweet, Hort Brit. 172 (1827).
Cactus triacanthos Willd. Enum. Suppl. 34 (1813).

Erect and proliferous, with oval to oblong joints: pulvini somewhat crowded, with yellowish bristles and usually 3 (4 to 1) still divaricate spreading or reflexed whitish spines, the upper 3 to 5 cm. long, often twice as long as the two lower ones: flowers reddish, 2.5 cm. in diameter.—Type unknown.

Throughout Tropical America.

Specimens examined: Cuba (*Wright* 1860-64): Antigua (*Wullschlogel* of 1849): cultivated in Hort. Modena.

The spines of this species are much weaker (as well as fewer) than those of *O. tuna*. According to the Kew index *O. triacantha* Sweet[1] is *O. curassarica* Mill.,[2] a south Mexican and South American plant, which we have not seen, but which is certainly not the species described above.

7. Opuntia lindheimeri Engelm. Pl. Lindh. 207 (Jan, 1850).
Opuntia engelmanni Salm, Cact. Hort. Dyck. 235 (1850).

Erect, 12 to 18 dm. high, with a stem at length woody and terete (15 cm. in diameter) bearing a grayish cracked and unarmed bark, and large pale-green obovate or orbicular-obovate joints (in larger specimens 30 cm. long by 22.5 cm. broad): pulvini remote (3 to 3.5 cm. apart), with sparse yellow rigid strongly unequal bristles, and few spines (in upper pulvini mostly two or three) 2.5 to 3.5 cm. long, strongly

[1]Hort. Brit. ed. 1, 172. [2]Gard. Dict. ed. 8, no. 7.

compressed or angular, straight or curved deflexed or variously divergent, straw-colored or horny, with reddish base or entirely red, and one or two additional lower ones 1.2 to 1.8 cm. long (slenderer, paler, often wanting): flowers yellow, red within, 6 to 7.5 cm. broad: fruit obovoid-globose (rarely pyriform), 5 cm. long and 3.5 cm. broad, purplish, with bright-purplish insipid or nauseous pulp: seeds somewhat irregular, mostly narrow-margined, 3 to 4 mm, in diameter. (*Ill.* Cact. Mex. Bound. t. 75, f. 1-4)—Type, Lindheimer 1722 of 1845 in Herb. Mo. Bot. Gard.

Along the whole Mexican border, from the Canadian River and mouth of the Rio Grande to the Pacific and adjacent islands, and southward into Chihuahua and Coahuila.

Specimens examined: Texas (*Lindheimer* 1722 of 1845; *Wright* 329, 437, 473, of 1852; *Bigelow* 117 of 1852; *Tweedy* of 1880): New Mexico (*Bigelow* 91; *Evans* of 1891, Lordsburg; *Mearns* of 1892, Grant Co.): Arizona (*Palmer* 81, 95, 477; *Rusby* of 1883, Oak Creek; *Evans* of 1891, Tucson; *Toumey* of 1892, Tucson): California (*Wislizenus* 223; *Rothrock* 10, Santa Cruz Island; *G. R. Vasey* of 1880. San Bernardino): Coahuila ("St. Louis Volunteers" of 1846): also cult. in Mo. Bot. Gard. 1853, 1861, 1862, and growing in 1893.

A stout, coarse looking plant of wide range and variation. This and apparently all other Platyopuntias are indiscriminately spoken of as "nopal" and "tuna," the former name being applied to the joint, the latter to the fruit. The spines are variously colored, being frequently a deep-red, or entirely white, or variegated. Evans's specimens from Lordsburg not only have deep-red spines, but also ovate joints. The four following forms have been suggested as varieties, and they may prove constant enough.

8. Opuntia lindheimeri dulcis (Engelm.).

Opuntia dulcis Engelm. Cact. Mex. Bound. 48 (1856).

Lower (6 dm. high) and more spreading, with smaller joints (15 cm. long), very numerous bristles, mostly twisted deflexed pale (almost white) spines, ovate sweet fruit, and smaller regular seeds. (*Ill.* Cact. Mex. Bound. t. 75, f. 5-7)—Type, Mexican boundary collections of Bigelow and Wright in Herb. Mo. Bot. Gard.

Along the middle Rio Grande, near Presidio del Norte, etc.

Specimens examined: Texas (*Bigelow* of 1852-54; *Wright* of 1852): also growing in Mo. Bot. Gard. 1893.

9. Opuntia lindheimeri occidentalis (Engelm.).

Opuntia occidentalis Engelm. & Bigel. Pacif. R. Rep. iv, 38 (1856).

Opuntia engelmanni occidentalis Engelm. Pacif. R. Rep. iv, errata, iii (1856).

Erect and spreading, 12 dm. high, forming large thickets, with joints as large as in the species, pulvini more remote and with very fine close-set bristles, one to three white (dusky at base) deflexed or divergent spines, very juicy but sour fruit, and larger (5 to 6 mm. broad) seeds with crenulate margins. (*Ill.* Pacif. R. Rep. iv, t. 7, f. 1, 2; t, 22, f.10)—Type, Schott of 1854 and 1855 in Herb. Mo. Bot. Gard.

Very abundant in southern California west of the coast mountains; also found near Laredo, Texas.

Specimens examined: California (*Schott* of 1854 and 1856; *Engelmann* of 1880; *Nevin* of 1881): Texas (*Nealley* of 1891, at Laredo): also cult. at Mo. Bot. Gard. 1876, and growing 1893.

Dr. Merriam reports this variety as abundant throughout the San Bernardino plain, and immense patches of it 40 miles east of Los Angeles. The habit of growth, very fine bristles, and larger seed serve to distinguish it from the species.

10. Opuntia lindheimeri cyclodes (Engelm.).

Opuntia engelmanni cyclodes Engelm. Syn. Cact. 291 (1856).

About 12 dm, high, with orbicular joints 15 to 18 cm. in diameter, mostly solitary straw-colored (dusky at base) straight and deflexed spines, small globose fruit 2.5 to 3.5 cm. in diameter, and seeds 4 to 5 mm. broad with broadly undulate thickish margins. (*Ill.* Pacif. R. Rep. iv, t. 8, f. 1; t. 29, f. 8, 9)—The type could not be found in the Engelmann Collection.

Front El Paso, Texas, to the Upper Pecos and Stein's Pass, in New Mexico.

Specimens examined: New Mexico (*Evans* of 1891, Stein's Pass): Texas (*Evans* of 1891, El Paso).

11. Opuntia lindheimeri littoralis (Engelm.).

Opuntia engelmanni littoralis Engelm. Bot. Calif. i, 248 (1876).

Joints often larger (3 to 4.5 dm. long), with pulvini closer together, longer and more slender spines, and smaller seeds.—Type Tittum and Mallinckrodt of 1874 in Herb. Mo. Bot. Gard.

Coast of southern California and the adjacent islands (reported from San Miguel, Santa Rosa, Santa Cruz, and Santa Catalina).

Specimens examined: Californian Islands (*Tittum & Mallinckrodt* of 1871; *Rothrock* of 1875, Santa Cruz).

12. Opuntia chlorotica Engelm. Syn. Cact. 291 (1856).

Opuntia tidballii Bigel. Pacif. R. Rep. iv, 11 (1856), *nomen nudum*.

Erect. 12 to 21 dm. high, forming large bushes, with stems at length woody and terete with scaly grayish or light-brown bark and completely covered with very numerous straw-colored bristles and yellow spines; joints orbicular-obovate, pale glaucous, 15 to 20 cm. long and 20 to 25 cm. broad: pulvini: about 2.5 cm. apart, with very numerous unequal bristles, and 3 to 6 (1 to 3 in lower pulvini) unequal angular pale straw-colored mostly deflexed spines 2.5 to 5 cm. long (the interior shorter and erect, 8 to 18 mm. long): flowers yellow, 5 to 7.5 cm. broad: fruit large (about 4 cm. long), ovate: seeds small (2.5 by 3.5 mm.), whitish, subreniform, thick, with obtuse margin. (*Ill.* Pacif. R. R. iv, t. 6, f. 1-3)—Type, Bigelow of 1853 and 1854 in Herb. Mo. Bot. Gard.

Western Arizona and southeastern California, and extending into the Charleston Mountains, Nevada.

Specimens examined: Arizona (*Bigelow* of 1853 and 1854; *Palmer* of 1877): California (*Bigelow* of 1854; *Parish* 1419, San Felipe).

The species is readily recognized by the very spiny trunk and very pale broad joints. The large and sometimes spreading bushes often bear 100 or more joints

The arrangement of the bristles is somewhat peculiar, the upper and outer ones (by far the more numerous) being shorter and thinner and covering the upper part of the areola, and within these a semicircular row of stouter and longer bristles, which join the outer and shorter spines of the outer and lower margin of the areola.

13. Opuntia tapona Engelm. MSS.

Joints obovate, 20 to 25 cm. long: pulvini about 5 cm. apart, with short marginal bristles and 2 (rarely more) pale rather stout compressed spines 1 to 1.5 cm. long: fruit elongated clavate stipitate, densely tuberculate, dark-purple, 5 to 6 cm. long, sterile so far as seen.—Type, Gabb 20a in Herb. Mo. Bot. Gard.

Sandy soil, especially southward in Lower California.

Specimens examined: Lower California (*Wm. M. Gabb* 20a, ill 1867, near Loreto).

The name refers to a fancied resemblance of the fruit to a bottle-stopper (*tapone*).

14. Opuntia larreyi Weber, MSS.

Plant only 9 to 12 dm, high, with large orbicular glaucous joints: fruit, "as large as a goose egg," juicy, purple, and with purple pulp: seeds small, "much like those of *O. ficus-indica*."—Type unknown.

A Mexican species, found by Dr. Weber in cultivation about Queretaro, and pronounced by him the most delicious of all the fruits he had tasted. Known as "camuessa."

15. Opuntia palmeri Engelm. MSS.

Joints oval, smooth (not tuberculated), pale glaucous, 20 to 25 cm. long by 15 to 20 cm. broad: pulvini 2.5 to 3 cm. apart, with pale brownish or gray persistent wool, a few very slender straw-colored bristles, and slender flattened or compressed straw-colored spines 2.5 to 3 cm. long (5 to 7 on upper pulvini with some smaller additional ones, 1 to 3 on lower pulvini), erect or spreading, or the upper ones (from upper part or pulvinus) mostly deflexed.—Type, Palmer of 1877. in Herb, Mo. Bot. Gard.

Near St. George, Utah.

Specimens examined: Utah (*Palmer* of June, 1877).

16. Opuntia pycnantha Engelm. MSS.

Erect, with ovate-orbicular compressed scarcely tuberculate joints 12.5 to 15 cm. long by 19.5 cm. wide, armed with densely interwoven mostly deflexed spines: pulvini approximate (6 to 8 mm. apart), with fulvous wool (becoming dusky), and weak bristles (at length elongated and very numerous): spines in younger joints 3-7, pale straw-color (at length ashy), 6 to 25 mm. long, all deflexed; in older, joints more numerous (as many as 20), longer and more rigid; flowers and fruit unknown.—Type, Agassiz of 1872 in Herb. Mo. Bot. Gard.

Magdalena Bay, Lower California.

Specimens examined: Lower California (*Prof L. Agassiz*, Magdalena Bay, collected on the Hopler expedition in 1872; *Brandegee* of 1889, Magdalena Island).

The above description was drawn up by Dr. Engelmann from the, Agassiz material. Brandegee's specimens supply a good joint, a flower, and ripe fruit, enabling me to supplement the description. The joint is 22 by 14 cm., the pulvini very large and prominent and close together, sometimes even in contact. The fulvous wool gradually becomes darker until it is black, and encircling it above there is usually a more or less prominent tuft of bright-yellow bristles. The single withered flower is small and greenish yellow. The fruit is evidently juicy, globose or obovoid, strongly tuberculate, closely set with the pulvini bearing dark wool, and yellow bristles and spines, about 4.5 cm. in diameter. The seeds are discoid and beaked, somewhat irregular, with thick margin, 3 to 3.5 mm. broad. The spines are terete.

17. Opuntia pycnacantha margaritana, var. nov.

Pulvini not so prominent, with more grayish wool, reddish bristles, dark-red more rigid and more or less angular and compressed spines.—Type in Herb. Brandegee.

Santa Margarita Island.

Specimens examined: Lower California (*Brandegee* of 1889).

Mr. Brandegee also notes that the flowers are red.

ii. Stem procumbent.

18. Opuntia procumbens Engelm. Syn. Cact. 292 (1856).

Prostrate, with the large pale-green orbicular-obovate joints always on edge, 15 to 30 cm. long by 15 to 22 cm. broad: pulvini 2.5 to 5 cm. apart, with long (3 cm.) tomentum, yellow rigid strongly unequal bristles, and 2 to 5 (sometimes 7 to 9) compressed-angular unequal deflexed spines 1 to 5 cm. long (lower ones shortest) and straw-color or paler, darker towards the base, often reddish or reddish-brown: fruit ovate, 3.5 cm. long: seeds 3 to 4 mm. in diameter, with broad irregular margins. (*Ill.* Pacif. R. Rep. iv, t. 7, f. 4, 5).—Type, Bigelow of 1854 in Herb. Mo. Bot. Gard.

In rocky places, from El Paso, Texas, to northwestern Arizona.

Specimens examined: Arizona (*Bigelow* of 1854): Texas (*Evans* of 1891, El Paso).

The original Arizona range is "from the San Francisco Mountains to Cactus Pass at head of Bill Williams River." The El Paso specimens are smaller than the more western ones, but otherwise there seems to be no difference.

19. Opuntia rubrifolia Engelm. MSS.

Prostrate, with thick ovate joints 1.2 to 15 cm. long by 10 cm. broad, not tuberculated: leaves spreading, somewhat recurved, reddish, 8 to 10 mm. long: pulvini 2 to 2.5 cm. apart, with brownish-gray persistent wool and numerous yellowish bristles (especially on the upper edge): spines at lower edge of pulvinus, mostly 2 or 3, slender, angular, and often twisted, 2.5 to 6 cm. long, often a few additional smaller ones, all de deflexed (almost appressed): flowers and fruit unknown.—Type, Palmer 3 in Herb. Mo. Bot. Gard.

St. George, Utah.

Specimens examined: Utah (*Palmer* 3).

20. Opuntia angustata Engelm. Cact. 292 (1856).

Prostrate or ascending, with elongated obovate joints (narrowed toward the base and rounded above) 15 to 25 cm. long or more and 7.5 to 10 cm. broad: pulvini over 2.5 cm. apart, with grayish wool, slender yellowish-brown bristles, and 2 or 3 (often 1 or 2 weaker ones added below) stout angular deflexed spines 2.5 to 5 cm. long, straw-colored or white, yellow or red toward the base: fruit obovate subglobose, broadly and deeply umbilicate, tuberculate and bristly, reddish, 2.5 to 3.5 cm. long: seeds about regular, with broad almost curled margins, 6 mm. or more in diameter. (*Ill.* Pacif. R. Rep. iv, t. 7, f. 3, 4; t. 22, f. 11)—Type, the Bigelow specimens in Herb. Mo. Bot. Gard.

From New Mexico to the mountains of southern California.

Specimens examined: New Mexico (*Bigelow* of 1853): Arizona (*Bigelow* of 1.854): California (*Bigelow* of 1854).

21. Opuntia angustata comonduensis, var. nov.

Joints semiobovate (one side straight, as if an obovate joint had been divided in the median line), tapering below as in the species, but with greatest diameter near the middle and tapering above, 20 cm. long, 4.5 to 7.5 cm. broad: spines terete: flower 5 cm. long, yellowish, with reddish tinge outside: fruit at last neither tuberculate nor spiny, but with prominent woolly and bristly pulvini, pyriform, about 4 cm. long: seeds smaller, 3.5 to 4 mm. broad.—Type in Herb. Brandegee.

Commondu, Lower California..

Specimens examined: Lower California (*Brandegee* of 1889).

The spines are most prominent along the curved margin and above, some pulvini becoming spineless, until in one specimen the whole joint is unarmed except a few pulvini. In his discussion of *angustata*[1] Dr. Engelmann remarks that while specimens east of the Colorado have sharply angular spines, the one that he had from the California mountains had spines not so angular, and some of them were almost terete. This Lower Californian variety has all the spines distinctly terete. As Dr. Engelmann's description of the fruit was drawn from a single specimen, it is probable that there was no evidence that the tubercles eventually disappeared.

C. Spines reddish or blackish.

22. Opuntia macrocentra Engelm. Syn. Cact. 292 (1856).

Ascending, 6 to 9 dm. high, with large suborbicular thin often purplish joints 12.5 to 20 cm. long and 10 to 17.5 cm. broad: pulvini 2 to 2.5 cm. apart, with grayish wool, slender short yellow bristles, uppermost and marginal ones alone armed, the lower without spines: spines 1 or 2 (rarely more), 5 to 7.5 cm. long, straight or variously flexed, reddish-black, paler upward, often annulate, upper terete, lower a little shorter and compressed or channelled: flowers yellow, 7.5 cm. broad: fruit ovate, 3 cm. long: seeds much twisted, 4 to 4.5 mm. broad, broadly and obtusely undulate margined. (*Ill.* Cact. Mex. Bound. t. 75, f. 8)—Type, the Wright specimens in Herb. Mo. Bot. Gard.

[1] Pacif. R. Rep., iv [pt 1], 39.

Sandy ridges in southwestern Texas to Arizona and extending southward into Chihuahua.

Specimens examined: Texas (*Wright* of 1851-52; *G. R. Vasey* of 1881, El Paso; *Evans* of 1891, Sierra Blanca; *Trelease* of 1892; *Woodward*): New Mexico (*Evans* of 1891, Lordsburgh): Arizona (*Wilcox* of 1894, Fort Huachuca): Chihuahua (*Pringle* 235, a spineless form distributed as *O. rufida*).

The thin joints and long nearly black spines characterize the species. The Chihuahuan specimen of Pringle is spineless and has smaller pinkish flowers (5 cm. broad); however, spiny and spineless joints are sometimes found on the same plant. Vasey's material has spines more grayish than usual and bristles more reddish-brown, being unusually suggestive of *mesacantha*.

23. Opuntia phæacantha Engelm. Pl. Fendl. 51 (1849).
Opuntia phæacantha nigricans Engelm. Syn. Cact. 293 (1856).
Opuntia phæacantha brunnea Engelm. l. c.

Diffuse, ascending, with obovate thick glaucous or sometimes purplish joints 10 to 17.5 cm. long and 6 to 11 cm. broad: pulvini 2.5 to 3.5 cm. apart, with grayish wool and slender yellowish or brownish bristles, mostly armed: spines 2 to 5, straight, reddish-brown to blackish, paler upwards, 2.5 to 6 cm. long, the upper one teretish and porrect, the rest shorter, unequal, more or less angular or compressed, deflexed. fruit cuneate-pyriform, much contracted at base, with a broad and shallow umbilicus, scarcely pulpy, 3 to 3.5 cm. long: seeds very variable, 4 mm. broad or smaller. (**Ill**. Cact. Mex. Bound. t. 75, f 9-15)—Type, the Fendler specimens in Herb. Mo. Bot. Gard.

Sandy ridges from the El Paso region of Texas to the Rio Grande, near Santa Fe, New Mexico, and eastern Arizona, and southward into Chihuahua.

Specimens examined: New Mexico (*Fendler* of 1846-47, along Rio Grande near Santa Fe): Arizona (*Parry* of 1867): Texas (*Wright* of 1851-52, in valley near El Paso; *Evans* of 1891, in same locality): Chihuahua (*Wislizenus* 249).

The flowers described in Pl. Fendl. and subsequent writings as those of this species prove not to belong here. In Watson's Bibliographical Index *O. polyantha* Haw. (*Cactus polyanthus* Sims) is referred here. In the Missouri Botanical Garden in 1893 there were growing plants of *polyantha* from South America, evidently that species as figured in the Botanical Magazine,[1] and not at all our *phæacantha*. *O. polyantha* much more resembles *O. tuna*.

24. Opuntia phæacantha major Engelm. Syn. Cact. 273 (1856).

Joints much larger, 12.5 to 15 cm. and even 20 cm. broad, with more remote pulvini, and shorter fewer paler spines.—Type, Fendler of 1846 in Herb. Mo. Bot. Gard.

Mountains near Santa Fe, New Mexico.

Specimens examined: New Mexico (*Fendler* of 1846; *Bigelow* of 1853).

This variety is characterized in Plantæ Fendlerianæ, but without name.

[1] liii, t. 2691.

25. Opuntia camanchica Engelm. Syn. Cact. 291 (1856).

Prostrate and extensively spreading, with ascending obovate-orbicular joints 15 to 17.5 cm. long by 13.5 to 17.5 cm. broad: pulvini about 3 cm. apart, with few greenish or yellowish-brown bristles, mostly armed: spines 1 to 3 (or marginal ones 3 to 6), compressed, reddish-brown to blackish-brown, paler at tip, 3.5 to 7.5 cm. long, the upper one elongated and suberect, the rest deflexed : fruit oval, with broad umbilicus, deep red, sweet and juicy, 3.5 to 5 cm. long: seeds angular, with broad thick acute or obtuse margins and deeply notched at the hilum, 4 to 6 mm. broad. (*Ill.* Pacif. R. Rep. iv, t. 9, f. 1-5; t. 22, f. 12-15)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

In rather fertile soil "at base of hills," from southern Colorado through western Texas, New Mexico, and Arizona.

Specimens examined: Colorado (*Engelmann* of 1881): Texas (*Evans* of 1891, near El Paso): New Mexico (*Bigelow* of 1853): Arizona (*Palmer* of 1869; *Evans* of 1891; *Trelease* of 1892).

This species is reported from the Llano Estacado, on the Upper Canadian, as a large and extensively spreading plant.

26. Opuntia tortispina Engelm. Syn. Cact. 293 (1856).

Prostrate, with ascending orbicular-obovate joints 15 to 20 cm. long: pulvini 2.5 to 3.5 cm. apart, with yellowish bristles: spines 3 to 5, white, angular, and channelled, often spirally twisted, 3.5 to 6 cm. long, with 2 to 4 more slender ones (1 to 2.5 cm. long) added below: flowers sulphur-yellow, 6 to 7.5 cm. broad: fruit ovate, with broad umbilicus, 4.5 to 5 cm. long: seeds orbicular, regular, and but slightly notched at hilum, 4 to 6 mm. broad. (*Ill.* Pacif. R. Rep. t. 8, f. 2, 3; t. 23, f. 1-5)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

From the plains of the Platte, Nebraska, to those of Indian Territory and northern Texas.

Specimens examined: Nebraska (*H. Engelmann* of 1858): Indian Territory (*Bigelow* of 1853).

27. Opuntia mojavensis Engelm. Syn. Cact. 293 (1856).

Prostrate, with suborbicular joints: pulvini remote, with large yellow bristles: spines 2 to 6, stout and annulate, acutely angular and conspressed, more or less curved, reddish-brown, paler toward tip, 2.5 to 6 cm. long, 1 to 3 smaller slenderer pale ones added below: fruit oblong, 4.5 cm. long. (*Ill.* Pacif. R. Rep. t. 9, f. 6-8)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

"On the Mohave, west of the Colorado," California.

Specimens examined: California (*Bigelow* of 1853).

(3) *Ascending joints rather small spines few, terete or scarcely angular, slender, flexible, pale: fruit smaller than in* (2).

26. Opuntia tenuispina Engelm. Syn. Cact. 294 (1856).

Diffuse or ascending, about 3 dm. high, with obovate bright-green joints attenuate at base and 7.5 to 15 cm. long by 5 to 10 cm, broad: pul-

vini 1 to 2.5 cm. apart, with slender short bright reddish-brown bristles: spines 1 or 2, elongated (3.5 to 7.5 cm.), white (sometimes dusky at base and apex, teretish, straight, slender, flexile. suberect or spreading (in upper pulvini the upper one porrect and the rest deflexed), and 1 to 4 shorter (1 to 3 cm.) white inferior one: flowers yellow, 6 to 7.5 cm. broad: fruit oblong, with deep umbilicus, 2.5 to 3 cm. long: seeds very irregular, with narrow margin and deeply notched hilum, 3 to 4 mm. broad (*Ill.* Cact. Mex. Bound. t. 75, f. 14)—Type, the Wright specimens in Herb. Mo. Bot. Gard.

Sandy ridges on the Rio Grande from El Paso, Texas, northward into adjacent New Mexico.

Specimens examined: New Mexico (*Wright* of 1852, Doña Ana): Texas (*Wright* of 1851-52, El Paso): also cult; in Mo. Bot. Gard. 1870.

29. Opuntia setispina Engelm.; Salm, Hort. Dyck. 239 (1850)

Ascending, with small suborbicular glaucous joints not over 5 cm. long: pulvini crowded (6 to 8 mm. apart), with yellowish bristles: spines 4 to 10, very slender (like the bristles), 1 to 3 longer (2.5 to 3.5 cm.) and subangular, 3 to 7 shorter and more or less deflexed: flowers and fruit unknown.—Type, Wislizenus of 1810 in Herb. Mo. Bot. Gard.

"Pine woods in mountains west of Chihuahua."

Specimens examined: Chihuahua (*Wislizenus* of 1846).

30. Opuntia filipendula Engelm. Syn. Cact. 291 (1856).

Ascending from a long thick tuberiferous root, 1.5 to 3 dm. high, with orbicular or obovate or oblanceolate thin bluish glaucous joints, 3.5 to 7.5 long by 2.5 to 5 cm. broad: pulvini 8 to 12 mm, apart, with white wool, greenish-yellow very slender numerous penicillate bristles (becoming very conspicuous), with or without spines: spines (if present) white, 1 or 2 elongated setaceous deflexed ones (not rarely subangular and twisted) 2.5 to 5 cm. long, and 1 or 2 smaller lower ones: flowers purplish, 6 cm. broad: seeds very thick, with narrow but thick and obtuse margins, 3.5 to 4 mm. broad. (*Ill.* Cact. Mex. Bound. t. 68)—Type, the Wright specimens in Herb. Mo. Bot. Gard.

Alluvial bottoms of the Rio Grande from the Pecos to El Paso, Texas, and southward into Chihuahua.

Specimens examined: Texas (*Wright* of 1852; *Schott* of 1855): Chihuahua (*Pringle* 147; E. A. *Mearns* of 1892, "Mesquite Spring").

(4) *Procumbent or ascending joints rather small spines: stout, subterete, white or dusky, or none; fruit clavate.*

31. Opuntia mesacantha Raf.; Seringe, Bull. Bot. Gen. 216 (1830).
Opuntia cespitosa Raf. l. c.
Opuntia rafinesquii Engelm. Syn. Cact. 295 (1856).
Opuntia vulgaris rafinesquii Gray, Man. ed. 2, 136 (1856).
Opuntia vulgaris in part of Amer. authors, not Haw.

Diffuse, from a fibrous root, with obovate or suborbicular very green joints 7.5 to 12.5 cm. long bearing elongated subulate spreading leaves 6 to 8 mm. long: pulvini 1.8 to 2.5 cm. apart, with slender reddish-

brown bristles, mostly unarmed: spines (when present) few, mostly only marginal, stout, terete, straight, erect or spreading, whitish (often reddish at base and apex), 1.8 to 2.5 cm. long, single, or 1 or 2 smaller deflexed ones in addition: flowers sulphur-yellow (often with red center), 6 to 8.5 cm. broad: fruit clavate, naked, with funnel-shaped umbilicus, 3.5 to 5 cm. long (less than half that in diameter), with acid or sweetish purplish pulp: seeds almost regular, compressed, with rather narrow and thick but acutish margins, 5 mm. broad (*Ill.* Pacif. R. Rep. iv, t. 10, f. 3-5; t. 23, f. 7, 8)—Type unknown.

Sterile, sandy or rocky soil in the Mississippi valley from Minnesota and Wisconsin to Kentucky, Missouri, Louisiana, and Texas; apparently not found west of the western boundary of Missouri and Arkansas.

Specimens examined: WISCONSIN (*Hale* of 1861, in part): *ILLINOIS* (*Engelmann* of 1833-34; *Hall* of 1861, sandy barrens of Mason Co.; *Hayden* of 1862; *Coulter* of 1894, growing): ARKANSAS (*Bigelow* of 1853): KANSAS (*Hitchcock* of 1893, sandhills near Manhattan): also cult. in Goebel's Gard. 1845; Mo. Bot. Gard. 1856; Harvard Bot. Gard. 1871; Meehan's Gard. 1885.

An exceedingly variable species, the principal varieties being described under the nine following forms.

32. Opuntia mesacantha grandiflora (Engelm.)

Opuntia intermedia Engelm. Pl. Lindh. 206 (1850), not Salm (1834).

Opuntia rafinesquii grandiflora Engelm. Syn. Cact. 295 (1856).

Somewhat ascending, with larger joints (12.5 to 15 cm. long), pulvini 2.5 cm. apart, very slender bristles, almost no spines, large flowers (11 to 12.5 cm. broad, red in center), and elongated fruit 6 cm. long. (*Ill.* Pacif. R. Rep. iv, t. 11, f. 2, 3)—Type, Lindheimer of 1847 in Herb. Mo. Bot. Gard.

On the Brazos, Texas.

Specimens examined: TEXAS (*Lindheimer* of 1847).

33. Opuntia mesacantha parva, now. nov.

Opuntia rafinesquii minor Engelm. and Bigel. Pacif. R. Rep. iv, 41, name p. 55 (1856), not *O. minor* C. Muell.

Orbicular joints but 5 cm. in diameter, spineless or with a few on the upper margin. (*Ill.* Pacif. R. Rep. iv, t. 11, f. 1)—Type, Engelmann of 1845 in Herb. Mo. Bot. Gard.

Sandstone rock in southern Missouri.

Specimens examined: MISSOURI (*Engelmann* of 1845): also growing in Mo. Bot. Gard.

34. Opuntia mesacantha microsperma (Engelm.).

Opuntia rafinesquii microsperma Engelm. Syn. Cact. 295 (1856).

Almost unarmed, with more compressed smaller seeds (1.6 to 1.8 mm. broad) having narrower margins.—Type cult. in Mo. Bot. Gard. 1854 and preserved in Herb. Mo. Bot. Gard.

With the species.

Specimens examined: cult. in Mo. Bot. Gard. 1854, with no locality.

35. **Opuntia mesacantha cymochila** (Engelm.).
Opuntia rafinesquii cymochila Engelm. Syn. Cad. 295 (1856).
Opuntia rafinesquii cymochila montana Engelm. and Bigel. Pacif. R. Rep. iv, 42 (1856).

With orbicular mostly armed joints 6 to 8.5 cm. broad, pulvini 1.2 to 1.6 cm. apart, straw-colored or yellowish bristles, 1 to 3 stout white (often reddish-brown at base) subcompressed or twisted spreading or deflexed spines 2.5 to 5 cm. long (often 2 or 3 smaller deflexed ones added), short obovate fruit 2.5 to 3 cm. long, and irregular twisted undulate-margined seeds 5 mm, broad. (*Ill.* Pacif. R. Rep. t. 12, f. 1-3; t. 23, f 10-12)—Type, the Bigelow specimens in Herb. Mo. Bot. Gard.

From Kansas to southwestern Texas, Arizona, and Utah.

Specimens examined: Kansas (*Hall* of 1870): Texas (*Bigelow* of 1852; *V. Bailey* of 1892, Washburn): New Mexico (*Bigelow* of 1853; *Evans* of 1891, Stein's Pass and Deming): Arizona (*Palmer* 302; *Wilcox* of 1894, Ft. Huachuca): Utah (*Watson* 434).

36. **Opuntia mesacantha stenochila** (Engelm.).
Opuntia rafinesquii stenochila Engelm. Syn. Cact. 296 (1856).

Prostrate, with obovate joints 1.0 cm. long by 7.5 cm. broad, pulvini 2.5 cm. apart and only the upper ones armed, yellowish or greenish bristles, solitary white spine 2.5 to 3 cm. long with sometimes 1 or 2 smaller deflexed ones added, long obovate-clavate green or pale red very juicy fruit 3.5 to 6 cm. long and with a broad umbilicus, and regular thick very narrow and obtuse-margined seeds 5 mm. broad. (*Ill.* Pacif. R. Rep. iv, t. 12, f. 4-6; t. 23, f. 9)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

"Cañon of Zuñi, western New Mexico."

Specimens examined: New Mexico (*Bigelow* of 1853).

37. **Opuntia mesacantha macrorhiza** (Engelm.).
Opuntia macrorhiza Engelm. Pl. Lindh. 206 (1850).
Opuntia rafinesquii macrorhiza Engelm. Syn. Cact. 296 (1856).
Opuntia rafinesquii fusiformis Engelm. l. c. 397.

Prostrate or ascending, with elongated fusiform irregularly thickened root, orbicular-obovate very green joints, most or only upper pulvini armed, yellowish-brown bristles, 1 to 3 stout or slender white or variegated spreading or deflexed spines 2.5 to 3 cm. long (often 1 or 2 additional slender deflexed ones), flowers 5 to 7.5 cm. broad, ovate (scarcely clavate) fruit green or pale-purple, 3.5 cm. long, and thick almost regular acute-margined seeds 5.5 mm. broad. (*Ill.* Cact. Mex. Bound. t. 69; Pacif. R. Rep. iv, t. 12, f. 7, 8; t. 23, f. 6)—Type, Lindheimer of 1843-45 in Herb. Mo. Bot. Gard.

From the "Big Bend" of the Missouri River to the Guadalupe River of Texas and Arizona; in sterile rocky places.

Specimens examined: Texas (*Lindheimer* of 1843-45, 1850, 1872; *Wright* of 1852; *Parry* of 1869; *Hall* of 1872) : Arizona (*Bigelow* of 1853, on Deer Creek): Kansas (*Wislizenus* of 1816, type of *fusiformis;*

Kellerman of 1888): ARKANSAS (no collector given, but cult. in Mo. Bot. Gard. from White River, near Fayetteville).

38. Opuntia mesacantha greenii, var. nov.

Opuntia greenii Engelm. MSS.

With fibrous roots, orbicular-obovate deep-green joints, numerous short reddish-brown bristles, upper pulvini armed with 1 to 3 spines (upper one straight, stout, terete, 2.5 to 3.5 cm. long, lower ones mostly smaller, paler and deflexed), which are brownish-red at base or entirely so, ovate spineless fruit 3 cm. long with rather shallow umbilicus, and irregular seeds with broad rather acute margins and 6 mm. broad.—Type, Greene of 1870 in Herb. Mo. Bot. Gard.

From Colorado to Arizona.

Specimens examined: COLORADO (*E. L. Greene* of 1870, Golden City; *C. S. Sheldon*, Ft. Collins): ARIZONA (*Toumey* of 1892, Grand Cañon and Williams; *Wilcox* of 1894, Ft. Huachuca).

39. Opuntia mesacantha oplocarpa, var. nov.

Opuntia oplocarpa Engelm. MSS.

Joints orbicular, deep-green, 7.5 to 8.5 cm. in diameter: pulvini with a penicillate tuft of long brown bristles at upper end, all armed except the lower ones: spines mostly 2, rather stout and straight, the upper one reddish-brown (especially toward the base), stouter, erect or porrect, the lower one paler (or even white), deflexed and usually weaker: fruit clavate, with broad and shallow umbilicus, rather dry, spineless (or nearly so), brownish-red, 5 cm. long: seeds wavy-twisted.—Type, Greene of 1870 in Herb. Mo. Bot. Gard.

Colorado to southwestern Texas.

Specimens examined: COLORADO (*E. L. Greene* of 1870. Golden City): TEXAS (*G. R. Vasey* of 1881, El Paso).

This certainly belongs to the maze of forms under *mesacantha*, and possibly may be referred to some of those described above. The seeds and orbicular joints suggest *cymochila*, but the prominent tufts of long brown bristles, the fewer spines, and the decidedly larger distinctly elevate unarmed fruit seem to justify separation for the present. The Vasey material has larger joints (about 12 cm. broad), and its spines are not always in pairs. Often there are three spines, two equally prominent brown upper ones and a lower and weaker deflexed white one, and even two or three very weak ones in addition appressed at lower edge of pulvinus. Those characters are suggestive of *cymochila*, but the larger joints and prominent reddish-brown bristles are quite distinctive. The two varieties *greenii* and *oplocarpa* are very near each other, and aside from the seed characters are to be distinguished by the shape of the joints, by the fact that the former has its 1 to 3 spines only on the upper pulvini, and the latter, with its spines mostly in pairs, has all the pulvini armed except the lowest ones, in both, the upper reddish porrect or ascending spine or spines and the lower pale deflexed one am quite characteristic.

40. Opuntia mesacantha vaseyi, var. nov.

Approaches *oplocarpa*, but joints narrow and rather elongate-obovate (16 by 10 cm.), very large pulvini, the 2 or 3 spines (occasionally another short, slender one added) all reddish-brown (occasional trace of yellow-

ish) and unequal (15 to 30 mm.), those on the face of the joint, usually in pairs and deflexed, those on the margin apt to be in threes and erect-spreading, fruit dark-red and spineless (about 5 cm. long), and seeds (4,5 to 5 mm. broad) with conspicuous thick somewhat irregular margin.—Type in Nat. Herb.

Western Arizona.

Specimens examined: Arizona (*G. R. Vasey* of 1881, Yuma; *H. H. Rusby* of 1883, Ft. Verde).

41. Opuntia fusco-atra Engelm. Syn. Cact. 297 (1856).

Diffuse, with orbicular-obovate tuberculate joints 6 to 7.5 cm. long: pulvini 12 to 18 mm. apart, with numerous short reddish-brown bristles, only the lower unarmed: spines mostly solitary, stout, suberect, brownish-black, 2.5 to 3 cm. long, often one shorter deflexed one added: flowers yellow, 7.5 cm. broad: fruit and seed unknown. (*Ill.* Pacif. R. Rep. iv, t. 11, f. 4)—Type, Lindheimer 33 of 1842 in Herb. Mo. Bot.. Gard.

"Sterile places in prairies west of Houston, Texas."

Specimens examined: Texas (*Lindheimer* 33 of 1842).

The stout brown (or above almost black) spines, and thick bunches of unusually stout brown bristles on small joints, give a characteristic appearance to the species.

42. Opuntia opuntia (L.).

Cactus opuntia L. Sp. Pl. i, 468 (1753).
Opuntia vulgaris Mill. Dict. ed. 8, no. 1 (1768).
Cactus humifusus Raf. Ann. Nat. i, 15 (1820).

Diffuse and prostrate, with a fibrous root: joints obovate or suborbicular, thick, bright or pale green, 5 to 10 cm. long by 5 to 6 cm. broad, bearing ovate cuspidate mostly appressed leaves 4 to 5 mm. long: pulvini subremote, with few short greenish-yellow bristles, mostly unarmed: spines very rare, when present, solitary, stout, variegated, suberect, less than 2.5 cm. long: flowers pale-yellow, 5 cm. broad: fruit obovate-clavate: seeds regular, thick, with thick margins, 5 mm. broad.—Type unknown.

From the southeast coast of Massachusetts to Georgia and Florida; apparently only in the low countries east and southeast of the Alleghanies.

Specimens examined: Massachusetts (*Sprague*, at Leyden): New York (*Hex. & Maier* of 1852): New Jersey (*Torrey & Gray* of 1841; *Hex. & Maier* of 1854; *Meehan* of 1876; *Martindale* of 1876): Delaware (*Canby* of 1861): Virginia (*Vasey* of 1878, Ft. Monroe): South Carolina (*Mellichamp* of 1871): also cultivated in numerous gardens.

This species is distinguished from *mesacantha* (which only grows west of time Alleghanies and with which it has been confused) by its smaller size, paler color, small pulvini, usual absence of spines, smaller flowers, and especially by its short thick more or less appressed leaves.

43. Opuntia pes-corvi Le Conte; Chapm. Fl, 145 (1860).

Prostrate and diffuse, bright-green, with small ovate or obovate swollen and often teretish fragile joints 2.5 to 7.5 cm. long, and half as thick: pulvini 8 to 16 mm. apart, with few very short slender and pale bristles, the lowest unarmed: spines 1 to 3, straight and slender, rigid, often compressed at base and twisted, dusky, 2.5 to 3.5 cm. long: flowers yellow, 3.5 to 4 cm. broad: fruit obovate, bristly, rose-purple, with sled- low umbilicus, fleshy, 12 to 14 nun. long: seeds very few (I or 2), narrowly and obtusely margined, 4 mm. broad.—Type unknown.

Barren sands, coast of Georgia and Florida.

Specimens examined: FLORIDA (*Chapman* of 1856 and 1860; *Hitchcock* of 1890): also cult. in Harv. Bot. Gard., 1871; Mo. Bot. Gard., 1882.

Evidently very near *O. opuntia*, and possibly only a small thick-jointed variety.

++ *Joints pubescent: erect or procumbent.*

(1) *Flowers yellow: spineless plants.*

44. Opuntia microdasys Lehm. Ind. Sem. Hamb. 16 (1827).
Opuntia pulvinata DC. Rev. Cact. 119 (1828).

Erect-spreading, 6 to 12 dm. high: joints oblong-obovate or orbicular, pubescent, bright-green, 5 to 7.5 cm. long by 3.5 to 5 cm. wide: leaves minute: pulvini 12 to 16 mm. apart, with yellow wool and numerous very slender yellow bristles, spineless: flowers yellow: fruit unknown.—Type unknown.

From Coahuila to southern Mexico.

Specimens examined: COAHUILA (*Gregg* 284 of 1847; *Palmer* of 1880; *Pringle* 3592): also growing in Mo. Bot. Gard., 1893.

45. Opuntia rufida Engelm. Syn. Cact. 298 (1856).

Erect-spreading, 6 to 19 dm. high, much branched: joints broadly obovate or suborbicular, pubescent, pale-green, 5 to 15 cm. long: leaves long acuminate, 5 mm. long: pulvini crowded, with penicillate tufts of very numerous slender reddish-brown bristles, spineless: flowers yellow, 6 cm. broad.—Type, Bigelow and Gregg specimens in Herb. Mo. Bot. Gard.

On the Rio Grande (on rocks and mountains) about Presidio del Norte, Chihuahua, southward to the valley of the Nazas, Durango.

Specimens examined: CHIHUAHUA (*Bigelow* of 1852, about Presidio del Norte): DURANGO (*Gregg* 634, valley of the Nazas).

Differs from *O. microdasys* in its more rounded and larger joints, longer leaves, and reddish-brown bristles.

(2) *Flowers red.*

46. Opuntia basilaris Engelm. Syn. Cact. 298 (1856).

Low, with obovate or triangular glaucescent minutely pubescent ascending joints 12.5 to 20 cm. long and proliferous (almost rosulate) from the base: leaves minute, 2 mm. long: pulvini 8 to 12 mm. apart,

depressed, with yellow wool, very slender and short at length very numerous reddish-brown bristles, and caducous bristly spines (but no Spines proper): flowers rich-purple (reported as sometimes white), 6 cm. broad fruit short-obovate, with broad umbilicus, dry, pubescent: seeds large, thick, subregular, with rather narrow but very thick margin, 6 to 10 mm, broad, (*Ill.* Pacif. R. Rep. t. 13, f. 1-5; t. 23, f. 14)—Type, the Bigelow, Schott, and Campbell specimens in Herb. Mo. Bot. Gard.

From southern Utah and Nevada (Silver Peak region) southward through western Arizona and southeastern California into Sonora.

Specimens examined: Utah (*Gabb* of 1867): Arizona (*Bigelow* of 1854; *Schott* of 1855, on the Lower Gila; *Campbell* of 1855; *Newberry* of 1858; *Palmer* of 1869; *Rusby* of 1883; *Toumey* of 1892, Yuma): California (*Schott* 2 of 1855; *Hayden* of 1858; *A. E. Janvier* of 1873, Ehrenberg; *Palmer* of 1876; *Weber* of 1877; *Engelmann* of 1880; *G. R. Vasey*, Whitewater; *Nevin* of 1889; *Trelease* of 1892).

Dr. Merriam says that this species is one of the commonest cactuses of the Sonoran deserts. Its appearance is quite characteristic, a huge number of joints of different shapes (obovate, fan-shaped, obcordate, emarginate, elongated or almost oblanceolate) issuing from the base at nearly the same point, forming a sort of rosette "resembling somewhat an open cabbage head."

47. Opuntia basilaris ramnosa Parish. Bull. Torr. Club, xix, 92 (1892).

"Spreading, the joints freely branching above; joints and fruit glabrous"—Type, in Herb. Parish.

Dry washes and gravelly benches of the Colorado and Mojave deserts.

Specimens examined: California (*Parish Bros.* of 1882, Whitewater).

Mr. Parish has called attention to the fact that this is the common form of the species in southern California, and says that only near the summit of the Cajon Pass has he seen plants branching at the base. If this be true, doubtless many of the specimens referred above to, *basilaris* are *ramosa*, but there seems to be no way of separating them by the characters of single isolated joints. It is probably also true that this very abundant cactus will be found throughout its range to show both habits of branching, which must give rise to plants of very different appearance. The Specimen cited above as having been examined shows but a single joint, but the joint and fruit are glabrous. I doubt whether the pubescent character will hold, as I have a glabrous joint with pubescent fruit.

48. Opuntia treleasii, sp. nov.

Erect, diffusely branching: joints orbicular to obovate, fleshy, with terete base, 15 to 25 cm. long: pulvini not depressed, with long (5 cm.) dense dirty-yellow bristles: leaves on young shoots 5 mm. long, spreading (more than twice as long as those of *basilaris* and darker-red): flower and fruit not seen.—Type, growing in Mo. Bot. Gard. 1893, from collection made by Trelease in 1892.

At Caliente, in the Tehaehapi Mountains, California.

Specimens examined: California (*Trelease* of 1892).

This species is near *O. basilaris*, but differs in its rounder more fleshy joints (terete below), pulvini not depressed (in *O. basilaris* there is a depression for the pulvinus with a furrow on either side in the general surface), yellowish bristles, and especially in its much larger leaves.

+– +–*Fruit dry and spiny: seed with very broad margin: diffuse and very spiny.*

++ *Joints compressed, suborbicular.*

49. Opuntia hystricina Engelm. Syn. Cact. 299 (1856).

Diffuse, with obovate-orbicular compressed joints 7.5 to 12.5 cm. long: pulvini 10 to 12 mm. apart, with closely set yellowish or brownish bristles, all armed: spines 10 to 15; the upper 5 to 8 (rarely 1 to 8) stoutish but flexile, angular, twisted or flexuous, erect, spreading or deflexed, whitish or brownish, 3.5 to 10 cm. long; the lower 5 to 7 more slender, radiant downward, white, 8 to 18 mm, long: flowers yellow or purple, 5 to 7.5 cm. broad: fruit obovate, with very shallow flattish umbilicus, 2.5 cm. long: seeds irregular, black, with broad and thick acutish margins, 7 mm. broad. (*Ill.* Pacif. R. Rep. t. 15. f. 5-7; t. 23, f. 15)—Type, Bigelow of 1853 in Herb. Mo. Bot. (Gard.

Extending from the western side of the Rio Grande, in New Mexico, to southeastern California and Nevada.

Specimens examined: Nevada (*H. Engelmann* of 1859; *Watson* 436, Began's Valley): Arizona (*Bigelow* 124 of 1853; *Newberry* of 1858; *Palmer* of 1870, and 474 of 1890, Ft. Huachuca; *Toumey* of 1802, Grand Canyon): California (*Palmer* 4 of 1876; *Parish Bros*. 168 of 1882; *Parish* of 1891; *Trelease* of 1892).

This species may fairly stand as the southwestern representative of *O. polyacantha*, from which it differs in its longer and more numerous gray or reddish spines, longer yellow bristles, and usually smaller flowers.

50. Opuntia polyacantha Haw. Suppl. Pl. Succ. 82 (1819).
Cactus ferox Nutt. Gen. i, 296 (1818), not Willd.
Opuntia media Haw. l. c.
Opuntia missouriensis DC. Prodr. iii, 472 (1828).
Opuntia missouriensis elongata Salm, Cact. Hort. Dyck. 67 (1850).
Opuntia missouriensis rufispina Engelm. Syn. Cact. 300 (1856).

Prostrate, forming large spreading masses: joints light-green, orbicular, tuberculate, 5 to 10 cm. (rarely 10 to 15 cm.) long: leaves minute, 3 to 4 mm. long: pulvini 8 to 12 mm. apart, with reddish-brown bristles (fewer but longer and darker than in other forms), all armed: spines 8 to 15; the 5 to 10 (generally 6 to 8) exterior ones radiant, setiform, whitish or reddish variegated; the 3 to 5 interior ones stout, reddish-brown (paler-tipped), 3 to 5 cm. long, 2 to 4 of them deflexed, the other one spreading or suberect and very stout: flowers yellow (orange within) or sometimes purple: stigmas 5 to 8: fruit ovate, dry and spiny, with shallow flat umbilicus, 2.5 cm. long: seeds irregular, large (5 to 6 mm. broad). (*Ill.* Pacif. R. Rep. t. 14, f. 1-3)—Type unknown.

Principally on the plains, but also in the mountains to the south, from the Upper Missouri and Washington to the Canadian River (Ind.

Terr.), the Upper Pecos (New Mex.), and Utah (throughout the Salt Lake Basin and the foothills of the Wahsatch).

Specimens examined: Montana (*Canby* 140 of 1883): Colorado (*Farwell* 1062): New Mexico (*Bigelow* of 1853, on the Upper Pecos, type of *rufispina*).

The extreme polymorphism of this species has resulted in a maze of bewildering forms impossible to classify. The form known as *rufispina* (*Cactus ferox* Nutt.) is the typical one, as described above and as illustrated by the specimens cited above. In addition to the five rather distinct varieties described below there is a large number of what may be called miscellaneous forms, not exactly typical, but not departing from the type sufficiently to be set apart as varieties. These miscellaneous forms, so far as examined, are as follows:

Washington (*Lyall* of 1860; *Suksdorf* 314): Oregon (*Cusick* 1389; *Spalding*, at Clearwater): Montana (*Hayden* 1851 and 1859): South Dakota (*Hayden* 1853 and 1855): Nebraska (*Hayden* of 1855; *Rydberg* of 1891, Phelps and Denel Cos.): Nevada (*Watson* of 1869; *Coville & Funston* 1981): Utah (*Palmer* 4): Colorado (*Hall & Harbour* 68, 183; *Hall* of 1862; *Greene* 36 of 1873; *Jones* 504): Indian Territory (*Hall* of 1869, Canadian River): New Mexico (*Bigelow* of 1858; *Rothrock* 6 of 1874, Santa Fe): also cult. in Hort. Salm-Dyck. 1847; in Harv. Hot. Gard. 1871; growing in Mo. Bot. Gard. 1893.

51. Opuntia polyacantha platycarpa (Engelm.).

Opuntia missouriensis platycarpa Engelm. Syn. Cact. 300 (185§).

Joints elongated-obovate to obovate-orbicular, 7.5 to 12.5 cm. long: pulvini 12 to 18 mm. apart, with few straw-colored bristles, the lower ones sometimes unarmed, or upper with few spines (sometimes only 6 to 12 mm. long), or with exterior spines, as in the species, and mostly one stout spreading or deflexed reddish-brown interior one: fruit depressed-globose, with a remarkably large and flat umbilicus, 16 to 18 mm. long. (*Ill.* Pacif. R. Rep. iv, t. 14, f. 4)—Type, the Hayden specimens of 1853-54 from Nebraska and Montana in Herb. Mo. Bot. Gard.

In the Upper Missouri region, from Idaho and Montana to Utah, Colorado, and Nebraska.

Specimens examined: Idaho (*MacDougal* 280): Montana (*Hayden* of 1854): Utah (*Watson* 434 of 1869, Parley's Park; *Hayden* of 1871; *Ward* 187, 443): Colorado (*Parry* of 1869): Nebraska (*Hayden* of 1853-54).

52. Opuntia polyacantha borealis, nom. nov.

Opuntia missouriensis microsperma Engelm. & Bigel. Pacif. R. Rep. iv, 16 (1856), not *mesacantha macrosperma* Engelm.

Joints and spines as in *platycarpa*: fruit ovate, with depressed umbilicus, shortly spiny: seeds smaller, 4 mm. broad, with narrow and acute margin. (*Ill.* Pacif. R. Rep. iv, t. 14, f. 5-7; t. 24, f. 1, 2)—Type, the "Fur traders" specimens of 1847 in Herb. Mo. Bot. Gard.

From British Columbia to Oregon and South Dakota.

Specimens examined: British Columbia (*Macoun* 5): Oregon (*Drake & Dickson* of 1889): South Dakota ("Fur traders" of 1847; *Hayden*): also cult. in St. Louis Gard. 1847.

53. Opuntia polyacantha albispina (Engelm. and Bigel.).

Opuntia missouriensis albispina Engelm. and Bigel. Pacif. R. Rep. iv, 46 (1856).

Joints broadly obovate: bristles straw-colored: spines 6 to 12, all ivory-white and more slender, 2.5 to 3 cm. long, the outer 6 to 10 setaceous the inner (in upper pulvini) 1 to 3 stouter, elongated, deflexed or spreading: flowers 7.5 to 8.5 cm. broad: fruit ovate, with very shallow umbilicus: seeds irregular, with broad and acutish margin, 6 to 7 mm. broad. (*Ill.* Pacif. R. Rep. iv, t. 14, f. 8-10; t. 23, f. 18)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

"Sandy mountains, near Albuquerque," New Mexico, is the original station; reported also from western Utah, and now found in Indian Territory.

Specimens examined: New Mexico (*Bigelow* of 1853): Indian Territory (*M. A. Carleton* of 1891).

The Carleton specimens seem certainly to represent this lost variety, which will doubtless be recognized over a wide area, but which may not stand as a worthy variety.

54. Opuntia polyacantha watsoni, var. nov.

Joints smaller, creeping, orbicular, 5 cm. broad: pulvini much crowded (6 to 8 mm. apart), bearing darker bristles: spines all dark; outer 3 or four from the lower edge of the pulvinus (sometimes 1 or 2 added above) setaceous, 4 to 5 mm. long; inner 1 to 3 stouter, much longer (10 to 36 mm), deflexed (except on margin of joint): stigmas 10: fruit clavate, 2.5 to 3 cm. long, strongly tuberculate and cristate, deeply umbilicate, with few spines: seeds with broad margin and prominently notched at hilum.—Type, specimens cited below in Herb. Mo. Bot. Gard.

From Nebraska and Wyoming to Colorado, Utah, and New Mexico.

Specimens examined: Nebraska (*Hayden* of 1853): Wyoming (no collector recorded, at Alden): Colorado (*French* of 1874): Utah (*Watson* 435 of 1869, Wahsatch Mts.): New Mexico (*Fendler* of 1846-47, near Santa Fe).

55. Opuntia polyacantha trichophora (Engelm.).

Opuntia missouriensis trichophora Engelm. Syn. Cact. 300 (1856).

Joints ovate: pulvini crowded, with straw-colored at length whitish, bristles, all armed: spines 10 to 18, white, setiform and capillary flexuous (in old joints very numerous, 15 to 25); the outer 8 to 12 shorter and radiant, the inner longer and deflexed, rarely a single suberect one: fruit ovate, 20 mm. long by 14 mm. broad: seeds very large (7 mm.), strongly compressed, broadly and acutely margined. (*Ill.* Pacif. R. Rep. iv, t. 15, f. 1-4; t. 23, f. 19)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

New Mexico (about Santa Fe and Albuquerque) and Texas (in the El Paso region); on volcanic rocks.

Specimens examined: New Mexico (*Bigelow* of 1853; *G. R. Vasey* of 1881, Socorro): Texas (*Trelease* of 1892): also growing in Mo. Bot. Gard. 1893.

The hoary appearance of older joints is very characteristic, "like an old man's beard." Vasey's excellent specimens help to a better understanding of this variety, which may deserve to rank as a species. The white outer radiant spines are 6 to 12 mm. long; the inner ones whitish or reddish-yellow, becoming grayish and much elongated and capillary, becoming as much as 6 or 7 cm. long and appearing in dense tufts on old joints, looking like a covering of coarse hair.

56. Opuntia sphærocarpa Engelm. Syn. Cact. 300 (1856).

Diffuse, with orbicular strongly tuberculate joints 7.5 cm. broad: pulvini 8 to 10 mm. apart, with short, straw-colored bristles, mostly unarmed (only the uppermost and marginal ones bearing spines) spines 1 or 2, reddish-brown, deflexed or spreading, 12 to 25 mm. long, often 1 to 3 shorter (4 to 8 mm.) ones added: fruit perfectly globose, with a small flat shallow umbilicus, scarcely spinulose, 18 mm. in diameter: seeds very irregular, with narrow but acute margin, 5 mm. long. (*Ill.* Pacif. R. Rep. iv, t. 13, f. 6, 7; t. 24, f. 3)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

"Mountains near Albuquerque," New Mexico.

Specimens examined: New Mexico (*Bigelow* of 1853).

57. Opuntia sphærocarpa utahensis Engelm. Trans. St. Louis Acad. ii, 199 (1863).

Prostrate and diffuse, with orbicular-obovate thick joints 5 to 7.5 cm. broad (younger often globose-obovate), pulvini 12 to 16 mm. apart, spines none or on upper pulvinus smallish or rarely one straight stout white one, yellow flowers 7,5 cm. broad, obovate fruit 2.5 cm. long (half as wide), with deep umbilicus, and seeds 4 to 5 mm. long.—Type, H. Engelmann of 1859 in Herb. Mo. Bot. Gard.

"Utah Basin (pass West of Steptoe Valley)" is the original locality, and that of Hayden is not recorded.

Specimens examined: Utah (*H. Engelmann* of 1859; *Hayden* of 1876): also cult. in Mo. Bot. Gard. 1876.

++ ++ *Joints tumid, ovate.*

58. Opuntia rutila Nutt.; Torr. & Gr. Fl. i, 555 (1840).
Opuntia erinacea Engelm. Syn. Cact. 301 (1856).

Ascending arid diffuse: joints swollen, ovate or teretish, 5 to 10 cm. long by 2.5 to 7.5 cm. broad (sometimes elongated and almost cylindrical): pulvini very crowded (4 to 6 mm. apart), with white wool, and at length straw-colored bristles, all armed: spines 3 to 5, slender, reddish-gray, 1 to 4 cm. long (1 to 3 upper shorter and erect, central one longer, spreading or declined, the rest deflexed, sometimes larger ones flattened and often twisted), 2 to 4 smaller ones added below: flowers rose-red or paler: fruit ovate, dry and spinulose, with a deep funnelform umbilicus, 2.5 to 3 cm. long: seeds large (6 mm, broad), much compressed, with broad acute margins. (*Ill.* Pacif. R. Rep. iv, t. 13, f. 8-11; t. 24, f. 4)—Type of *O. rutila* unknown, of *O. erinacea*, Bigelow of 1854 in Herb. Mo. Bot. Gard.

From Green River, southwestern Wyoming (the original Nuttallian

station), through Utah and Nevada into Arizona and southeastern California.

Specimens examined: Utah (*Watson* of 1868; *Palmer* of 1870 and 1877, Fillmore to St. George; *Johnson* of 1870; *Ward* 188; *Bailey* 1939): Nevada (*Shockley* 274; *Bailey* 1959, 1989; *Coville & Funston* 1941): Arizona (*Palmer* of 1870): California (*Bigelow* of 1854, near the Mojave; (*Coville & Funston* 2013, 2014).

The numerous reddish-gray spines with red points bristling hedgehog-like in every direction give a very characteristic appearance. Dr. Merriam says of it: "Species with enormously long and slender spines, not found in California except on the Panamint Mountains."

59. Opuntia arenaria Engelm. Syn. Cact. 301 (1856)

Ascending and diffuse, 1.5 to 3 dm. high, spreading 6 to 9 dm.: roots stout, creeping horizontally, elongated and often stoloniferous, far spreading in the loose sand: joints obovate, thick and swollen or subcompressed, or teretish, shining-green, strongly tuberculate, 3.5 to 7.5 cm. long by 2.5 to 5 cm. broad: leaves minute: pulvini 6 to 10 mm. apart, with sparse white wool, and numerous bristles (especially on old joints), which are pale when young and tawny when old, almost all armed: spines 3 to 10; the upper 1 to 4 stouter, whitish or reddish. brown, often subangular, 2 to 3.5 cm. long (the uppermost one stouter and porrect, the rest shorter and divergent or deflexed); the lower 2 to 6 shorter (4 to 12 mm.), setaceous and radiant, white: flowers sulphur-yellow, 5 to 6 cm. broad: fruit oblong-ovate, contracted at top, dry and spinose, with a deep funnelform umbilicus, 2 to 3 cm. long: seeds irregular, with broad thick margin, 5 to 6 mm. long. (*Ill.* Cact. Mex. Bound. t. 75, f. 15)—Type, the Wright specimens in Herb, Mo. Bot. Gard.

Sandy bottoms of the Rio Grande near El Paso, Texas, and adjacent New Mexico.

Specimens examined: Texas (*Wright* of 1851, 1852, and 1854; *Schott*): New Mexico (*Fendler* 7, 150, 153): also cult. in Mo. Bot. Gard. 1855.

Allied to *fragilis*, but distinguished by the larger more tuberculate joints, smaller pulvini with more numerous bristles, longer slenderer spines, and spinose fruit

60. Opuntia fragilis (Nutt.) Haw. Suppl. Pl. Succ. 82 (1819):
Cactus fragilis Nutt. Gen. i, 296 (1818).

Subdecumbent, with small ovate subcompressed or subglobose (even terete) scarcely tuberculate shining green joints variable in size and shape (fruit-bearing ones compressed, 3.5 to 5 cm. long by 2.5 to 3 cm. broad, the others smaller and more tumid): pulvini large, 8 to 12 mm. apart, with white wool, and very few short whitish bristles (on old joints a little more abundant, coarser, and straw-colored): spines 1 to 4 (mostly 4 and cruciate), the uppermost one stout, angular, suberect or porrect, yellowish-brown, 12 to 20 mm. long, the others weaker (6 to 16 mm.), paler, spreading or radiant, and 2 to 6 additional slender white radiant ones below 4 to 8 mm. long: flowers pale-yellow, about 5 cm. broad: fruit ovate, almost naked, with funnelform umbilicus, about

2.5 cm. long: seeds few, large (6 mm.), with broad and thick obtuse corky margin. (*Ill.* Pacif. R. Rep. iv, t. 24, f. 5)—Type unknown.

From British Columbia southward through Minnesota and Montana to Wisconsin, Kansas, Colorado, and Utah; fertile prairies or sterile places.

Specimens examined: British Columbia (*Dawson* of 1885)): Minnesota (*Dawson* of 1884): Wisconsin (*Hale* of 1861, in part, Baraboo bluffs): Montana (*Canby* of 1883): Nebraska (*Hayden* of 1854): Kansas (*Fisher* of 1893, Ellsworth): Colorado (*Parry* of 1864): Utah (*Engelmann* of 1858; *Watson* 437, Utah Valley): also cult. in Mo. Bot. Gard. 1855; growing in same garden in 1893.

Dr. Engelmann says that this species is very common on sterile prairies at the base of the Rocky Mountains, but that it is rarely found in lower and still more rarely in fruit. It propagates chiefly by the extremely brittle joints which even the wind breaks off and carries about.

61. Opuntia fragilis brachyarthra (Engelm.).

Opuntia brachyarthra Engelm. Syn. Cact. 302 (1856).

Prostrate or ascending, with swollen tuberculate joints, pulvini 4 to 8 mm. apart, 3 to 5 stouter whitish or brownish terete spines 18 to 25 mm. long (1 or 2 spreading or suberect, the rest deflexed), flowers about 2.5 cm. broad, and somewhat spinulose fruit. (*Ill.* Pacif. R, Rep. iv, t. 12, f. 9)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

Southern Colorado and northern New Mexico.

Specimens examined: Colorado (*Greene* of 1871): New Mexico (*Bigelow* of 1853, near Santa Fe).

The other New Mexican station is "under pine trees, Inscription Rock, near Zuñi." It is a question whether this form should stand as a distinct variety, but its more constantly swollen tuberculate joints, more crowded pulvini, more numerous and stouter and terete spines, smaller flowers, and more spinulose fruit may serve to indicate it. "The short and tumid joint resemble the joints of a finger."

Among Dr. Weber's manuscript notes the four following *Platyopuntia* forms are characterized, but the information concerning them is so meager that I do not venture to publish his names.

Opuntia sp. "Cultivated from Venado southward to San Luis Potosi under the name 'tuna chaveña.' A tall plant, bearing a sweet, pleasant-tasted fruit which is much brought to market. Flowers red. Fruit the size of an egg, wine-red; pulp reddish. Seed large, much compressed."

Opuntia sp. "Cultivated about San Luis Potosi under the name 'tuna blanca.' Plant high (3 m. ?) quite spiny. Fruit very large, ovoid, with whitish pulp. Cultivated for the fruit, which is much esteemed, but not so frequently as 'cardona.' Could it be a form of *ficus-indica*? But the seed is much larger than that of the Italian forms of that species."

Opuntia sp. "A tall, large-jointed species, with slender acicular spines. Fruit ovoid, spineless, with a larger rather flat umbilicus with circular wrinkles, and apparently numerous (perhaps 35 or 40) circular

areolæ. Seed remarkably small. Erect, 9 to 12 dm. high." This may be *O. strigil*.

Opuntia Sp. "A very tall (27 to 36 dm.), large-jointed, erect plant, with numerous spines (lower ones and especially central ones deflexed), and ovoid fruit which is red inside and out. Known as 'cardona,' and most commonly cultivated in and about San Luis Potosi. Abundantly eaten fresh and mashed and dried in a paste or cheese-like form; also the purple juice expressed and drunk with water like orangeade."

II. Cylindropuntia. *Joints cylindraceous, more or less tuberculate: seeds not margined* (except in ** + +).

* *Low plants with short clavate joints and without a firm woody skeleton: larger spines angular-compressed and without sheaths* (*exc.* clavellina *and* tunicata): *flowers yellow* (*exc.* pulchella), *large: fruit dry and very bristly*.

\+ *Spines short* (3 to 20 mm).

62. Opuntia bulbispina Engelm. Syn. Cact. 301 (1856).

Prostrate, in spreading masses 6 to 12 dm. in diameter, with fusiform roots: joints small (18 to 24 mm. long and 12 mm. in diameter), ovate (scarcely clavate), fragile, often proliferous from apex, with ovate tubercles 6 to 12 mm. long: pulvini scarcely bristly: spines teretish, scabrous, bulbous at base; interior 4 cruciate, 8 to 12 mm. long (the lower the longer); exterior 8 to 12 radiant, 3 to 6 mm. long: flower and fruit unknown. (*Ill.* Cact. Mex. Bound. t. 73, f. 5-6)—Type, Gregg of 1848 in Herb. Mo. Bot. Gard.

From New Mexico to Coahuila.

Specimens examined: New Mexico (*Nealley* of 1891): Coahuila (*Gregg* of 1848, near Perros Bravos, Saltillo).

In Watson's Bibliographical Index and in the Kew Index this is made a synonym of *tunicata*, but it differs in almost every respect, having no sheaths, notch shorter spines, and small and much shorter joints.

63. Opuntia parryi Engelm. Amer. Journ. Sci. ser. 2, xiv, 339 (1852).

Prostrate, with ovate joints (clavate at base) 6 to 10 cm. long and bearing oblong elongated tubercles 18 mm. long: pulvini with few rigid brownish bristles: spines very numerous, in three series, angular, scabrous, reddish-gray (at length ashy); interior about 4, stouter, triangular-compressed, 24 to 32 mm. long; the next exterior 4 to 8, divergent, angular, 6 to 16 mm. long; the most exterior (but mostly lateral or inferior) 6 to 10 slender, rigid, radiant: fruit ovate, clavate at base, very spiny, 3.5 cm. long: seeds regular, beakless, with broader commissure than usual, 4 to 5 mm. in diameter. (*Ill.* Pacif. R. Rep. iv, t. 22, f. 4-7)—Type not found in the Engelmann collection.

Gravelly plains of the Mojave, southeastern California.

Specimens examined: California (*Bigelow* of 1853).

Distinguished from *O. clavata* by the shape of the .joints, the bristles, the slenderer darker more numerous spines, and the smaller, more regular beakless seeds. Dr. Parry's original specimen was collected near San Felipe.

64. Opuntia clavata Engelm. Wisliz. Rep. 11 (1848).

Low cespitose plant, forming dense spreading level-topped masses 6 to 12 dm. in diameter and with ascending branches: joints shortly clavate, bright-green, 2.5 to 7.5 cm. long and 2.5 cm. thick, with ovate tubercles 12 to 16 mm. long, and subulate leaves 4 to 5 mm. long: pulvini large and closely approximate, with white rigid bristles: spines white and scabrous; interior 4 to 7, flattened, 12 to 30 mm. long, the upper one triangular and erect, the lower ones broader (broadest 3 mm.), striate above and keeled below, deflexed; exterior 6 to 12, more slender, 4 to 16 mm. long, radiating in every direction: flowers yellow, 5 cm. broad: fruit elongate-clavate, deeply umbilicate, lemon-yellow, 3.5 to 4 cm. long and 2,5 cm. in diameter, almost covered with white, slender radiating bristles: seeds beaked, 5 to 6 mm. in diameter, with impressed linear commissure. (*Ill.* Pacif. R. Rep. iv, t. 22, f. 1-3; t. 24, f. 6: Cact. Mex. Bound. t. 73, f. 5, 6)—Type, Wislizenus and Fendler specimens of 1846 and 1847 in Herb. Mo. Bot. Gard.

In the region about Albuquerque and Santa Fe, New Mexico; also in southern Nevada, and presumably to be found in adjacent Utah and Arizona.

Specimens examined: New Mexico (*Wislizenus* of 1846, near Albuquerque; *Fendler* 275 of 1846 and 1847, near Santa Fe; *Bigelow* of 1853; *Rothrock* 92, El Rito; *Vasey* 173): Nevada (*Coville & Funston* 430).

65. Opuntia pulchella Engelm. Trans. St. Louis Acad. ii, 201 (1863).

Small, cespitose, 7.5 to 25 cm. high, the main stem erect: joints obovate-clavate, lightly tuberculate, 2.5 to 7.5 cm. long: pulvini crowded: upper spines from white to nearly black, straight, 8 to 36 mm. long, a single one longer, flattened, porrect or deflexed); the others radiant and very short (1 to 3 mm.): flowers bright purplish-red or deep rose-red, 3 to 3.5 cm. broad: fruit clavate, about 2.5 cm. long, with numerous flexible not barbed bristles: seeds thick and round, 4 mm. in diameter, with broad, flat commissure.—Type, H. Engelmann of 1859 in Herb. Mo. Bot. Gard.

Western and southern Nevada and adjacent Arizona; presumably in southeastern California.

Specimens examined: Nevada (*H. Engelmann* of 1859, Walker River; *Gabb* of 1867, Walker River; *Watson* 438, Monitor Valley; *Lieut. Wheeler* of 1872; *Lemmon* 943; *Shockley* 319): Arizona (*Bischoff* of 1871).

Remarkable in this group for its purple flowers.

+– +– *Spines long (2.5 to 6 cm.).*

66. Opuntia grahami Engelm. Syn. Cact. 304 (1856).

Prostrate, with thick fusiform roots: joints short-clavate, bright-green, ascending, 3.5 to 5 cm. long, with oblong tubercles, 12 to 14 mm. long: leaves ovate, 4 mm. long: pulvini with white wool, and bristles at length very numerous, elongated and rigid: spines slender, scabrous, reddish, at length ashy brown; interior ones 1 to 7, teretish or quad-

rangular or rarely compressed, stouter, spreading, 3.5 to 5 cm. long; exterior ones 4 to 6 and much smaller: flowers yellow, 5 cm. broad: fruit ovate, very spiny: seed beakless, 5 to 5.5 mm. in diameter, with indistinct linear commissure. (*Ill.* Cact. Mex. Bound. t. 72)—Type, Wright specimens of 1831 in Herb. Mo. Bot. Gard.

Sandy bottoms of the Rio Grande near El Paso, Texas, and downward.

Specimens examined: Texas (*Wright* 10, 40, 539, of 1851; *Evans* of 1891; *E. A. Mearns* of 1892, El Paso).

67. Opuntia emoryi Engelm. Syn. Cact. 303 (1856).

Prostrate and spreading, 15 to 45 cm. high: joints cylindrical with clavate base, glaucous, ascending and curved, 10 to 15 cm. long and 2.5 to 3.5 cm. in diameter, with oblong-linear elongated (2.5 to 3.5 cm.) closely approximated tubercles: pulvini with few rigid bristles: spines very numerous, pitted or roughened, reddish-black or brown, at length ashy; interior ones 5 to 9, stouter, triangular, compressed, porrect or deflexed (upper ones only suberect), 3.5 to 6 cm. long, 1.5 to 2 mm. broad; exterior ones 10 to 20, in many series, radiating in every direction, the exterior gradually smaller and less angular, the upper slenderer and teretish, the lower more rigid and compressed: flowers yellow, reddish without, 5 to 6 cm. broad: fruit ovate, clavate at base, yellow, very bristly and spiny, 5 to 6 cm. long: seeds irregular, 4.5 to 6.5 mm. in diameter, with mostly an indistinct transverse commissure. (*Ill.* Cact. Mex. Bound. t. 70-71)—Type, specimens of Wright and Bigelow in Herb. Mo. Bot. Gard.

Arid soil, from the El Paso region of Texas westward into Arizona and southward into Chihuahua and Sonora.

Specimens examined: Texas (*Evans* of 1991): New Mexico (*Wright & Bigelow,* at Copper Mines; *G. R. Vasey* of 1881, Socorro): Arizona (*Schott* 8 of 1758): Chihuahua (*Bigelow* 13 of 1852).

68. Opuntia schottii Engelm. Syn. Cact. 304 (1856).

Prostrate, with short-clavate ascending joints 5 cm. long and bearing elongated tubercles 16 to 18 mm. long: pulvini with few bristles: spines very scabrous, reddish (broader ones with white margin); interior about 4, cruciate, 3.5 to 5 cm. long; upper triangular and erect, the rest plane above and convex beneath, the lower broader; exterior 8 to 10, slender and radiant, very unequal, 8 to 18 mm. long: fruit obovate, clavate, somewhat spiny: seeds beaked, angular, 4 mm; in diameter, with linear, indistinct commissure. (*Ill.* Cact. Mex. Bound. t. 73, f. 1-4)—Type, specimens of Schott and Wright in Herb. Mo. Bot. Gard.

On arid hills, between the San Pedro and Pecos, Texas.

Specimens examined: Texas (*Wright* of 1849; *Schott* 853; *Weber* of 1866).

Distinguished by its broad and very rough dirty-red spines and scanty bristles.

69. Opuntia schottii greggii Engelm. Cact. Mex. Bound. t. 73, f. 4 (1859).

Tubercles longer (20 to 24 mm.): spines stout, somewhat less rough and more slender, 12 to 15, some borne on upper margin of pulvinus; the 4 centrals triangular, much less rough, 2.5 to 4 cm. long; the 8 to 12 exterior ones of very different sizes. (*Ill.* l. c.)—Type, Gregg of 1848 in Herb. Mo. Bot. Gard.

San Luis Potosi.

Specimens examined: San Luis Potosi (*Gregg* of 1848).

This form is described by Engelmann in Synopsis Cactaceæ (1856) and in Cactaceæ of the Mexican Boundary, but with no name, the name being first given in explanation of plates in the latter work.

70. Opuntia invicta Brandegee, Pl. Baja Calif. 163 (1889).

Low and branching, about 3 dm. high: joints 10 cm. long and 4 to 7.5 cm. thick: radial spines 6 to 10, slender and radiant, 6 to 10 mm. long (sometimes longer); central spines 10 to 15, very stout and rigid, quadrangular or flattened, strongly striate, ashy at base with lighter tips, spreading in every direction, 2.5 to 4.5 cm. long: flowers yellow, abundant, 5 cm. broad: fruit covered with reddish spines: seeds 2 mm. in diameter.—Type in Herb. Brandegee.

Common about San Juanico and north to El Campo Aleman, Lower California.

Specimens examined: Lower California (*Brandegee*).

It is difficult in this species to distinguish exactly the line between centrals and radials, as they somewhat intergrade. The species is an uncertain one and may be a Cereus, but it groups well enough with *O. schottii* to be retained at present in *Opuntia*.

71. Opuntia clavellina Engelm. MSS.

Stems frutescent, about 9 dm. high: joints slender, clavate, 5 to 10 cm. long and a little over 1 cm. in diameter, with elongated tubercles: spines 3 to 6, stout, 1 to 3.5 cm. long, with straw-colored or brown sheaths, the central one longer and porrect: flowers yellow. fruit clavate, short, tuberculate.—Type, Gabb 22 and 23 in Herb. Mo. Bot. Gard.

On volcanic tables, western slope of the peninsula, near Mission Purissima, Lower California.

Specimens examined: Lower California (*Gabb* 22, 23).

72. Opuntia tunicata (Lehm.) Pfeiff. Enum. 170 (1837).

Cactus tunicatus Lehm. Ind. Sem. Hort. Handb. 17 (1827).

Suberect, very branching, 3 dm. high and 2.5 to 3.5 cm. in diameter: joints dusky-green, clavate, almost terete, 16 to 20 mm. in diameter, with short leaves and depressed tubercles: pulvini with white wool: spines 6 to 9 (almost wanting in some localities) from lowest part of pulvinus, 4 to 6 upper ones larger, 2.5 to 5 cm. long, 2 or 3 lowest short (8 to 12 mm.), all white and with a subpellucid sheath.—Type unknown.

Throughout it Mexico and the West Indies and southward through South America to Brazil.

Specimens examined: Coahuila (*Gregg* of 1848-49): San Luis Potosi (*Gregg* of 1848; *Parry* of 1878; *Parry* and *Palmer* 282; *Borracte* of 1880; *Eschanzier* of 1891): Mexico, with no state given (*Bourgeau* 304 of 1865): Cuba (*Wright* of 1860-64): also growing in Mo. Bot. Gard. 1893.

This very widely distributed species is also reported in Mexico from Sonora and Raza Island (in northern part of the Gulf of California).

* * *Stems more or less erect, much branched: joints mostly cylindrical: woody skeleton solid or tubular and reticulated: larger spines terete and sheathed: flowers purplish* (*mostly yellow in* +– ++)

+– *Wood mostly reticulate-tubular: joints thick, with distinct tubercles: spines numerous.*

++ *Diffusely branched: joints suberulate: flowers mostly yellow: fruit dry and spiny.*

73. Opuntia ciribe Engelm. MSS.

Short, robust, and arborescent, densely branched, rarely more titan 9 dm. high, but very compact: joints obovate, 5 cm. long and 3 cm. in diameter, with crowded angular obovate tubercles 6 mm. long: pulvini sparsely if at all bristly: large spines 3 to 5 pale-yellow, sheathed, 12 to 16 mm. long; 4 to 6 small dark bristly unsheathed ones on lower part of pulvinus: flowers yellow: fruit tuberculate like the joint. Type, Gabb 24 in Herb. Mo. Bot. Gard.

Lower California, "from Comondu and Loreto northward beyond Rosario."

Specimens examined: Lower California (*Gabb* 24).

74. Opuntia davisii Engelm. Syn. Cact. 305 (1856).

Stem spreading and somewhat procumbent, with dense wood and divaricate branches, 4.5 dm. high: joints attenuate at base, rather slender, 10 to 15 cm. long (younger ones erect), with oblong-linear tubercles 14 to 16 mm. long: inner spines 4 to 7, subtriangular, divergent, reddish-brown, in a loose straw-colored sheath, 2.5 to 3.5 cm. long; lower ones 5 or 6, slender, 6 to 12 mm. long: flower yellowish?: fruit ovate, spiny, 2.5 cm. long or more. (*Ill.* Pacif. R. Rep. iv, t. 16.)—Type, Bigelow of 1853 in Herb. Mo. Bot. Gard.

From northwestern Texas through New Mexico and southern Colorado to southern California.

Specimens examined: Texas (*Bigelow* of 1853, "Staked Plains;" *Mensebach* of 1879 and 1882): New Mexico (*Rusby* 145): Colorado (*Brandegee* of 1875): Arizona (*Palmer* 303 of 1870), Bear Springs): california (*Parish* of 1880): also cult. Mo. Bot. Gard. 1877 and 1882; and growing 1893.

75. Opuntia echinocarpa Engelm. Syn. Cact, 305 (1856).

A low shrub 1.5 to 4.5 dm. high, with reticulate-woody stem, erectish or partially prostrate, with numerous very spreading branches: joints ovate, clavate at base, 2.5 to 6 cm. long, less than 2.5 cm. thick, with prominent ovate crowded tubercles 8 to 10 mm. long: pulvini with few

coarse straw-colored bristles: larger spines about 4, cruciate, whitish, in a straw-colored or whitish sheath 18 to 24 mm. long; smaller ones 8 to 16, hardly sheathed, radiating in every direction, 8 to 18 mm. long: flowers greenish-yellow, 3.5 to 4 cm. broad: fruit dry, depressed-globose or hemispherical, broadly and deeply umbilicate, very spiny: seeds subregular or angular, thick, 4 mm. in diameter or more, with broad commissure. (*Ill.* Pacif. R. Rep. iv, t. 18, f. 5-10; t. 24, f. 8.)—Type, specimens of Bigelow and Schott in Herb. Mo. Bot. Gard.

From southern Utah and southern Nevada through northern and western Arizona and southeastern California into Sonora.

Specimens examined: Utah (*Palmer* 187; *Johnson*, at St. George *Bailey* 1960 of 1891): Arizona (*Bigelow* of 1854, near mouth of Williams River; Schott 7, at Ft. Yuma; *Parry* of 1881; *Toumey* of 1892, Baning and Yuma): California (Hitchcock of 1875; *Engelmann* of 1880; *Parry* of 1881; *G. R. Vasey* of 1881, Whitewater).

This is said to be the common arborescent *Cylindropuntia* of the Mojave desert and the deserts of southern Nevada. The hemispherical fruit, with broad and deep umbilicus, is often described as "saucer-shaped." The spines are sometimes very short.

76. Opuntia echinocarpa robustior, nom. nov.

Opuntia echinocarpa major Engelm. Syn. Cact. 305 (1856), not *phæacantha major* Engelm.

Taller (12 to 15 dm. high), with elongated (20 to 25 cm.) joints attenuate at base, oblong linear tubercles 12 to 18 mm. long, slender penicillate bristles, longer and fewer spines (the 4 central ones 2.5 to 4 cm. long, only 4 to 8 smaller radiant ones), looser sheath and fruit globose or clavate at base.—Type not found in the Engelmann collection.

Along the Lower Colorado in Arizona and California, and southward into Sonora.

Specimens examined: Arizona (*G. R. Vasey* of 1881, Yuma): California (*Newberry* of 1858; *Lemmon* of 1878; with no collector given in 1880; *Parish Bros.* of 1882).

77. Opuntia echinocarpa parkeri (Engelm.).

Opuntia parkeri Engelm. MSS.

Taller (9 to 15 dm. high), with erect branches, longer (10 cm.) joints, crested tubercles 18 mm. long, light yellowish-brown spines in sheaths of similar color (about 6 smaller radiant ones), depressed globose or oval less spiny fruit with flat or funnelform umbilicus, and irregular seeds (6 mm. in diameter) with narrow twisted commissure.—Type, C. F. Parker of 1879 in Herb. Mo. Bot. Gard.

San Diego County, California, east side of mountains facing desert.

Specimens examined: California (*C. F. Parker* of 1879).

78. Opuntia echinocarpa nuda, var. nov.

Spines slender, short and numerous, reddish-brown, often with lighter tips, the larger ones (1 to 1.5 cm. long) with brownish-yellow sheaths: flowers greenish-yellow, about 3 cm. high and 2 cm. broad: fruit ob-

ovate, about 2 cm. long, with broad shallow umbilicus, almost if not entirely spineless (occasionally a few spines persisting for a time): seeds almost regular, but slightly compressed, 3.5 to 5 mm. broad, with a straight but hardly broad commissure.—Type in Herb. Brandegee.

Lower California, near San Gregorio.

Specimens examined: Lower California (Brandegee of 1889).

79. Opuntia serpentina Engelm. Amer. Jour. Sci. ser. 2, xiv, 338 (1852).

? *Cereus* (?) *californicus* Torr. & Gr. Fl. i, 555 (1840), not *Opuntia californica* Engelm. Emory's Rep. 157 (1848).

Somewhat erect (7.5 to 12.5 dm. high) or prostrate, diffuse, with elongated, subverticillate, divaricate ascending branches: joints elongated-cylindrical, 15 to 30 cm. long, 2 to 3 cm. in diameter, with prominent ovate tubercles: pulvini with whitish bristles: spines 7 to 15, light-yellowish or rusty, sheathed, 6 to 18 mm. long, upper ones stellate-divaricate, lowest ones deflexed: flowers greenish-yellow, reddish outside, cup-shaped, 3.5 cm. broad: fruit subhemispherical, with broad and deep umbilicus ("saucer-shaped"), dry, long-woolly and very spiny, yellowish-brown, about 18 mm. long: seeds thick, irregular, with narrow commissure.—Type not found in the Engelmann collection.

On dry hillsides near the seacoast about San Diego, California.

Specimens examined: California (*Schott* of 1854; *Hitchcock* of 1875; *Engelmann* of 1880; *G. R. Vasey* of 1880, San Diego): Lower California (*Brandegee*, Magdalena Bay): also cult. Mo. Bot. Gard. 1876.

The Lower Californian specimens have 20 or more spines, all stellately spreading with no special lower one deflexed. The fruit is 3 to 4 cm. long, and the seeds 2 to 3 mm. broad, light brown.

80. Opuntia bernardina Engelm. Bull. Torr. Club, xix, 92 (1892).

A loosely branched shrub several stemmed from the base, erect with ascending or erectish branches, rather slender, 6 to 15 dm, high, with reticulate wood: joints cylindrical, 7.5 to 30 cm. long, with slender elongated oblong tubercles 2.5 to 3 cm. long (very prominent on younger joints, shorter and less marked on older ones): pulvini with a dense row of very short dark more or less persistent bristles at upper edge, and spreading often recurved leaves 4 to 8 mm. long: spines yellow; the sheathed ones 4 or 5, 1 to 3 cm. long, the lowest longest and mostly deflexed; and 4 appressed short (6 to 12 mm.) slender radial ones mostly on lower edge of pulvinus: flowers greenish-yellow tinged with brownish-red outside, 2.5 to 4 cm. broad: fruit ovate, deeply umbilicate, tuberculate (each tubercle with a single short spine), less than 2.5 cm. long, at length dry: seed flat, 6 mm. broad, with a channelled commissure and conspicuous persistent funiculus.—Type, Parry of 1851, G. Engelmann of 1880 and 1882, and Parish 814 in Herb. Mo. Bot. Gard.

Dry hills and mesas in the San Bernardino plain, California, northward through Cajon Pass, and in Santa Clara valley.

Specimens examined: California (*Parry* of 1851; *Parker* of 1874;

G. Engelmann of 1880 and 1882; *G. R. Vasey* of 1881; *Parish* 814; *Trelease* of 1892).

The common *Cylindropuntia* of the San Bernardino Valley. Apparently it does not extend to the coast region or the desert.

81. Opuntia tesajo Engelm. MSS.

With very short woody stem, and growing in little clumps 3 dm. or less in diameter: joints slender and not distinctly tuberculate: flowers simple, bell-shaped, yellow.—Type, Gabb 26 in Herb. Mo. Bot. Gard.

"Among rocks, especially toward the west coast and in the more central portions," Lower California..

Specimens examined: Lower California (*Gabb* 26 of 1867).

Certainly a very meager description, but as full as the material justifies and possibly sufficient for subsequent identification.

++ ++ *Arborescent: joints tumid and fragile: tubercles depressed; flowers purple: fruit mostly sterile and proliferous.*

82. Opuntia prolifera Engelm. Amer. Journ. Sci. ser. 2, xiv, 338 (1852).

Stem 9 to 30 dm. high, 5 to 17.5 cm. in diameter, with reticulated woody cylinder, and numerous horizontal very divaricate branches: joints ovate or ovate-cylindrical, tumid, fragile, congested toward apex of branches, very green, lower at length refracted and brown, 7.5 to 15 cm. long mid 3.5 to 5 cm. in diameter, with obovate-oblong tubercles 12 mm. long: pulvini tomentose, and the older with fine straw-colored bristles: spines 8 to 10, very variable, always with large loose sheaths which are light yellowish or rusty, 2.5 to 3.5 cm. long, one being subcentral and the rest stellate-spreading, the lower shorter (12 to 16 mm.): flowers dark-red, salverform, 3.5 cm. broad: fruit clavate, obovate or subglobose, deeply umbilicate, strongly tuberculate like the joints, nearly always abortive and usually proliferous: seeds large, regular, 6 mm. broad, with broad prominent commissure.—Type not found in the Engelmann collection.

Dry hills in southern California and adjacent Arizona, and extending into Lower California (San Ignacio and northward) and the adjacent islands (Guadalupe, Santa Catalina, San Clemente).

Specimens examined: California (*Gabb* 21 of 1867; no collector given of 1874; *Parker* of 1876; *Engelmann* of 1880; *G. R. Vasey* of 1880, San Diego): Arizona. (*Trelease* of 1892, at Benson): also cult, in Meehan's Gard. 1879.

Mr. Schott's notes describe this species as "on arid, hills about San Diego, near dry beds of streams, forming impassable and extensive thickets which are like unapproachable coral reefs." Mr. Brandegee notes that in Lower California it is "sometimes almost spineless."

83. Opuntia fulgida Engelm. Syn. Cact. 306 (1856).
Opuntia fulgens Engelm. Bot. Calif. i, 250 (1876).

Stem erect, flexuose, 15 to 36 dm. high, 15 cm. in diameter, with reticulate wood and few divaricate branches: joints ovate or ovate-

cylindrical, tumid, glaucous, congested at apex of branches, 7.5 to 20 cm. long, often 5 cm. in diameter, with ovate-oblong hardly prominent tubercles 12 to 14 mm. long: pulvinus woolly, with pale straw-colored bristles: spines 5 to 9, about equal, with loose lustrous sheaths, porrect-stellate (completely hiding the surface of young joints), 2.5 to 3 cm. long: flowers small, purple, cup-shaped, less than 2.5 cm. broad: fruit ovate, with flat umbilicus, fleshy, spineless but with large white tomentose pulvini, 2.5 to 3 cm. long, becoming dull-purple, oftenest sterile and fasciculately proliferous: seeds much compressed and very angular, beaked, with narrow commissure, 2 to 3 mm. broad (or with beak often 4 mm.). (*Ill.* Cact. Mex. Bound. t. 75, f. 18)—Type not found in the Engelmann collection.

Front southern Nevada through Arizona and the mountains, of western Sonora and Lower California.

Specimens examined: NEVADA (*Coville & Funston* of 1891, Cottonwood Springs): ARIZONA (*Palmer* 100 and 104 of 1867; *Bischoff* of 1872; *Parry* of 1881, Tucson; *Rusby* of 1883, Peach Springs; *Evans* of 1891, Tucson; *Toumey* of 1892, Tucson): SONORA (*Schott* 8; also a Pringle photograph): LOWER CALIFORNIA (*Brandegee* of 1889, Calanuget and Magdalena Island): also growing in Mo. Bot. Gard., 1893.

Very conspicuous on account of its shining spines, and hence called "vela de coyote," or "candle of the wolf." With a more arborescent form than *bigelovii*. The upper joints do not detach readily and hence propagation by joints must be rare. According to Parry, also, the proliferous fruits do not seem to develop plants. Brandegee notes in his Lower California specimens that the flowers are sometimes "light-yellow with reddish tinge," and sometimes the spines are hardly equal.

84. Opuntia fulgida mamillata (Schott).

Opuntia mamillata Schott; Engelm. Syn. Cact 308 (1856).

More tree-like, with a distinct trunk and dense top, 15 to 18 dm. high: joints 7.5 to 10 cm. long, 3.5 cm. in diameter, with prominent ovate tumid tubercles ("like those of *Mamillaria*"): pulvini with very short bristles, or none: spines 4 to 6, slender, short (6 to 18 mm.), mostly deflexed, with straw-colored sheaths: seeds scarcely beaked, smaller and with narrower commissure.—Type, Schott 6 in Herb. Mo. Bot. Gard.

Southern Arizona and Sonora.

Specimens examined: ARIZONA (*Palmer* 105 of 1867; *Engelmann* of 1880): SONORA (*Schott* 6).

Dr. Engelmann's manuscript notes indicate that he had come to the conclusion that *mamillata* could not be regarded as specifically distinct from *fulgida*.

85. Opuntia bigelovii Engelm. Syn. Cact. 307 (1856).

Erect and arborescent, 30 to 36 dm. high, 7.5 to 10 cm. in diameter, with reticulated wood, numerous erect or ascending branches congested and forming a dense head, the lower at length refracted and brown: joints ovate or ovate-cylindrical, tumid, bright or pale green, fragile, 5 to 15 cm. long and 2.5 to 5 cm. in diameter, with depressed-hemispherical crowded tubercles 6 to 8 mm. long: pulvini immersed, with a

penicillate tuft of pale bristles: stouter spines 6 to 10, pale straw-colored and in lustrous whitish sheaths, 1 to 2.5 cm. long, usually 2 or 3 deflexed and the rest divergent; slenderer ones 6 to 10, lower and radiating, 8 to 14 mm. long: flowers purple, 2.5 to 4 cm. broad: fruit ovate, deeply umbilicate, tuberculate, unarmed or with a few spines, fleshy and greenish, 2.5 to 5 cm. long: seeds small and very irregular. (*Ill.* Pacif. R. Rep. iv, t. 19, f. 1-7)—Type, Bigelow of 1854 in Herb. Mo. Bot. Gard.

From southern Nevada southward through western Arizona and southeastern California, into Lower California.

Specimens examined: Nevada (*Bailey* of 1891): Arizona (*Bigelow* of 1854, Williams River; *Schott* of 1855; *Parry* of 1880, on the Colorado). California (*Parry* of 1876; *Engelmann* of 1879; **Parish** of 1880 and 1882, San Bernardino; *G. R. Vasey* of 1881, Whitewater; *Trelease* of 1892): Lower California (*Brandegee* of 1889, Purissima and Comondu).

Distinguished from *fulgida* and *prolifera* by its short tubercles, immersed. pulvini, and large tuberculate somewhat spiny fruit. The young joints are very fragile. The tuft of bristles is borne at the notched tips of the imbricate tubercles. The spines are variable as to number and direction, ranging from the numbers and directions given in the above description to a single sharply deflexed spine. The seeds seem sometimes quite regular and discoid, 3 to 4 mm. broad.

++ ++ ++ *Frutescent or arborescent: joints cylindrical: tubercles mostly prominent and crested: flowers purple.*

(1) *Fruit not spiny.*

86. Opuntia whipplei Engelm. Syn. Cact. 307 (1856).

Stem erect, rarely spreading or subprostrate, 2 to 18 dm. high, with reticulate wood and divaricate branches: joints cylindrical, 5 to 30 cm. long, 1 to 2 cm. in diameter, with ovate crowded tubercles 10 mm. long: pulvini sparsely woolly and scarcely bristly: spines short, with ashy or straw-colored sheaths, 1 to 4 larger ones divaricate (the lower longer and deflexed), 6 to 18 mm. long, 2 to 8 smaller ones at lower margin, deflexed or radiating in every direction: flowers red: fruit subglobose, with funnelform umbilicus, lightly tuberculate, unarmed, yellow, somewhat fleshy and sweet, about 2.5 cm. long: seeds regular, 3 to 3.5 mm. broad, with linear commissure. (*Ill.* Pacif. R. Rep. iv, t. 24, f. 9, 10)—Type, specimens of Bigelow and Wright in Herb. Mo. Bot. Gard.

From southern Utah and Nevada through New Mexico and Arizona to southern California, Sonora, and Lower California.

Specimens examined: Utah (*Palmer* of 1877, St. George; *Parry* of 1881, *Bailey* or 1879-81, Santa Clara Creek): New Mexico (*Wright* of 1849; *Bigelow* of 1853; *Carleton* 385 of 1891): Arizona (*Bigelow* of 1853-54; *Palmer* of 1867 and 1870; *Bischoff* of 1871; *Engelmann* of 1880; *Lemmon* of 1881; *Pringle* of 1881, San Xavier Mission; *Parry* of 1881; *Rusby* 623 of 1883, Prescott; *Newberry* of 1888; *Evans* of 1891; *Toumey* of 1892, Tucson; *Wilcox* of 1894, Ft. Huachuca): California (*Agassiz*, San Diego): Lower California (*Palmer* 161 of 1890, Raza Island).

87. Opuntia whipplei spinosior Engelm. Syn. Cact. 307 (1856).

Taller (small trees 18 to 30 dm. high), with rhombic tubercles, mostly longer (12 to 18 mm.), much more numerous (commonly 12 to 14) stellate-porrect and mostly radiant spines, cup-shaped flowers 3 to 3.5 cm. broad, and larger seeds (4 mm.). (*Ill.* Pacif. R. Rep. iv, t. 17, f. 1-4)—Type, Schott 5 of 1855 in Herb. Mo. Bot. Gard.

Southern Arizona.

Specimens examined: Arizona (*Schott* 5 of 1855; *Pringle* of 1881; *Vasey* of 1881; *Toumey* of 1892, Phœnix and Tucson; *Wilcox* of 1894, Ft. Huachuca).

In giving the range Schott notes "from Gila River south to Santa Cruz River and Tucson and further east." The flowers are sometimes more or less yellow-tinged.

88. Opuntia arborescens Engelm. Wisliz. Rep. 6 (1848).

Cactus cylindricus James, Cat. 182 (1825); not Cereus cylindricus Haw. Syn. 183 (1812).

Cactus bleo Torr. Ann. N. Y. Lye. ii, 202 (1828), not HBK.

Opuntia exuviato-stellata Lem. Lab. Monogr. Cact. 492 (1845); but this is only *Opuntia stellata* Salm, ined.

Arborescent and erect, northward 15 dm. high, southward becoming 60 to 90 dm, high, 12.5 to 25 cm. in diameter, with verticillate, horizontally divaricate or pendulous very spiny branches: joints verticillate (mostly in 3s or 4s), cylindrical and very green, 5 to 15 cm. long, less than 2.5 cm. in diameter, with prominent elongated compressed-cristate tubercles 14 to 18 mm. long, and terete elongated spreading leaves 12 to 20 mm. long: pulvini with short wool, but scarcely bristly: spines 8 to 30, terete, horny or reddish-brown, in straw-colored sheaths, porrect in every direction, 1 to 8 interior ones longer (16 to 28 mm.), more loosely sheathed, the central subdeflexed, the exterior ones weaker, closely sheathed, 8 to 16 mm. long, all sometimes very short: flower purple, 6 to 7.5 cm. broad: fruit globose or hemispherical, 2.5 cm. in diameter, variously umbilicate (dependent on prominence of upper tubercles), prominently cristate-tuberculate, unarmed, dry or nearly so, yellow; seeds regular, smooth, 3 to 4 mm. broad, with narrow commissure. (*Ill.* Pacif. R. Rep. iv, t. 17, f. 5, 6; t. 18, f. 4; t. 24, f. 12; Cact. Mex. Bound. t. 75, f. 16, 17)—Type, Wislizenus of 1846 and Fendler of 1847 in Herb. Mo. Bot. Gard.

From central Colorado southward through Texas, New Mexico, and Arizona into Chihuahua and Sonora amid flu southward.

Specimens examined: Colorado (*Parry*, Canyon City; *Pringle* of 1881, Trinidad; *Alice Eastwood* of 1890, Durango; *Mrs. S. B. Walker* of 1894, Canyon City): Texas (*Wright* of 1851-52; *G. R. Vasey* of 1881, El Paso; *Evans* of 1891): New Mexico (*Wislizenus* 307 of 1846; *Fendler* 277 of 1847, Santa Fe; *Wright* 354, 390, 399; *Bigelow* of 1853-54; *Bolander* of 1872; *G. R. Vasey* of 1881, Socorro; *Mrs. Summer* 1002; *Carleton* of 1891; *Evans* of 1891, Lordsburg; *Mearns* of 1892, Carrizalillo Mts.): Arizona (*Emory* of 1848; *Cones & Palmer* of 1865;

Bischoff of 1871; *Lemmon* 305; *Palmer* 800; *Rothrock* 101, 584; *Pringle* of 1881; *Vasey* of 1881; *Palmer* of 1890, Ft. Huachuca; *Nealley* of 1891, Silver City; *Wilcox* of 1894, Ft. Huachuca; *Dr. Loew*, Chloride): Sonora (*Thurber* 336): Coahuila (*Palmer* 377 of 1880): also cult. in Mo. Bot. Gard. 1862, growing in 1893.

A Mexican species of wide range and extending northward to the plains of Colorado, covering extensive tracts. Nealley's specimens, from Silver City, Arizona, have shorter perpendicular and suberect central spines, shorter than the radials. Vasey's from El Paso have tubercles 25 to 30 mm. long, which so separate the bunches of spines that the joints have not their usual spiny appearance. Palmer 377 from Coahuila was distributed as *imbricata*, and I doubt not that much Mexican *arborescens* has been mistaken for that species. The 1 or 2 white spines of *imbricata*, as well as its clavate joints, should easily distinguish it from *arborescens*, although it is very doubtful whether it deserves specific separation.

89. Opuntia imbricata (Haw.) DC. Prodr. iii, 471 (1828).
Cereus imbricatus Haw. Rev. 70 (1812).

An irregular branching shrub 9 to 15 dm. high, with trunk often 7.5 cm. in diameter, branching above, solitary or forming thickets: joints more or less clavate, with prominent compressed-cristate tubercles, and elongated subulate leaves: pulvini with straw-colored wool: spines 1 or 2, white, setaceous or rigid, sheathed: flowers rose-colored, crowded near the summit of late branches: fruit depressed-globose, umbilicate: seed thick, irregular, 3 to 3.5 mm. in diameter. (*Ill.* Cact. Mex. Bound. t. 73, f. 7, 8)—Type unknown.

From Coahuila and San Luis Potosi to southern Mexico.

Specimens examined: Coahuila (*Palmer* 310 of 1880; *Parry & Palmer* 281): State of Mexico (*Gregg* 568, 677, 684, 685 of 1849): zacualco (*Bourgeau* 264 of 1865-66): Mexico, with no state indicated (*Wright* of 1847): also cult. Gard. Montpel. 1126,

Very closely related to *arborescens*, and possibly only a small sparsely armed form of it, but in the absence of type material or even complete material it is for the present kept separate

90. Opuntia versicolor Engelm. MSS.

Arborescent, with spineless trunk 5 to 7.5 cm. in diameter, irregularly much branched: joints cylindrical, 12 to 18 cm. long or more, about 1.5 cm. in diameter, with linear rather prominent tubercles (when young) 1 to 2.5 cm. long, soon flattening and disappearing on older branches, and round-ovate cuspidate leaves: pulvini with short gray wool, and usually a small cluster of bristles at upper edge: spines 4 to 13 on young joints, 15 to 20 on older ones, stellate, reddish-brown, with straw-colored sheaths (close and soon disappearing), thin inner 1 to 4 usually deflexed and unequal (6 to 13 mm.), the radials shorter: flowers yellow, 2 to 2.5 cm. broad: fruit becoming clavate, 2 to 2.5 cm. long, at length reddish or yellowish and apparently dry: seeds irregular, angular, about 5 mm. broad, with narrow commissure.—Type, specimens of Parry, Pringle, G. Engelmann, and Miller, in Herb. Mo. Bot. Gard.

Neighborhood of Tucson and Benson, Arizona, on mesas and foothills.

Specimens examined: Arizona (*Parry* of 1880 and 1881; *G. Engelmann* of 1880; *Pringle* of 1881; *Miller* of 1881: *Nealley* of 1891; *Toumey* of 1892, Tucson).

This species has been distributed under this name ever since 1881, but I have been unable to find any published description. Toumey's specimens have much shorter, more prominent, and more crowded tubercles than usual.

91. Opuntia molesta Brandegee, Pl. Baja Calif. 164 (1889).

Steam few, sparingly branched, 12 to 18 dm. high: cylindrical joints 15 to 20 cm. long and 2.5 cm. in diameter, with few not prominent tubercles: spines 5 to 9, of which 1 to 3 are 2.5 to 5 cm. long, the rest less than 1.2 cm. long, all reddish-brown to blackish, the 2 upper large ones divaricate, the lower one porrect or deflexed, the small and apparently naked ones usually at lower edge of pulvinus and deflexed: flower purple, 5 cm. broad: fruit obovate, juicy, 2.5 to 4 cm. long, not tuberculate or spiny, but with remnants of the woolly pulvini: seeds very irregular, with a swollen, warty look, the narrow commissure in a deep furrow, 5 to 8 mm. in diameter.—Type in Herb. Brandegee.

San Ignacio, Lower California.

Specimens examined: Lower California (*Brandegee* of 1889).

Mr. Brandegee says that the long spines are sometimes not present. Their sheaths are straw-color to brownish, very loose and bladdery, giving the spines a massive look when unbroken.

92. Opuntia calmalliana, sp. nov.

Habit and height unknown: joints cylindrical, 1 to 2 cm. in diameter, glaucous, with linear-oblong crested (mostly distinct) tubercles 20 to 25 mm. long: pulvini densely covered with yellowish wool, and with a penicillate tuft of whitish bristles at upper edge: spines usually 4, the upper one stout and porrect, reddish with yellowish tip (as are all the spines), 2 to 2.5 cm. long (occasionally 1 or 2 short upper ones added), the usually 3 (sometimes 4) lower ones more slender and sharply deflexed, 1 to 1.5 cm. long (occasionally one of them longer): flowers apparently purple: ovary covered with very prominent woolly pulvini which are more or less bristly and spiny, but ripening into a smooth juicy obovate fruit: seeds discoid and beaked, irregularly angular, with broad commissure, about 4 mm. broad.—Type in Herb. Brandegee.

Calmalli, Lower California.

Specimens examined: Lower California (*Brandegee* of 1889).

This species is closely related to *molesta*, but its spines are different, though on the same general plan, and its seeds are very different.

(2) *Fruit more or less spiny.*

93. Opuntia thurberi Engelm. Syn. Cact. 308 (1856).

Erect and frutescent: joints slender-cylindrical (12 mm. in diameter), with oblong-linear tubercles 18 mm. long: pulvini with short yellow wool and scarcely any bristles: spines 3 to 5, short (6 to 16 mm.), dusky,

with straw-colored or yellowish sheaths, laterally divergent, the lowest one stoutest and deflexed: flower salverform, dull brick-red, 3.5 cm. broad.—Type, Thurber 373 in Herb. Mo. Bot. Gard.

"Near Bacuachi, Sonora."

Specimens examined: SONORA (*Thurber* 373).

94. Opuntia acanthocarpa Engelm. Syn. Cact. 308 (1856).

Erect and arborescent, stout, 15 to 18 dm, high, with reticulate wood, and few alternate (never verticillate) ascending divaricate branches: joints cylindrical, 10 to 20 cm. long, 2.5 cm. in diameter, with oblong-linear tubercles 18 to 20 mm. long: pulvini with short wool and scanty bristles: spines 8 to 25, stellate-porrect in every direction, with straw-colored or brownish sheaths, the inner (1 to 7) 2.5 to 3 cm. long, the outer (6 to 20) 8 to 20 mm. long: flowers copper-color and small: fruit depressed-subglobose, broadly umbilicate, tuberculate, with rather few but stout spines, 2.5 cm. long: seeds sharply angular, 5 to 6 mm. broad, with broad commissure. (*Ill.* Pacif. R. Rep. iv, t. 18, f. 1-3; t. 24, f. 11: N. Am. Fauna, no. vii, t. 7, 8)—Type, Bigelow of 1854 in Herb. Mo. Bot. Gard.

From southwestern Utah and Southern Nevada southward through Arizona and southeastern California into Sonora.

Specimens examined: ARIZONA (*Bigelow* of 1854; *Palmer* (numerous numbers) of 1867; *Engelmann & Palmer*; *Rusby* 622 of 1883, Peach Spring; *Smart* 245; *Toumey* of 1892, Tucson): CALIFORNIA (*Coville & Funston* 1943, Death Valley Exped.): SONORA (*Thurber* 4, near "Bacuacha"): also growing in Mo. Bot. Gard., 1893.

Among Toumey's specimens is one with spineless fruit, but evidently this species. In such a case the flowers and seeds are necessary to separate it from *arborescens*.

+ + *Wood dense: joints slender, obscurely tuberculate spines single* (*or 1 or 2 smaller ones added above*)*; seeds more or less margined.*

95. Opuntia kleiniæ DC. Rev. Cact. 118 (1828).

Opuntia wrightii Engelm. Syn. Cact. 308 (1856).

Erect and shrubby, 6 to 12 dm. high, 2.5 to 3.5 cm. in diameter below, with few ascending branches: joints cylindrical, slender, 8 mm. in diameter, with elongated depressed tubercles 14 to 18 mm. long, and elongated subulate spreading leaves 10 mm. long: pulvini with white wool and very slender penicillate bristles: the single spine (rarely 1 or 2 smaller divergent ones added above) porrect or a little deflexed, 16 to 20 mm. long, reddish to ashy, with straw-colored deciduous sheaths: flowers brick-red, 2.5 to 3 cm. broad: fruit obovate, about 1.5 cm. long.—Type unknown.

From the Pecos region of Texas to El Paso, and southward through Coahuila and Sonora to southern Mexico.

Specimens examined: TEXAS (*Wright* of 1851 and 1852; *Parry* 49; *Evans* of 1891): COAHUILA (*Palmer* 376): also cult. in Mo. Bot. Gard, 1862 and 1881, and growing in 1893.

96. Opuntia arbuscula Engelm. Syn. Cact. 309 (1856).

Erect and arborescent, 21 to 24 dm. high, the smooth green trunk 10 to 12.5 cm. in diameter, very capitate-branching at apex (top formed by numerous slender divaricate branches): joints lightly tuberculate, the ultimate ones 5 to 7.5 cm. long, 8 mm. in diameter, with oblong-linear depressed (flat and indistinct) tubercles 12 mm. long: pulvini with white wool, and few very slender penicillate bristles: the single spine (or sometimes 2 side by side) porrect, at length deflexed, with straw-colored or yellow sheath, 18 to 25 mm, long, rarely 1 or 2 shorter and lower deflexed ones added: flowers greenish-yellow tinged with red, 3.5 cm. broad: fruit "bristly."—The type specimens are those of Schott ("on desert heights, near Maricopa village, on the Gila"), but they could not be found in the Engelmann collection.

Deserts of Southwestern Arizona and southward into Sonora.

Specimens examined: Arizona (*Emory* of 1846; *Engelmann* of 1880; *Parry* of 1881; *Pringle* of 1881, mesas near San Xavier Mission; *Evans* of 1891, Tucson; *Toumey* of 1892, Mesa City; *Wilcox* of 1894, Fort Huachuca).

The Evans specimen contains fruit which is clavate, strongly tuberculate and bristly, with funnelform umbilicus, 2 to 2.5 cm. long. It is immature, so that no color is indicated, and probably not the full size. This species is often confused with the *leptocaulis* forms, but its dense, stouter, almost interlocking apical branches, its long flat tubercles, and its yellowish sheathed spines separate it easily. There is great variation in spine characters, the following forms occurring naked (spines probably deciduous); one spine (the common form); 2 equal spines side by side; 2 prominent spines and 1 or 2 smaller ones; 3 or 4 spines, all alike but only 5 to 15 mm. long, making a short spiny-looking joint. Some of these forms might have been separated as varieties, but almost all of them, certainly the most diverse ones, have been found on different branches of the same plant. The pulvini are apt to be quite bristly, and the wool is oftener dirty-white than bright-white.

97. Opuntia leptocaulis DC. Roy. Cact. 118 (1829).
Opuntia fragilis frutescens Engelm. Pl. Lindh. 245 (1845).
Opuntia frutescens Engelm. Wisliz. Rep. 28 (1848).
Opuntia frutescens brevispina Engelm. Syn. Cact. 309 (1856).
Opuntia leptocaulis brevispina Watson, Bibl. Index, 407 (1878).

Erect and frutescent 9 to 15 dm, high, 2.5 to 3.5 cm. in diameter, with light-gray scaly bark and erectish branches ("like pipestems"): joints cylindrical, 4 to 6 mm, in diameter, with indistinct tubercles 6 to 10 mm. long, the young joints sessile: the mostly single spine slender, 8 to 12 mm. long, in a close sheath: flowers greenish or sulphur-yellow, 14 to 20 mm. broad: fruit obovate, smooth, often proliferous, not tuberculate, deep-scarlet, fleshy, 10 to 18 mm. long: seeds few, white, compressed, with narrow and often acute margin, 3 mm. in diameter. (*Ill.* Pacif. R. Rep. iv, t. 20, f. 4, 5; also t. 24, f. 16-19)—Type unknown.

Common from northern Mexico, throughout Texas, and westward to Arizona; also extending to southern Mexico.

Specimens examined: Texas (*Lindheimer* of 1845; *Wislizenus* of 1847;

Thurber of 1850; *Wright* of 1851 and 1852; *Hall* of 1872, near Austin): New Mexico (*E. A. Mearns* of 1892, Grant Co.): Arizona (*Trelease* of 1892; *Toumey* of 1892, Tucson): Coahuila (*Gregg* 125 and 438; *Palmer* of 1880): San Luis Potosi (*Parry and Palmer* of 1878): also growing in Mo. Bot. Gard. 1893.

The Lindheimer form described in 1915 is the form with short spines, and is the characteristic form of Texas and northeastern Mexico. The original *leptocaulis* form was described from Coulter's collection, made further south in Mexico.

98. Opuntia leptocaulis stipata, nom. nov.

Opuntia frutescens longispina Engelm. and Bigel. Pacif. R. Rep. iv, 56 (1856), not *O. longispina* Haw. Philos. Mag. 109 (1830).

Young joints stipitate: spines stouter, longer (2.5 to 5 cm.), and in loose sheaths. (*Ill.* Pacif. R. Rep. iv, t. 20, f. 2, 3)—Type, specimens of Bigelow, Wright, and Thurber in Herb. Mo. Bot. Gard.

From the Colorado River of Texas to the Colorado of the West and southward into Sonora, San Luis Potosi, and Lower California.

Specimens examined: Texas (*Bigelow* of 1853; *Wright* 421; *Lindheimer* 1872; *Berlandier* 195, 1455, 1828; *Reverchon* 342, Brownwood; *G. R. Vasey* of 1881, El Paso; *Carleton* 410 of 1891, Oldham County; *Evans* of 1891): New Mexico (*Wright* of 1851; *Bigelow* of 1853): Arizona (*Bigelow* of 1851; *Schott* of 1855; *Palmer* 93, 98; *Rusby* 146 of 1883, San Francisco Mts.; *Toumey* of 1892, Tucson; *Wilcox* of 1894, Ft. Huachuca): Sonora (*Thurber* of 1851): San Luis Potosi (*Parry & Palmer* 280): Lower California (*Brandegee* of 1889, San Gregorio, Enrique, Agua Dulce): cult. in Mo. Bot. Gard. 1881; also growing in same garden in 1893.

99. Opuntia leptocaulis vaginata Watson, Bibl. index, 407 (1878).

Opuntia vaginata Engelm. Wisliz. Rep. 16 (1848), in part.

Joints 6 to 8 mm, in diameter, with rather distinct tubercles 12 to 18 mm. long: the large spines 2.5 to 6 cm. long, dark (mostly black), with very loose glistening yellowish to brownish sheaths, and 1 or 2 smaller ones added: fruit tuberculate, yellow: seed 4 to 5 mm. in diameter. (*Ill.* Pacif. R. Rep. iv, t. 24, f. 1; t. 24, f 13-15)—Type, specimens of Wislizenus in Herb. Mo. Bot. Gard.

From southwestern Texas to Arizona, and southward into Coahuila and San Luis Potosi.

Specimens examined: Texas (*Wislizenus* of 1837 and 1846; *Lindheimer* of 1851; *Wright* 421): New Mexico (*Wislizenus* of 1846; *Wright* 1851-52; *Bigelow* of 1853; *E. L. Greene* of 1880): Arizona (*Lemmon* 303): Coahuila (*Gregg* 753): San Luis Potosi (*Gregg* 568): also Cult. in Mo. Bot. Gard., 1850.

The mostly solitary very long Spines are porrect, standing out on every side of the slender stems like great thorns. The leaves are usually quite persistent.

100. Opuntia ramosissima Engelm. Amer. Journ. Sci. ser. 2, xiv, 339 (1852).

Opuntia tessellata Engelm. Syn. Cact. 309 (1856).

Very bushy from a stout trunk (2.5 to 7.5 cm. in diameter) with

dark gray scaly bark, 6 to 20 dm high, with numerous slender divaricate branches: joints slender cylindrical, 6 to 7 mm. in diameter, covered with crowded and depressed-flattened 5- or 6-angled ashy gray tubercles S to 6 mm. long: pulvini with wool, but scarcely bristly, unarmed or with a single (rarely double) elongated (3.5 to 5 cm.) porrect or somewhat deflexed spine (rarely a few additional minute ones), which is whitish and yellow to reddish and brown, and in a very loose yellow sheath (contracted at base and firmly adhering to the spine, loose and saccate above): flowers purple, 1 to 2 cm. broad: fruit ovate (contracted at base and apex), with narrow and deep umbilicus, dry and tuberculate, bristly, 18 to 20 mm. long: seeds few, somewhat regular, with thick spongy margin, 3.5 to 4 mm. broad. (*Ill.* Pacif. R. Rep. iv, t. 21, f. 1-7)—Type not found in the Engelmann collection.

Deserts of the Colorado from southern Nevada through southeastern California and western Arizona into Sonora.

Specimens examined: Arizona (*Schott* of 1856; *Parry* of 1867; *Bischoff* of 1871; *Palmer* of 1876; *Toumey* of 1892, Yuma): California (*Parry* of 1852; *Bigelow* of 1854; *Cooper* of 1861; *Wright* of 1882; *Parish Bros.* 170 or 1882, San Bernardino Mts.; *Trelease* or 1892): Sonora (*Schott* of 1855; *Pringle* of 1884, sandy plains, near Gulf of California).

The original name *ramosissima* (1852) was considered an unsuitable one in a section in which all the species are branching; it was therefore changed to *tessellata* (1856), referring to the curious crowded and angular flattened tubercles. The spines are crowded together at the upper end of each year's growth, and these with their yellow shining sheaths surmounting very slender branches covered with scale-like tubercles give the plant a striking appearance. The spines have a wide range of coloration, since they may be not only whitish to yellow (the usual colors), but having always a yellowish tip, they may be ashy-gray or deep reddish-brown, or even black below or sometimes a combination of all of these colors.

** * * Stem erect but weak; and using a support, branching and woody: spines none; flowers yellow.*

101. Opuntia rotundifolia Brandegee, Zoe, ii, 21 (1891).

Erect and slender, weak and branching, 20 to 30 dm. high, supported by bushes, with a cylindrical woody stem only, 1 to 1.5 cm. in diameter: joints 6 to 10 cm. long, with fleshy round ovate leaves 2 to 3 cm. long and wide: pulvini remote, with gray wool, numerous retrorsely barbed, usually reddish-brown, bristles 3 to 5 mm. long, and no spines: flowers yellow, about 4 cm. broad: fruit slender-clavate, bristly, about 5 cm. long and 4 to 6 mm. in diameter: seeds few, whitish and flattened, densely covered with white hairs (somewhat deciduous with age).—Type in Herb. Brandegee.

"Not uncommon at low elevations in the Cape Region," Lower California.

Specimens examined: Lower California (Brandegee of 1890, San José del Cabo).

The specimens I have examined are presumably a part of the type material. They consist of naked terete stems 1 to 5 mm. in diameter, with the small

tomentose areolæ averaging about 2 cm. apart; and a package of fragmentary material. The remarkable broad fleshy leaves are very much shrunken, but in their shriveled state measure 10 to 17 mm. long and wide. Mr. Brandegee has seen "the whole plant covered with a mass of thick green leaves, amongst which a few yellow flowers were visible." Such leaves are naturally suggestive of *Peireskia*. The single flower in the material before me is small, about 2 cm. high and broad, but it may be quite immature and is certainly much shrunken. I have not seen the remarkable hairy seeds.

ARTIFICIAL KEY TO THE SPECIES.

It seems impossible to make a satisfactory artificial key for *Opuntia*, as the species are separated, poorly at best, by a variety of characters. The following attempt may be of some service. The numbers refer to the serial numbers of the synoptical presentation:

I. Joints flat and more or less round.—Platopuntias.

* Spineless.

Mexico.
microdasys (44). rufida (45).
Florida and tropical America.
ficus-indica (3).
Atlantic States.
opuntia (42).
Southwestern United States.
Joints obovate.
lævis (4), basilaris (46), utahensis (57).
Joints obovate to orbicular.
filipendula (30), mesacantha (31), treleasii (48).

* * Spiny.

Florida and Georgia.
pes-corvi (43).
Mexico.
stenopetala (1), setispina (29).
Lower California.
tapona (13), pycnantha (16), comonduensis (21).
Western United States.
Joints neither obovate nor orbicular.
Spines yellow or straw-color.
tuna (5), palmeri (15), rubrifolia (19), fragilis (60).
Spines white or whitish.
trichophora (55), brachyarthra (61).
Spines reddish or brownish.
rutila (58), fragilis (60), brachyarthra (61).
Joints orbicular.
Spines mostly 1 to 3.
Spines reddish-brown (at least some of them).
macrocentra (22), oplocarpa (39), sphærocarpa (56).
Spines whitish (perhaps reddish at base or apex).
filipendula (30), mesacantha (31), cymochila (35).
Spines straw-colored.
cyclodes (10).
Spines mostly 4 to 15 and dark.
strigil (2), mojavensis (27), hystricina (49), polyacantha (50), watsoni (54).

Western United States-Continued.
Joints obovate.
Spines straw-colored.
lindheimeri (7), chlorotica (12), procumbens (18), angustata (20).
Spines white or whitish (sometimes dusky at base or apex).
Spines mostly 1 to 3.
Longest spines not exceeding 3.5 cm.
dulcis (8), occidentalis (9), mesacantha (31), stenochila (36), macrorhiza (37).
Longest spines about 5 cm.
angustata (20), filipendula (30).
Spines mostly 4 to 10.
Longest spines not exceeding 3.5 cm.
albispina (53), arenaria (59).
Longest spines 6 to 10 cm.
tortispina (26), tenuispina (28), hystricina (49).
Spines reddish or brown to black.
Spines mostly 1 to 3.
Longest spines not exceeding 3.5 cm.
lindheimeri (7), greenii (38), vaseyi (40), fusco-atra (41).
Longest spines 5 to 7.5 cm.
procumbens (18), phæacantha (23), camanchica (25).
Spines mostly 4 to 15.
Longest spines not exceeding 3.5 cm.
strigil (2), arenaria (59).
Longest spines about 5 cm.
procumbens (18), platycarpa (51), borealis (52).
Longest spines 6 to 10 cm.
phæacantha (23), camanchica (25), hystricina (49).

II. Joints cylindraceous, more or less tuberculate.—Cylindropuntias.

* *Spineless.*

ramosissima (100), rotundifolia (101).

* *Spiny.*

+– *Spines without sheaths.*

Longest spines not exceeding 1 to 3.5 cm.
bulbispina (62), parryi (63), clavata (64), pulchella (65).
Longest spines 5 to 6 cm.
grahami (66), emoryi (67), schottii (68), invicta (70).

+– +– *Spines with sheaths.*

Mexico.
tunicata (72), imbricata (89), thurberi (93).
Lower California.
clavellina (71), ciribe (73), molesta (91), calmalliana (92).
Southwestern United States.
Spines mostly 5 to 20.
Fruit spiny.
Longest spines not exceeding 2 to 2.5 cm.
echinocarpa (75), serpentina (79).
Longest spines 3 to 3.5 cm.
davisii (74), bernardina (80), acanthocarpa (94)
Fruit not spiny.
Longest spines not exceeding 1.5 to 2.5 cm.
bigelovii (85), whipplei (86), versicolor (90).
Longest spines 3 to 3.5 cm.
prolifera (82), fulgida (83), arborescens (88).

Spines mostly solitary.
Longest spines not exceeding 1 to 2.5 cm.
kleiniæ (95), arbuscula (96), leptocaulis (97).
Longest spines 5 to 6 cm.
stipata (98), vaginata (99), ramosissima (100).

GEOGRAPHICAL DISTRIBUTION.

The genus *Opuntia* is far more largely represented in the United States than any other genus of *Cactaceæ*, extending into British Columbia and to the Atlantic Seaboard and displaying a maze of forms in the Southwestern States. This is specially true of PLATOPUNTIA. The great uncertainty as to the species of *Opuntia* is probably account- able for the large enumeration of them peculiar to our flora. Numerous forms have never been recognized a second time, and others are kept distinct from each other and from Mexican forms when they should doubtless be merged. In almost every unvisited locality "new species" are found so freely that no confidence can be placed in our conception of specific lines in this genus. The following discussion is based upon the presentation of the previous pages, but it should be understood that it must be largely modified by a fuller understanding of the genus.

The two sections, PLATOPUNTIA and CYLINDROPUNTIA are so distinct from each other that they will be considered separately.

CYLINDROPUNTIA, with 28 forms enumerated as belonging to our flora, but 11 of which are restricted to the United States, does not extend north of central Colorado or east of Texas. It is preeminently a Sonoran and Lower Californian type, and 25 of the 28 forms occur in the desert region of western Arizona and southern California. Of the 17 forms in common with the Mexican flora 15 are now traced into Sonora and Lower California, and the others certainly will be. Further exploration of those Mexican States will doubtless reduce the number of species now enumerated as peculiar to our flora. The 11 forms regarded at present as endemic are distributed as follows: *echinocarpa parkeri, serpentina*, and *bernardina* in southern California, and doubtless of Lower Californian origin; *whipplei spinosior* and *versicolor* in southern Arizona, certainly to be found in Sonora; *parryi, clavata*, and *pulchella* more isolated in southern Nevada and adjacent regions; *davisii* extending from southern California to southern Colorado and northwestern Texas; and *grahami*, a low-ground species, found along the Rio Grande bottoms from El Paso downward, and *schottii*, found as yet only in Texas between the San Pedro and Pecos, the two species of our endemic Cylindropuntias which do not indicate a lower Californian or Sonoran connection.

The seventeen Cylindropuntias in common with Mexico are, with two exceptions, all found in the desert regions of southern California and Arizona, some of them extending into Nevada, others further eastward into Utah and Colorado, and some reaching Texas. They occur in two types, the more robust and more spiny forms (such as *echinocarpa,*

prolifera, *fulgida*, and *arborescens*), and the more slender and less spiny forms (of which *leptocaulis* may be taken as a representative). Exclusive of varieties, there are nine representatives of the former group and four of the latter. In the first series, *bulbispina* has as yet been reported only from New Mexico, extending southwestward into Coahuila. The remaining eight species are massed in Arizona and extend beyond it as follows: *prolifera* only into adjacent California, occurring in the Lower Californian flora; *fulgida* and *bigelovii*, both Sonoran and Lower Californian in origin, extending not only into adjacent California, but reaching southern Nevada; *Echinocarpa, whipplei*, and *acanthocarpa* having the same extension into California and Nevada, but also reaching southern Utah; *emoryi* and *arborescens* not extending westward or directly northward of Arizona, but stretching eastward to southwestern Texas, the latter being the only one of the group to reach Colorado. Of the four slender and less spiny species *kleiniæ* has been reported only from southwestern Texas, but its occurrence in Sonora as well as Coahuila would indicate a wide Mexican range and the great probability that it occurs in Arizona. In the ease of the other three species *arbuscula* is found only in southwestern Arizona; *ramosissima* extends into adjacent California and southern Nevada; while *leptocaulis*, the most common species, extends eastward from Arizona into Texas, even as far as the Colorado River.

Platopuntia is represented in our flora by 51 forms, one of which (*tuna*) is a tropical American form extensively introduced by cultivation, notably in southern California. Of the remaining 50 forms, 44 are described as endemic, but 5 being regarded as identical with Mexican forms. It is hard to avoid the conclusion that this is more an expression of our ignorance of the Mexican forms and of specific limitations than of a fact. Three species occur east of the Appalachians: *ficus-indica*, reaching Florida from the tropics; *pes-corvi*, a curious endemic species of Georgia and Florida; and *opuntia*, the common coast species from Massachusetts to Florida. The remaining 47 forms are characteristic of our western flora, but 10 of them ranging north of Colorado or east of Indian Territory. Just as Arizona is the center of our display of Cylindropuntias, so western Texas and adjacent New Mexico are the special home of Platopuntias, 29 of the 47 forms occurring there. Platopuntia is characterized by the development of three very strong types which display a bewildering maze of forms, viz: *lindheimeri, mesacantha*, and *polyacantha*. The species *lindheimeri*, of Mexican origin, ranges through our southern border, from the Gulf to the Pacific, while two of the varieties, *occidentalis* and *littoralis*, are confined to southern California, and the other two, *dulcis* and *cyclodes*, belong to Texas, the latter reaching into adjacent New Mexico. The two other types, *polyacantha* and *mesacantha*, are far wider in their distribution. The type *polyacantha* is not found in the Arizona-California-Nevada region, but ranges far north, extending from Texas

into British Columbia, this and *fragilis* being the only PLATOPUNTIA forms north of our border. The species *polyacantha* extends from Indian Territory and northern New Mexico through Utah to Montana and Washington; *borealis* is the most northern variety, ranging from South Dakota and Oregon into British Columbia; *platycarpa* extends from Utah and Colorado to Idaho and Montana and eastward to Nebraska; *watsoni* extends from New Mexico to Utah, Wyoming, and Nebraska; *albispina* extends from New Mexico to Utah and Indian Territory; while the peculiar *trichophora* is confined to the El Paso region of Texas and adjacent New Mexico. It would seem that in this ease a strong type has spread far northward and has been extensively modified. In the case of *mesacantha*, however, we find our most variable type. It is easy to define at least nine varieties of it, but there still remain numerous forms unworthy of varietal rank and still not strictly typical. Its range is wider even than that of *polyacantha*, occupying the Arizona region and extending east of the Mississippi, in fact closely represented on the Atlantic by *opuntia*, but, so far as known, not extending into British Columbia. The species *mesacantha* ranges from Texas to Minnesota, extending eastward into Indiana and Kentucky, its variety *microsperma* accompanying it. The variety *macrorhiza* has the most northwestern extension, reaching the "Big Bend" of the Missouri from Texas and Arizona. The form *cymochila* has a range second in extent only to *macrorhiza*, touching the species in Kansas and reaching Utah and Arizona to the west. The remaining six varieties are far more restricted: *parva* in southern Missouri; *grandiflora* on the Brazos in Texas; *oplocarpa* in western Texas and Colorado; *greenii* in Colorado and Arizona; *stenochila* in western New Mexico; and *vaseyi* in western Arizona. The only other far northern species is *fragilis*, which begins at the south in southern Colorado and adjacent New Mexico and Utah, and extends northward into Montana and British Columbia, and eastward to Kansas mid Minnesota. The species *tortispina* has an eastern range along the plains, extending from northern Texas to Nebraska. The remaining 23 forms are purely southwestern, as follows: *fusco-atra* is a form of eastern Texas; *strigil, filipendula, tenuispina*, and *arenaria* belong to the El Paso region; *sphærocarpa* and *phæacantha major* are restricted to New Mexico; *palmeri, rubrifolia*, and *sphærocarpa utahensis* are forms of Utah; *lævis* is peculiar to Arizona; *mojavensis* and *treleasii* are restricted to southern California; *chlorotica, basilaris*, and *rutila* belong to the desert region of southern California, Arizona, Nevada, and Utah; *angustata* and *hystricina* extend from southern California to New Mexico, the latter also reaching Nevada; *procumbens* and *camanchica* extend from Arizona to the El Paso region of Texas, the latter also reaching southern Colorado. The total enumeration of Platopuntias in the southwest shows 20 forms in Texas, 17 in New Mexico, 14 in Arizona, 11 in southern California, 11 in Utah, and 7 in Colorado. But 4 species are reported as yet from Nevada, but this is evidently entirely inadequate.