
Tucholsky
Wagner
Zola
Scott
Sydow
Schlegel
Turgenev
Wallace
Fonatne
Freud
Twain
Walther von der Vogelweide
Fouqué
Friedrich II. von Preußen
Weber
Freiligrath
Frey
Fechner
Fichte
Weiße Rose
von Fallersleben
Kant
Ernst
Frommel
Richthofen
Hölderlin
Engels
Fielding
Eichendorff
Tacitus
Dumas
Fehrs
Faber
Flaubert
Eliasberg
Ebner Eschenbach
Maximilian I. von Habsburg
Feuerbach
Fock
Zweig
Eliot
Vergil
Ewald
Goethe
London
Elisabeth von Österreich
Mendelssohn
Balzac
Shakespeare
Dostojewski
Ganghofer
Lichtenberg
Rathenau
Trackl
Stevenson
Doyle
Gjellerup
Hambruch
Tolstoi
Mommsen
Lenz
Droste-Hülshoff
Thoma
Hanrieder
Dach
Verne
von Arnim
Hägele
Hauff
Humboldt
Reuter
Karrillon
Rousseau
Hagen
Hauptmann
Gautier
Garschin
Damaschke
Defoe
Hebbel
Baudelaire
Descartes
Hegel
Kussmaul
Herder
Wolfram von Eschenbach
Schopenhauer
Darwin
Dickens
Rilke
George
Bronner
Melville
Grimm
Jerome
Bebel
Campe
Horváth
Aristoteles
Proust
Voltaire
Federer
Bismarck
Vigny
Barlach
Herodot
Gengenbach
Heine
Storm
Casanova
Tersteegen
Grillparzer
Georgy
Gilm
Chamberlain
Lessing
Langbein
Gryphius
Brentano
Lafontaine
Strachwitz
Claudius
Schiller
Kralik
Iffland
Sokrates
Bellamy
Schilling
Katharina II. von Rußland
Gerstäcker
Raabe
Gibbon
Tschechow
Löns
Hesse
Hoffmann
Gogol
Wilde
Vulpius
Gleim
Luther
Heym
Hofmannsthal
Morgenstern
Klee
Hölty
Goedicke
Roth
Heyse
Klopstock
Kleist
Luxemburg
Puschkin
Homer
Mörike
La Roche
Horaz
Musil
Machiavelli
Kierkegaard
Kraft
Kraus
Navarra
Aurel
Musset
Lamprecht
Kind
Kirchhoff
Hugo
Moltke
Nestroy
Marie de France
Laotse
Ipsen
Liebknecht
Nietzsche
Nansen
Ringelnatz
Marx
Lassalle
Gorki
Klett
Leibniz
von Ossietzky
May
vom Stein
Lawrence
Irving
Petalozzi
Knigge
Platon
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North American Species of Cactus

John Merle Coulter

Imprint

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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 Cactaceae. 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 Cactaceae, 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 mate-

rial, 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 Cactaceae 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 Cactaceae 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.

CACTUS, ANHALONIUM, AND LOPHOPHORA.

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 Linnaeus in his Systema, ed. l (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.

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.

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 Deitr. 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 in-

nermost 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 Fe, 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. zephranthoides (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.