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THE NORTH AMERICAN SPECIES OF CRYPTANTHA.

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THE NORTH AMERICAN SPECIES OF CRYPTANTHA.

The genus *Cryptantha* is a group of annual herbs centering in western America and belonging to the tribe *Eritrichieae* of the family *Boraginaceae*. It has long been recognized as a genus of decided difficulty. This is due both to the variability of its species and to the minute size of the fruiting and floral structures which, as experience has shown, are the only satisfactory basis for precise specific differentiation. In recent years the mass of collected material of this genus has become so large, and the failure of the provisional classification of the earlier authors so patent, that the need of a thorough restudy and reclassification of the group has been increasingly apparent. It is hoped that the present monograph of the North American species will partially meet this obvious need and to some extent bring order out of the chaos that has caused so many botanists to neglect this technical but highly interesting group of West American plants.

Preliminary studies of the North American species of *Cryptantha* were begun by the writer at the University of California in 1920. Intermittently the work has been continued up until the present. During this time many species have been seen in the field and types and critical material have been studied in several of the major herbaria of the United States. The present treatment was prepared at Harvard University and is based upon the material in the Gray Herbarium and the University of California Herbarium, and such other material as has been borrowed during the final critical study of the genus. The mass of material of *Cryptantha* from the herbarium of the University of California has been invaluable, since it is replete with authentic fragments, particularly of the species described by Greene, and since it consists in large part of the critical and extensive accumulations of Mrs. Katherine Brandegee, who was one of the keenest students of the group. The genus having its geographical center in California, the advantages of having available such an extensive and critically assembled representation from that region is apparent, especially so when it is realized that the collection was studied in conjunction with the large general collection, and very numerous types and historical specimens, contained in the Gray Herbarium. In combining the representations of the genus from the two herbaria mentioned over 1500 different specimens were made available for detailed study and comparison during the final review of the genus.

The detailed investigation resulting in this paper was carried on at the Gray Herbarium under the direction of Professor B. L. Robinson who has unstintingly given me of his time and scholarly aid. It is a pleasure here to express my gratitude for his friendly interest and encouragement, and ready aid in matters of perplexing nomenclature and difficult classification. I am also indebted to Professor W. A. Setchell of the University of California, who, in continuation of his many favors, has made it possible for me to restudy in detail the *Cryptantha* material from the University of California Herbarium. For assistance in bibliographic matters relating to this as well as other papers, I wish to express my indebtedness to the late Mary A. Day, Librarian at the Gray Herbarium, and to her successor, Miss Ruth D. Sanderson.

GENERAL DISCUSSION.

History of the Genus.

The generic name *Cryptantha* seemingly first appeared in a seed-list of the Hamburg Botanical Garden published in 1833 by Lehmann,[1] Del. Sem. Hort. Hamb. iv. The next appearance of the name was in a seed-catalogue from the gardens at St. Petersburg published in 1836 by Fischer & Meyer, Ind. Sem. Hort. Petrop. ii. 35. Two Chilean species, *C. glomerata* and *C. microcarpa*, were newly described, but no generic diagnosis was given. The third appearance of the name was in 1837 when these Chilean species appeared under a formal generic diagnosis in George Don's General System of Gardening and Botany, iv. 373. The effective publication of the generic name *Cryptantha*, therefore, dates from Don's General System, since in that work was fulfilled for the first time the requirement of a generic description called for in Art. 38 of the International Rules of Botanical Nomenclature.

The genus *Krynitzkia* was launched in 1841, being fully described in a seed-catalogue from the St. Petersburg gardens published by Fischer & Meyer, Ind. Sem. Hort. Petrop. vii. 52. The genus included a single Californian species, *K. leiocarpa*, transferred from

[1] This publication has not been examined, being apparently unrepresented in North American libraries. As Dr. J. H. Barnhardt has pointed out to me, however, no *Cryptantha* is listed among the six species reported on pages 4 and 5 of the Litteratur-Bericht zur Linnaea für das Jahr 1833 as having been briefly described by Lehmann in the seed-list mentioned, and it seems probable that if the name did appear in 1833, it was merely as a *nomen nudum*. The earliest reference associating the name *Cryptantha* with the Delectus Seminum of 1833 appears to have been that of De Candolle, Prodr. x. 129 (1846).

Echinospermum under which it had been described by the same authors in 1836.

The next important event in the history of the group occurred in 1846 with the appearance of the tenth volume of De Candolle's Prodromus. In this work *Krynitzkia* was kept up, although, except for a few poorly understood species given as doubtful members of *Lithospermum* or *Myosotis*, all species of *Cryptantha* then known were transferred, along with various species of *Plagiobothrys* and *Oreocarya*, to *Eritrichium* § *Cryptantha* (containing only the two original species) and *Eritrichium* § *Rutidocaryum*.

In 1871 Torrey's genus *Piptocalyx* was published by Watson, Bot. King Exped. 240 (1871). It was based upon *Lithospermum circumscissum*, a plant of western United States described by Hooker & Arnott in 1840.

A few years later Gray, Proc. Am. Acad. x. 58–61 (1874), published the results of his first study of the eritrichioid borages of western United States. Following De Candolle he referred all the species of *Cryptantha* to *Eritrichium*, and cited as synonyms of the latter *Plagiobothrys*, *Krynitzkia* and *Piptocalyx*. Gray's presentation of the group in the Synoptical Flora, ii. pt. 1, 193–197, in 1878 is essentially that of his paper in 1874.

In the year 1876 Bentham & Hooker published that part of their Genera Plantarum, ii. 850–851, treating the *Boraginaceae*. These authors, accepting the work of De Candolle and Gray, added still more diverse elements to the already overburdened genus *Eritrichium*. The species of *Cryptantha* were placed under that genus and considered generically indistinguishable from plants now classified under *Oreocarya*, *Plagiobothrys*, *Amblynotus*, *Megastoma*, *Anoplocaryum*, *Trigonotis* and *Eritrichium*.

The genus *Eritrichium* thus became so unwieldy and so obviously heterogeneous that its break-up was inevitable. The reaction began with Gray's notable paper in 1885, Proc. Am. Acad. xx. 257–286, in which the species of *Cryptantha* and *Piptocalyx* were placed under *Krynitzkia* along with species now referred to *Amblynotus*, *Oreocarya*, *Antiphytum* and *Plagiobothrys* § *Allocarya*. This treatment was repeated in the supplement of the second edition of the Synoptical Flora, ii. pt. 1, 423–430 (1886), published shortly before his death in 1888.

In a series of three papers published in 1887 by Greene, Pittonia i. 8–23, 55–60 and 107–120, the American representatives of De Candolle's overburdened *Eritrichium* were segregated in detail. First the

genus *Allocarya* was formed to cover the species Gray had treated as *Krynitzkia* § *Myosotidea*. Then *Piptocalyx* was resurrected, and two new genera, *Eremocarya* and *Oreocarya*, were founded, the first based upon the plant of southwestern United States described as *Eritrichium micranthum* by Torrey in 1859, and the second upon *Eritrichium* § *Pseudokrynitzkia* and part of *Krynitzkia* § *Pterygium* described by Gray in 1885. *Amblynotus* and *Antiphytum*, although not mentioned, were apparently also considered distinct from *Krynitzkia*. *Krynitzkia* having been finally trimmed to evident homogeneity, Greene, commenting cynically on Gray's reasons for accepting *Krynitzkia*, discarded the name and took up the earlier *Cryptantha*.

In 1899 *Piptocalyx* Torr. having been found to be a homonym of the valid name of an Australian monimiaceous shrub published in 1870, the substitute generic name *Greeneocharis* was published by Gürke & Harms. In 1906 Grant, Bull. So. Calif. Acad. Sci. v. 28, proposed the name *Wheelerella* as a substitute for *Greeneocharis*, since the latter name was said to have not met with Greene's approval. In 1923 both *Eremocarya* and *Piptocalyx* were reduced to *Cryptantha* by Johnston, Contr. Gray Herb. n. s. lxviii. 55–57.

The genus *Johnstonella* Brand, Fedde Repert. 1925 (as learned from proof sheets) is based upon *Eritrichium racemosum*, a Californian plant described by Watson in 1882.

In the present paper *Cryptantha* is taken as including *Krynitzkia*, *Piptocalyx*, *Eremocarya* and *Johnstonella*.

Gross Morphology.

Roots. All the North American species of *Cryptantha* are clearly annual. In most of the species the root is a slender herbaceous taproot obviously of short duration. In *C. racemosa* and *C. holoptera*, however, the taproot frequently becomes lignified to such a degree that the species have been repeatedly described as perennial. Nevertheless field observation has shown that these species are also annual. Professor E. C. Jeffrey has obligingly sectioned and examined material showing the maximum wood-development in *C. racemosa*. No growth-rings were discernable in a woody root about 9 mm. thick or in a section of stem nearly 5 mm. thick. Since the species grows in a desert area which is subjected to a sharply defined rainy and dry season it is more than probable that the plant is indeed annual, since even in such circumstances it lacks annual-rings though these are produced in such associated desert shrubs as *Ephedra*, etc.

A purple dye is secreted in the roots of some species, particularly so in *C. micrantha*. According to Norton, Rep. Mo. Bot. Gard. ix. 149 (1898), this is alkannin, a dye secreted by species belonging to various genera of the *Boraginaceae*. The presence of conspicuous amounts of alkannin in the roots of *C. micrantha* has been stressed as one reason for giving that species generic recognition (as *Eremocarya*). However, very noticeable amounts of alkannin are frequently produced in the roots of *C. Fendleri*, *C. Grayi*, *C. muricata*, *C. maritima*, etc., although this fact seems to have been generally overlooked. In most species there is scarcely any evidence of the production of this dye.

STEMS. The stems are usually slender and herbaceous, not infrequently somewhat fistulose. In *C. racemosa* the basal portion of the stem frequently becomes decidedly woody and almost 8 mm. thick. In this species, as well as in a number of others, the bark is frequently exfoliated in age. The common form of branching in the species of this genus is sparse, loose and ascending. Frequently, however, the branching becomes diffuse. Occasionally it is widely spreading, the branches becoming even subprostrate. Although the very lowermost branches are not uncommonly opposite, the middle and upper ones are more or less dichotomous. The dichotomy in *Cryptantha* varies much in the definiteness to which it is developed, although present in some degree in all the species. Strange to say, dichotomy has been considered a characteristic of *C. circumscissa* and *C. micrantha* and as characters of the segregate genera, *Greeneocharis* and *Eremocarya*. The dichotomy of these species differs from that of indubitable members of *Cryptantha* neither in degree nor in nature. The ascendingly branched habit, rather characteristic of the genus, is absent in the common forms of *C. Fendleri* and *C. foliosa*, in which the stem is stiffly erect and forms a conspicuous axis.

LEAVES. The leaves are narrow and elongate, becoming linear, lanceolate or oblanceolate, and having acute to obtuse or very rarely retuse apices. Though commonly sessile the lowermost leaves are sometimes more or less narrowed into a petiole. The texture of the foliage is usually firm. The several basal pairs of leaves are unmistakably opposite with more or less short, sheathing, connate bases. Opposite lower leaves are produced by all the North American species of the genus, being obvious in the seedlings, although tending to be obscure in the mature plants. Despite this fact, *Cryptantha* has been repeatedly described as having consistently alternate leaves. Opposite leaves frequently persist in fruiting plants of *C. affinis*, *C. ros-*

tellata, etc. In some species, such as *C. maritima* and *C. circumscissa*, the leaves, especially the basal portion, become tessellated through the silicification of the epidermal cells. Usually, however, the leaves are at most somewhat abundantly pustulate.

TRICHOMES. The trichomes of *Cryptantha* are all simple, unicellular, and more or less siliceous. They differ in no striking way from the type of appendages occuring in most genera of the *Boraginaceae*, cf. Solereder, Syst. Anat. Dicot. ed. 2, i. 555–560 (1908). The siliceous hairs are either smooth and somewhat transparent, or are more or less roughened by encrustations and somewhat opaque. They are clear or more or less tawny in most species, but in *C. flaccida*, *C. simulans*, etc., they are noticeably pallid. Commonly the hairs are straight, but decidedly falcate and uncinate ones are developed on the calyx-lobes of *C. flaccida* and allies. The bristles vary notably in direction, length and rigidity, the common form being a stiff, long, slender one. Since this type of pubescence varies much in stiffness, two degrees of rigidity are distinguished under the names, "hispid" and "hirsute." The very stiff, somewhat pungent extreme, exemplified by the conspicuous hairs produced by typical *C. intermedia*, is termed "hirsute." The less rigid, more slender pubescence developed on the stems of such species as *C. Hendersoni* is termed "hispid." The trichomes are commonly spreading or somewhat appressed. Not infrequently, however, in such species as *C. flaccida*, *C. Clevelandi*, *C. dumetorum*, etc., the hairs are short and very closely strigose. More or less stiffish villous hairs are frequently developed, particularly on the calyx-lobes. This is best shown in *C. crinita* and *C. maritima*, var. *pilosa*. Subvillous hairs are occasionally found on the stems of some species, notably *C. pterocarya*. The bristles on the calyx-lobes are frequently quite stout. Probably the most decided extreme of this development is to be found in *C. foliosa*.

Associated with the bristle-like trichomes on the stem and leaves are the pale blistery structures called pustules. These are composed of a circle of slightly elevated, silicified, opaque, tessellately arranged epidermal cells surrounding the base of the trichome. They show much variety in size and frequency, varying from total absence to decided abundance, and up to a diameter of 1–3 mm. Similar structures are known in many European borage genera, cf. Revedin, N. Giorn. Bot. Ital. ser. 2, ix. 301–318 (1902). According to Solereder, l. c., the pustulate trichome-bases are cystolith-like in origin.

INFLORESCENCE. The flowers of *Cryptantha* are borne in two ranks in unilateral cymosely arranged spikes or racemes. Although funda-

mentally the spikes or racemes are disposed in a rhipidial cyme, this fact is often obscured by the complete reduction of the internodes within the inflorescence and consequent crowding of the spikes or racemes into fascicles terminating the branches. In species such as *C. micrantha, C. circumscissa, C. albida, C. Grayi, C. micromeres,* etc, the spikes are not at all fascicled, the cymose forking appearing to be indefinitely repeated and ending only at the death of the plant. With other species, of which *C. affinis, C. ambigua, C. echinella, C. mariposae, C. patula,* etc., are examples, the cymose forking is repeated only a very few times, perhaps only once. In all these cases the spikes or racemes are solitary or geminate, and not grouped into fascicles. The cymosely forking stem is terminated at any one time by a pair of spikes or racemes, and bears down its sides the solitary spikes which earlier were terminal. In such species as *C. muricata, C. flaccida, C. intermedia,* etc., by a complete suppression of the internodes separating the spikes, 3–6 of these have been crowded together to form a terminal fascicle. In *C. micrantha* scattered internodes are suppressed, this being shown by the opposite or subopposite bracts sprinkled through the inflorescence.

The racemes or spikes are loosely or somewhat densely flowered in age, but in *C. glomeriflora, C. leiocarpa, C. Torreyana* and *C. simulans* the flowers are frequently glomerate-congested. Most of the species have the spikes or racemes bractless or at most with 1 or 2 bracts occasionally subtending the lowermost flowers. In *C. albida, C. maritima, C. minima, C. micrantha, C. circumscissa,* etc., the spikes are leafy-bracted throughout or nearly so. Some forms exemplified by *C. ambigua, C. mariposae, C. crassisepala,* etc., have the peduncles of the spikes or racemes leafy, whereas others, such as *C. intermedia, C. pterocarya, C. microstachys,* etc., have even these naked. The rhachis of the spike is terete in all species except *C. dumetorum,* in which it is decidedly compressed and rather fragile.

Corolla. The corolla is white, and subtubular or more commonly short rotate-salverform. It may be very minute and inconspicuous, or become conspicuous and as much as 7 mm. broad. The tube always about equals the calyx-lobes and bears below the middle 5 stamens, the filaments of which about equal the length of the short-oblong included anthers. The throat is poorly developed, producing at the base 5 small intruded hemispherical or subtrapeziform appendages that occasionally almost close it. The lobes are variously developed, being either ovate-oblong or suborbicular, and either widely spreading or more or less strictly ascending. In the North American

species there are no cleistogamous flowers such as those developed in several groups of Chilean species.

Calyx. The calyx is usually much accrescent in fruit, *C. micromeres* being the species in which this is least so. Since the accrescent fruiting calyx is the most modified, in addition to being the most conspicuous, it alone is considered. Commonly it is divided to near the base, although in species such as *C. pusilla*, *C. sparsiflora* and *C. glomeriflora* it is less deeply so. In *C. circumscissa*, however, the calyx is obviously united to near the middle and in addition is unique in the genus in being circumscissile just below the sinuses. The fruiting calyx commonly shows more or less evident tendency towards irregularity or asymmetry. The mature calyces of such species as *C. albida*, *C. oxygona*, *C. pterocarya*, *C. holoptera*, *C. pusilla*, *C. micrantha*, etc., are regular or subregular. On the other hand the fruiting calyces of *C. dumetorum*, *C. flaccida*, *C. recurvata*, *C. echinosepala*, etc., are obviously asymmetrical. Commonly the irregularity is manifest in the slightly greater length and more conspicuous pubescence of the abaxial calyx-lobe. Less commonly, however, as in *C. recurvata* and *C. echinosepala*, it is the axial calyx-lobe that is the longest and most hispid or hirsute. Because it commonly very closely invests the nutlets, the mature calyx frequently becomes somewhat asymmetrical in consequence of the irregularities in shape or abortion of the nutlets. *Cryptantha dumetorum* has the calyx axially and downwardly gibbous, *C. affinis* has it compressed, *C. recurvata* has it obviously curved, and such species as *C. utahensis* or *C. flaccida* have it oblique or distorted. The base of the mature calyx may be rounded, conical or more or less angulate, and may be regular or oblique or evidently asymmetrical. In texture it is usually somewhat firmly herbaceous with the epidermis tending to become silicified. The calyces of *C. circumscissa* exhibit the extreme of this tendency towards silicification. The lobes of the mature calyces vary from narrowly ovate through lanceolate to linear. Though occasionally erect, they are commonly somewhat connivent above and have their tips spreading or even recurved. In pubescence the fruiting calyx shows various tendencies. The midrib, which is weakly developed in such species as *C. pterocarya*, *C. pusilla*, *C. circumscissa*, etc., and very strongly so in *C. crassisepala*, *C. intermedia*, etc., is commonly armed with evident bristles which vary in length, direction, slenderness and rigidity. The fructiferous calyx is usually ascending, but may be strictly and closely appressed to the rhachis as in *C. dumetorum*, *C. flaccida*, *C. microstachys*, etc., or spreading or deflexed as in *C. recurvata* or *C. echinosepala*.

The pedicel of the completely developed calyx is commonly very short or almost undeveloped. Although pedicels are lacking or practically absent in most species, evident and well developed ones are produced by *C. racemosa*, *C. holoptera* and *C. crinita*. Since the pedicels are clearly developed only in these three species they alone, in the present monograph, as treated as having "racemes." The remaining species, which have sessile calyces or very obscure pedicels, have been uniformly accredited with "spikes" although the unit of the inflorescence in some of the species might be more exactly described as "spicate-racemose" or "racemose-spicate." The preponderance of species have deciduous calyces. As already mentioned *C. circumscissa* has a circumscissile calyx. In this the lower cup-like portion is firmly attached and clearly persistent. Persistent calyces also occur in *C. micrantha* and *C. dumetorum*, and subpersistent ones are produced by *C. albida* and *C. racemosa*.

FRUIT.[1] The fruit of *Cryptantha* consists of 4 or fewer, elongate, ventrally grooved nutlets affixed to a usually elongate central gynobase. Most of the species have 4 ovules, but in *C. recurvata* and *C. maritima* only 2 are normally present. *Cryptantha maritima*, however, has an insular variety that is distinguished only by having 4 rather than 2 ovules. In shape the nutlets vary from broadly ovate or triangular-ovate to narrowly lanceolate. The back may be somewhat flattened, but is commonly more or less convex, although in *C. muricata* it is obtusish with a suggestion of a medial dorsal ridge. The sides of the nutlets in most species are clearly rounded or somewhat obtusely angled, but they may be quite acutely angled as in *C. mohavensis*, *C. angustifolia*, etc. In species like *C. utahensis*, *C. costata*, *C. racemosa*, etc., the margin is drawn out into a very narrow, thin, knife-like border. In other species the margin is greatly developed, wing-like, and about the width of the body of the nutlet. *Cryptantha holoptera* and *C. pterocarya* produce nutlets of this sort. In *C. pusilla* and frequently in *C. muricata*, the edges of the nutlets are thickened to form a bead-like margin. The surface of the nutlet may be smooth and shiny as in *C. Torreyana*, *C. leiocarpa*, *C. Fendleri*, etc., or may be variously roughened. In species such as *C. ambigua*, *C. simulans* and *C. Hendersoni* the roughenings consist of small, low, rounded bosses, a condition here described as tuberculate. Other species may have the nutlets studded with conical warts and thus become muricate, or with rather elongate nipple-like warts rendering

[1]The nutlets as well as all other minute structures have been consistently studied through a binocular dissecting microscope magnifying 38 diameters.

the surface papillate. Other species such as *C. muricata, C. intermedia, C. barbigera,* etc., have the surface of the nutlets verrucose, i. e. sprinkled with coarse simple warts. Species such as *C. crassisepala, C. echinella* and forms of *C. Hendersoni* have the nutlets covered with spinular papillae. On the roughened as well as the smooth nutlets the surface is frequently more or less covered with minute, white discules. Such nutlets have been traditionally but not very precisely described as granulate.

Although 4 ovules are commonly produced, one or more of them may fail to mature. Some species, it is true, characteristically mature 4 nutlets, but even in these one or more may be aborted. This abortion may prevail throughout the plant or be restricted largely to either its younger or older parts. This suggests that abortions may be partially connected with the nutrition of the plant as influenced by seasonal conditions. In other species, such as *C. flaccida, C. microstachys, C. texana,* etc., only a single nutlet is matured under normal conditions. This is either the axial or the abaxial one, its position being commonly characteristic of the species. In still other species, such as *C. Clevelandi* or *C. hispidissima,* the number of nutlets developed does not seem to be constant, 1–4 being matured, although, according to the species, the axial or abaxial nutlet is always developed. This tendency to individualize a particular one of the 4 nutlets seems to be more or less evident in all the species. It has been carried out in a conspicuous extreme in *C. crassisepala, C. maritima, C. dumetorum, C. micromeres,* etc., in which one nutlet is more firmly attached, larger than the others and often differently colored or roughened. In some species with homomorphous nutlets, such as *C. albida,* this tendency is revealed only by the greater persistence of some particular nutlet. A few species do not seem to show the tendency described. In *C. mohavensis* and *C. Watsoni* they seem to be almost perfectly homomorphous. In the specific group containing *C. ambigua* there appears to be no prevailing tendency towards individualizing a particular nutlet. In this respect the specific group is unique. The natural classification offered in this monograph is largely formed of groupings of species agreeing in the position (axial or abaxial) of the individualized or odd nutlet. Strange to say, it has been the current impression that heteromorphous nutlets were restricted to the specific group containing *C. crassisepala,* although, in fact, the condition is well developed in another specific groups, and, as already stated, its presence in the *C. crassisepala*-group is notable only because it has there an extreme expression.

The ventral groove of the nutlet may be open or closed (not fused) and may be simple or forked below. Some species, such as *C. Torreyana*, have the groove almost invariably closed, others, such as *C. Fendleri*, have it characteristically open, while still other species, such as *C. intermedia*, may have it open or closed. In *C. albida* the groove is very broadly dilated and becomes excavated. A similar condition is present in the consimilar nutlets of *C. crassisepala* and *C. minima*. The groove of *C. costata* is open, but is extremely shallow. In *C. flaccida* the groove is not only closed, but frequently has one margin overlapping the other. The groove of *C. leiocarpa* is closed and not forked or is very obscurely so at the very base. In *C. ambigua*, *C. Torreyana*, etc., it is very broadly forked below. In most species there is a small open areola formed at the forking. The groove on the more or less asymmetrical nutlets of *C. affinis* and *C. glomeriflora* is evidently excentric and dilated below into an irregular triangular areola.

The gynobase varies from quadrangular-subulate to narrowly pyramidal or very shortly columnar. Usually it is subulate as in *C. intermedia*, *C. leiocarpa*, *C. Fendleri*, *C. pterocarya*, etc. The narrowly pyramidal form is produced by *C. albida*, *C. pusilla*, etc. In species such as *C. texana*, *C. glomeriflora*, *C. microstachys*, the gynobase is reduced to an inconspicuous, exceptionally short column. It commonly reaches to about ⅔ the height of the nutlets, though frequently in such species as *C. Grayi*, *C. costata*, *C. holoptera*, etc., it reaches to the summit of the nutlets, or in species such as *C. glomeriflora* and *C. microstachys* only to about ¼ the height of the latter. Commonly the style is sharply differentiated from the gynobase. In *C. micrantha*, however, the style is not clearly set off and appears to be the subulate prolongation of the gynobase. In the length of the style and the height to which it reaches on the nutlets, the species noticeably vary. Generally the style reaches to $^{2}/_{3}$–$^{4}/_{5}$ the height of the nutlets, but it may just reach the tips of the nutlets or even surpass them. In species such as *C. glomeriflora* and *C. flaccida* the style reaches less than $^{1}/_{3}$ the height of the nutlets.

Abnormalities. In Southern California and less commonly in the deserts of Nevada and Utah, the plants of *Cryptantha* frequently become fasciated. All or only some of the stems are affected. The abnormal stems are short and for the most part unevenly reddish-tinged, and are clothed with strictly ascending, scarcely reduced leaves. The spikes are usually undeveloped, or are partially developed and form a glomerate infertile mass above. The affected plant as a

whole is very dense and broom-like. Although clearly abnormal the cause of this condition has not been ascertained. *Cryptantha* has been reported as host for *Puccinia ryptanthes* Diet. & Holw., *P. submitens* Diet. and *Synchitrium myosotidis* Kühn., but none of these fungi causes such abnormal growth. A microscopic examination has failed to disclose any other fungi affecting the plant, nor any mites, aphids or similar parasites capable of profoundly disturbing it. The condition described has been noted in *C. intermedia*, *C. barbigera*, *C. simulans*, *C. angustifolia*, *C. gracilis*, and *C. pterocarya*, although it appears to be most common in the species first mentioned.

Systematic Position of the Tribe Eritrichieae.

Cryptantha is obviously a member of the *Eritrichieae* and appears to have been derived from the closely related, and also West American genus, *Oreocarya*. It is believed that this genus was evolved from the *Lithospermeae* through some forms similar to the North American species of *Antiphytum*. These opinions assume the correctness of the arrangement of the tribes of the *Boraginaceae* given in a recent paper by Johnston, Contr. Gray Herb. n. s. lxxiii. 42 (1924). Since the assumption there expressed, that the *Cynoglosseae* are derived from the *Lithospermeae*, is directly contrary to that accepted in standard works, it seems well to state the reasons for this belief so that the direction of evolution may be understood and phylogenetic speculations regarding *Cryptantha* logically founded.

Brand, Pflanzenr. iv. Fam. 252, pt. 1, 14 (1921), agreeing with previous authors, considers the *Cynoglosseae* among the *Boraginoideae* to be most nearly related to the *Heliotropioideae*, saying "Der endständige Griffel, das Charakteristikum der *Cordioideae*, *Ehretioideae* und *Heliotropioideae* findet sich bei den *Borraginoideae* in 2 Gattungen, *Trichodesma* und *Lacaitaea*, wenigstens zur Blütezeit. Diese beiden Gattungen müssen daher an der Spitze der *Cynoglosseae* stehen, ..." However, *Trichodesma* and *Lacaitaea* clearly have pyramidal gynobases, their appendaged nutlets are attached supramedially and have free bases. These developments represent considerable departure from the *Heliotropioideae* and very much greater departure than the common developments produced by the *Lithospermeae*. This may be appreciated after consideration of the following data.

The *Boraginaceae* appear to have sprung from ancestors with two, (at least) biovulate carpels. This is suggested by the occurrence in many of the shrubby genera of the *Heliotropioideae* and *Ehretioideae*

of fruit which is 2-celled, is more or less incompletely 4-celled, or has decidedly paired carpels, cf. Miers, Contr. Bot. ii. 190–261 (1869), and further suggested by stages in the development of the fruit in various members of the family, cf. Baill. Adansonia iii. 1–7, t. 1 (1862); Rosanoff, Jahrb. Wiss. Bot. v. 72–80, t. 5–6 (1866) and Payer, Organ. Vég. 546–549, t. 112 (1857). At an early stage in the development medial partitions form which divide each of the two carpels so that at maturity the fruit becomes virtually 4-carpellate.

The primitive fruit was probably similar to that of the *Hydrophyllaceae*, being 2- or imperfectly 4-celled, capsular, and terminated by a lobed style. The lobed style consistently occurs in those tribes of the *Boraginaceae* which are commonly considered primitive, i. e. the *Heliotropioideae*, *Ehretioideae* and *Cordioideae*. Within the *Boraginoideae* the style is lobed or bears geminate stigmas only in the *Lithospermeae*. Within in the subfamily it is borne on a flat receptacle or more commonly on an elevated gynobase. In the more primitive subfamilies the style is seated in the pericarp, usually at the tip of the more or less globular, 2–4-celled fruit. There is no thickened, persistent gynobasic column connecting the style directly with the receptacle, the style being seated in pericarpial tissue and falling away with some one of the carpels when the fruit breaks up. This condition prevails in the *Heliotropioideae* and *Ehretioideae*, and is completely and fundamentally different from that in the *Cynoglosseae* and in *Trichodesma* or *Lacaitaea* in particular.

The nutlets have resulted from a pinching in of the pericarpial walls to form lobes of the fruit each containing one carpel. The stages of this development may be appreciated by a comparative study of the fruit of *Heliotropium* or, better still, *Coldenia*. *Coldenia canescens*, T. & G. Pacif. R. R. Rep. ii. pt. 2, 169, t. 7 (1856), has an unlobed fruit bearing a decidedly terminal style. *Coldenia Nuttallii*, Torr. Bot. Wilkes Exped. 410, t. 12 (1874), or *C. hirsutissima*, T. & G. l. c. 170, t. 9, has the lobing evident and the style attached to the pericarp between and below the apices of the nutlets. In *C. litoralis* the lobing is almost complete and the style is affixed practically upon the receptacle. From a study of this, and similar series, it seems clear that the development of the nutlets has proceeded by the deepening downward from the apex, and inward from the sides, of the pinching in of the pericarp between the carpels. This finally results in an obviously basal attachment of the nutlets, and the gradual lowering of the style-base between the nutlets until it is at last directly and firmly affixed upon the receptacle. The gynobase appears to be sub-

sequently developed, either by the thickening of the style-base, or by the pushing up of the central portion of the receptacle.

It seems clear that the *Cynoglosseae* are not the primitive members of the subfamily *Boraginoideae*, for the nutlets are not attached basally, but apically or subapically, and, except in such anomalous genera as *Harpagonella*, *Antiotrema* and *Bothriospermum* in which the nutlets are completely inverted and attached by the (morphological) tip to a flattened gynobase, the gynobase is obviously developed. A study of the stages in the history of nutlet-development in the *Heliotropioideae* and *Ehretioideae* is conclusive in showing that the base of the fruit-lobe, in these unspecialized groups, is never free when the apex is not, although the contrary condition is of common occurrence. The nutlets being basally attached and the gynobase commonly flat in the *Lithospermeae* it seems quite obvious that the group is indeed the most primitive one of the *Boraginoideae* and hence closest to the *Heliotropioideae*. Significant in this regard, is the fact that the heliotropioid stigma is suggested in certain species of *Lithospermum*. The stigma in this genus occasionally becomes somewhat lateral with the style-branches prolonged beyond them. Rarely the lobes become more or less fused and the stigmas, brought near one another, tend to cohere just as illustrated by Reichenbach, Icon. Fl. Germ. xviii. t. 113 (1858). The result is a stigma differing in no profound way from that characteristic of the *Heliotropioideae*. The primitive subfamilies being prevailingly woody it is also significant that within the *Boraginoideae* the most decided tendency towards woodiness is found in the *Lithospermeae*.

Not only do the *Cynoglosseae* lack certain features suggesting close relationship in the *Heliotropioideae*, but they have developments which make such an affinity seem improbable. As previously mentioned, the style is gynobasic and though appearing to be terminal in *Trichodesma* is not really so. A careful examination of *Trichodesma* shows clearly that the style is not attached at the apex of the fruit and seated in pericarpial tissue, as in *Heliotropium* for example, but is definitely borne at the apex of a well developed gynobase. The nutlets are covered with highly specialized appendages which suggest nothing in the *Heliotropioideae* or *Ehretioideae*, although the development of these appendages can be traced back into the immediately related tribe *Eritrichieae*, from which the *Cynoglosseae* seem in fact to have evolved. The apical nutlet-attachment of the *Cynoglosseae* is wholly unlike any development in the less specialized subfamilies, but is obviously the termination of a strong tendency towards

elevation of the nutlet-attachment which is discernable in the *Lithospermeae* and quite evident in the *Eritrichieae*.

The *Lithospermeae* being thus considered the most primitive tribe of the *Boraginoideae* because of its basifixed unappendaged nutlets, non-gynobasic usually lobed style or double stigmas, unspecialized corollas, and frequent development of woody habit, it now becomes a relatively simple matter to place the tribe *Eritrichieae*. The *Lithospermeae* appear to have evolved from some primitive member of the *Heliotropioideae* or specialized member of the *Ehretioideae*. The tribe appears to have given rise to two principal evolutionary lines. On one hand to the relatively unimportant line represented by the *Anchuseae*, in which the nutlet-attachment has tended to become conspicuously margined and the attachment-surface on the nutlet tended to become elevated into a strophiolate plug. On the other hand it has evolved into a major line of development which ends in the *Cynoglosseae*, the most specialized group in the entire family. This latter evolutionary line is characterized by a tendency of the nutlet-attachment to move from the chalaza-end of the nutlet towards the radicle-end, i. e. from base to apex, and for the nutlets to vary from rounded and smoothish towards margined and variously roughened and appendaged. The *Eritrichieae* form a rather arbitrary group including the medium developments on the latter line. The tribe is usually regarded as including the genera in which the nutlet-attachment is typically lateral. The nutlets may be smooth or roughened or appendaged, margined or unmargined. The other characters indicative of the *Eritrichieae* have been already outlined in another paper, Contr. Gray Herb. n. s. lxxiii. 57 (1924), and need not be repeated here.

Generic Relations.

As previously stated, *Cryptantha* is obviously a member of the tribe *Eritrichieae* and is apparently derived from the very closely related genus *Oreocarya*. Among their immediate relatives, *Oreocarya* and *Cryptantha* are together characterized by the possession of a medial ventral groove on the nutlets, this formed by the non-fusion of the pericarpial walls. This development appears to have been brought about by the gradual encroachment of the pericarp over the surface of a sharply cut triangular attachment-scar such as those present in the *Lithospermeae*. This encroachment gradually narrows the attachment-surface of the nutlet and forms a groove which is usually somewhat forked at the base. In *Cryptantha* and *Oreocarya* the groove

is narrow, but not completely closed. In *Amsinckia, Plagiobothrys,* etc., the forked groove is entirely shut and its location is marked by a ridge of fused, pericarpial tissue which bears the caruncular scar, or small modified areola at the forking below the middle of the nutlet.

It seems quite likely that *Oreocarya* has been derived from some form of *Antiphytum*, a genus of the *Lithospermeae* evidently derived from *Lithospermum*. Such a species as *A. peninsulare* not only has a habit suggestive of *Or ocarya* and related genera, but has nutlets, which, except in the nature of the attachment, are remarkably like those of some species of *Oreocarya* and *Plagiobothrys*. Its rather large attachment surface is lateral and submedial, but is otherwise like the attachment-surface of most *Lithospermeae*. The encroachment of the pericarp over the scar of *A. peninsulare* would result in a nutlet remarkably like that of *Oreocarya* or *Plagiobothrys;* the particular similarity depending on the extent to which the encroachment proceeded. It is to be noted, however, that *Antiphytum* has a style bearing geminate stigmas, whereas *Oreocarya, Plagiobothrys, Cryptantha,* etc., all have solitary stigmas. Inasmuch as the stigmas of *Antiphytum* are less obvious than are those of *Lithospermum*, its progenitor, it is not hard to suppose that this tendency was carried to an extreme and the geminate stigmas became coalescent in the progenitor of *Oreocarya*.

Cryptantha is a specialized off-shoot from *Oreocarya*. The latter genus consists of rather coarse perennials, or rarely biennials, with persistent fructiferous calyces and homomorphous nutlets. In *Cryptantha* a successful, annual, herbaceous habit has been evolved, in addition to more or less deciduous fruiting calyces and somewhat heteromorphous nutlets. By taking on the annual habit, and developing detachable somewhat bur-like fruiting calyces, *Cryptantha* has been able to reproduce, spread and evolve very rapidly, adapting itself to the variety of conditions in western America and greatly surpassing *Oreocarya* both in number and in the variability of its species.

Oreocarya seems to have also given rise to *Plagiobothrys*, a group which seems to have evolved into *Amsinckia*, and into a line producing *Microula, Craniospermum*, etc. The principal derivative of *Oreocarya,* however, appears to be *Hackelia,* for through that genus *Oreocarya* appears to connect with *Cynoglossum* and the tribe *Cynoglosseae*.

While the medial ventral groove on the nutlets of *Oreocarya* and *Cryptantha* characterize these genera among their immediate relatives, the development is by no means peculiar to them. It is present in *Microcaryum, Amblynotus* and *Megastoma,* and slightly developed in *Oreogenia* and *Chionocharis*. *Microcaryum, Oreogenia* and *Chiono-*

charis appear to be Asiatic developments from the plexus containing *Plagiobothrys*. The immediate relations of *Amblynotus* are wholly obscure. *Megastoma*, although remarkably simulating *Cryptantha*, cf. Bonnet & Barratte, Ill. Phaner. Tunis t. 11 (1895), and having been accepted as a close relative of the genus by all authors including the writer, Contr. Gray Herb. n. s. lxxiii. 64 (1924), appears in fact to be of the *Lithospermeae* and to be most closely related to *Echiochilon*. The detailed study of specimens, recently at hand, shows the stigma to be decidedly geminate, and the yellowish unappendaged corollas to be slightly irregular and to bear the stamens at slightly unequal heights. *Megastoma* is immediately related to *Echiochilon*, agreeing with it in its irregular calyx and corolla, but differs from it in its broadly grooved nutlets, large gynobase, glabrous and much less irregular corolla and almost equally inserted stamens. *Echiochilon* is practically an African genus, and the affinities just mentioned with *Megastoma*, a plant of the deserts of Algeria and Tunis, seem thoroughly satisfactory on phytogeographical grounds, and vastly more so than the supposed relations between *Megastoma* and *Cryptantha*.

Generic Concept.

As here taken the genus *Cryptantha* includes *Krynitzkia*, *Piptocalyx*, *Eremocarya* and *Johnstonella*. Since two of these genera have achieved some currency in botanical literature it seems well to review the claims which these rejected genera have for recognition.

Since the resurrection of *Cryptantha* by Greene in 1887, *Krynitzkia* has been almost universally regarded as a clear synonym of the earlier genus. *Krynitzkia*, in fact, appears to have been deliberately maintained only by Katherine Brandegee and Prof. M. E. Jones. Mrs. Brandegee, I have been told, was not satisfied that the cleistogamous Chilean species, i. e. the true species of *Cryptantha*, were actually congeneric with the more abundant open-flowered species which form the bulk of the genus in South America and the entire representation of it in North America. Being in doubt as to the applicability of the earlier name, *Cryptantha*, she was content to follow Gray in accepting the name *Krynitzkia*, since there could be no uncertainty regarding the applicability of it to the North American plants. Similar reasons, as well as his confidence in Gray's judgment, seem to have given Jones the basis for his persistent use of *Krynitzkia* in the broad interpretation of Gray.

The two original species of *Cryptantha* and several other closely

related ones depart from the common phases of the genus in no striking development other than the presence in the inflorescence of more or less numerous cleistogamous flowers. As these commonly occur variously mixed with open flowers, and since they are borne on plants which in gross habit and inflorescence, as well as in details of fruit and calyx, are quite like the completely normal-flowered plants, there seems to be no reason why we should differ from Reiche, Fl. Chile v. 217–237 (1910), who has studied the Chilean species, and consider the name *Cryptantha* applicable only to the few Chilean species bearing cleistogamous flowers in the inflorescence. Especially is this the case when it is remembered that another and more peculiar phase of cleistogamy, in such species as *C. phaceloides* and *C. linearis*, goes completely unrecognized.

Of the four genera reduced under *Cryptantha*, *Piptocalyx* is the most notable. Under the name *Piptocalyx* or *Greeneocharis* this portion of the genus has gained rather wide generic recognition following its reinstatement by Greene in 1884. Previously, however, it had been usually treated as a section under *Eritrichium* and later under *Krynitzkia*. In 1921 Johnston gave it sectional rank under *Cryptantha*. The outstanding development of *Piptocalyx* is its persistent circumscissile calyx. In flowers, fruiting structures, as well as inflorescence and branching, it differs in no fundamental way from the *Cryptantha* species related to *C. angustifolia*. In fact, its gross habit is such that it was once described as a species of *Cryptantha* by A. Nelson. Greene, in resurrecting the genus, made much of the dichotomy of *Piptocalyx*, although the cymose branching is decidedly similar, if not exactly the same as that developed in *C. Grayi*, *C. angustifolia*, etc. Rather than showing a profound difference, like the fruiting structures, the cymose branching suggests a very close affinity between *Piptocalyx* and *C. micrantha*, *C. Grayi* and *C. angustifolia*. The character of branching failing to separate *Cryptantha* and *Piptocalyx* the latter must, perforce, stand or fall according to the emphasis placed on its peculiar calycine developments. It is to be noted that the possible generic characters of *Piptocalyx*, the circumscissile fission of the calyx and the persistence of the cupulate calyx-base, merely represent phases of a single aberrant structure. For this reason it has been considered unwise to separate the plant from its obviously close affinities in *Cryptantha*. Furthermore, species with circumscissile calyces and those without are universally admitted to the closely related genus *Plagiobothrys*, and in addition the degree to which the calyces are persistent in *Cryptantha* is variable, they being

readily deciduous, or persistent or subpersistent as in *C. albida*, *C. racemosa*, *C. dumetorum*, *C. micrantha*, etc.

Eremocarya, like *Piptocalyx*, has achieved wide recognition since its publication in 1887. Unfortunately it appears to lack characters of generic value. Greene, who launched the genus, laid much emphasis upon its spikes, which were described by him as "biserial and very dense, conspicuously leafy-bracted, and repeatedly forked." Except for the bracts and the complete lack of reduced internodes, the inflorescence and branching of *C. angustifolia* and *C. Grayi* are exactly similar to those of *Eremocarya*. More or less similar biserial, leafy-bracted and repeatedly forked cymes are to be found in such species as *C. circumscissa*, *C. albida*, *C. maritima*, etc. It can be decisively said that *Eremocarya* can not be separated from *Cryptantha* by any character of inflorescence.

The calyx of *Eremocarya* is said to differ from that of *Cryptantha* in its persistence. However, calyces as persistent as those of *Eremocarya* occur in *C. dumetorum*, a species no one has attempted to exclude from *Cryptantha*. The style in *Eremocarya* is scarcely distinguishable from the gynobase proper. This thickened style, appearing as a continuation of the gynobase, much surpasses the nutlets and bears the stigma almost at the level of the tips of the calyx-lobes. Similarly elongate and persistent styles are developed in *C. racemosa*. The thickness of the style, therefore, appears to be the only peculiar character of *Eremocarya*. This is not considered of generic value.

The genus *Johnstonella* is being proposed by Brand to include certain species thought to be generically ambiguous. *Cryptantha racemosa*, the type species, is said to have persistent calyces, thereby exhibiting a salient character of *Oreocarya*. In habit the plant is clearly a *Cryptantha*. It seems to be of particular note only because of its more or less suffrutescent character. In duration, however, it is unquestionably annual. Furthermore it can be definitely said to have deciduous calyces. There are at least twenty collections in the Gray Herbarium and University of California Herbarium which exhibit completely or partially denuded raceme-rhachises. The calyces are no more persistent than are those of *C. holoptera* or *C. albida*, and not so decidedly so as are those of *C. dumetorum*. The genus is clearly synonymous.

Expanding the limits of *Cryptantha* to include the four genera just discussed we dispose of several small or monotypic genera, and obtain a very naturally defined and readily recognized genus. This covers more or less stiffly haired, rather slender annual herbs which agree

in having more or less distinctly biserial spikes or racemes of white flowers and later somewhat irregular deeply lobed hairy calyces, and which develop 1–4 somewhat heteromorphous nutlets that are attached laterally to an erect gynobase through a medial ventral groove. As a group it inhabits sunny open places, in North America ranging from southern Alaska to southern Mexico, although it is most common in western United States, and particularly so in California. It is to be confused only with *Oreocarya* and *Plagiobothrys*. From the former, its closest relation, it differs in its slender annual, rather than coarse biennial or perennial habit, and commonly deciduous, rather than invariably persistent calyces. From *Plagiobothrys* (including *Allocarya* and *Sonnea*) it differs in having the nutlets attached through a ventral groove, rather than through a caruncular scar or along the crest of the ventral keel.

The Species.

Fifty-seven species, two of which are new, are here recognized as occurring in North America. This is approximately half the total number of species, the genus having a similar development in Chile, Argentina and Peru. In North America most of the species occur in California, forty-five being known from that state alone. The genus, however, is not infrequent over most of western United States. One species, *C. Torreyana*, ranges northward to southern Alaska and another, *C. albida*, occurs as far south as southern Mexico. The most easterly ranging species are *C. minima*, which reaches central Nebraska, and *C. texana*, which reaches east-central Texas. Most of the species grow in warm, open, gravelly or sandy places, particularly on the desert, others occur on dry, sunny, open flats in the pine-belt of the mountains and still others grow on open, grassy slopes or in clearings or burns in chaparral. The plants have no conspicuous place in the vegetational succession of the region, being secondary herbs commonly forming vernal or estival colonies in the earlier stages of the succession.

The describers of the oldest species made much of the shape and appendages of the corolla. With the increase of material the relative uniformity of the corolla-structures became apparent, and the attention, after having first been laid on the mere presence or absence of roughenings on the nutlets, was finally focused on the character of the nutlet-groove. Much of the confusion that has obscured the species of this genus is directly traceable to the persistent and ex-

cessive emphasis which has long been laid on this character. The groove of the nutlet shows much more intraspecific variation than has been realized. While decidedly valuable in recognizing certain species, it is after all a character of only secondary importance, and, like every other character in this genus, is subject to decided and frequently erratic variations. It is obvious that the character is only to be used in conjunction with others.

The most important specific characters are certain fruit-developments. Among the most valuable of these are the extent and nature of the individualization of the axial or abaxial nutlet, the number, size, shape and surface of the nutlets, the nature of the nutlet-groove, the shape and height of the gynobase, and the height reached (in relation to the nutlet-length) by the style. The size of the corolla is frequently significant, as is also the size, shape, direction and depth of lobing of the fruiting calyx, and the shape, direction and pubescence of the mature calyx-lobes. The arrangement of the spikes or racemes, as well as the presence or absence of bracts, is important. So also is the character of the pubescence.

The excessive variability of the characters of *Cryptantha* does not seem to have been fully appreciated. Particularly confusing in this genus is its propensity for unexpected, erratic variation in a single character or group of related characters. This is probably due to the fact that the species have a short life-cycle and are in active evolution. As a result the worker in this group is constantly confronted with much aberrant material. It is frequently necessary, therefore, to admit as atypical phases of a given species many specimens whose mass of characteristics indicate the accepted relation, even though the atypical character be a favorite one and perhaps that emphasized in the key. To attempt to name these atypical forms seems thoroughly unwise, since they are endless, and commonly represent odd plants or extremely localized phases, or, as seems likely, intraspecific hybrids.

Some of the species admitted completely intergrade. In most cases these species occupy adjacent floral districts, and the intergradation is confined to a definite region lying between them, being thus in all probability of hybrid origin. In any case it seems best to maintain certain intergrading groups as specific, since to insist upon absolute non-intergradation as a criterion of specific difference would result in extensive reductions and give a condition as unsatisfactory as would extensive segregation. The groups treated as species, however, can be readily recognized after a little study and appear to be eminently natural, having a characteristic gross aspect and credible ranges.

SYSTEMATIC ACCOUNT.

Generic Characters.

Cryptantha Lehm. Calyx lobed to below middle or more commonly almost to base, accrescent in fruit, usually deciduous; lobes linear to lanceolate or rarely lance-ovate, erect or connivent above in fruit, often slightly unequal; pedicels erect to widely spreading, commonly very poorly developed. Corolla white, minute to evident, regular, glabrous; tube cylindrical, equalling calyx-lobes or surpassed by them; throat saucer-shaped or somewhat funnel-form, more or less closed below with 5 semicircular or subtrapeziform intruded appendages; lobes 5, imbricate, orbicular to obovate-oblong, spreading or occasionally somewhat erect. Stamens 5, included; filaments short, equally inserted below the middle of the corolla-tube; anthers short-oblong, about as long as the filaments. Ovules 4 or rarely 2, amphitropous. Nutlets 1–4, straight, usually vertical, ovate to lanceolate, affixed laterally through an elongate medial ventral groove to a pyramidal or subulate erect gynobase, unmargined or with more or less well developed marginal wing, smooth or somewhat warted or spiculiferous, neither rugose nor keeled, usually deciduous, tending to be heteromorphous. Seeds ascending, vertical, chalaza-end lowermost. Cotyledons flat, broad, undivided. Style included in the corolla-tube at anthesis, surpassing the tips of the mature nutlets or greatly surpassed by them, bearing a distinctly solitary simple terminal stigma.—West American annual herbs with stiffish pubescence. Leaves linear to lanceolate or spatulate, elongate, several lower pairs always opposite, the upper ones alternate. Flowers in bracted or naked fasciculate or cymosely disposed spikes or racemes.

Bibliography of the Group and its chief Subdivisions.

Cryptantha Lehm. Del. Sem. Hort. Hamb. iv. (1833); F. & M. Ind. Sem. Hort. Petrop. ii. 35 (1836); Ann. Sci. Nat. ser. 2, v. 297 (1836); Linnaea xi., Lit. 103 (1837); G. Don, Gen. Syst. iv. 373 (1837); Greene, Pittonia i. 110–120 (1887); Baill. Hist. Pl. x. 373 (1891); Coville, Contr. U. S. Nat. Herb. iv. 164–166 (1893); Greene, Bot. San Francisco Bay Reg. 261–262 (1894); Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 110 (1893); Rydb. [Fl. Mont.] Mem. N. Y. Bot. Garden i. 330–332 (1900); Howell, Fl. N. W. Amer. 486–489 (1901); Jepson, Fl. W. Mid. Calif. ed 1, 444–446 (1901); ibid. ed. 2, 346–348 (1911); Piper, [Fl. Wash.] Contr. U. S. Nat. Herb. xi. 483–485 (1906); Rydb.

Fl. Colo. 289 (1906); Nels. New Man. Bot. Cent. Rocky Mts. 415–416 (1909); Abrams, Fl. Los Angeles ed. 1, 333–335 (1904); ibid. ed. 2, 306–308 (1917); Hall & Hall, Fl. Yosemite 205–206 (1912); Frye & Rigg, Northwest Fl. 327–328 (1912); Piper & Beattie, Fl. S. E. Wash. 209–210 (1914); Wooton & Standley, [Fl. N. Mex.] Contr. U. S. Nat. Herb. xix. 546–547 (1915); Henry, Fl. So. Brit. Columbia 255 (1915); Rydb. Fl. Rocky Mts. 725–729 (1917); Millsp. & Nutt. [Fl. S. Catalina Isl.] Pub. Field Mus. Nat. Hist., Bot. v. 232–234 (1923); Davidson & Moxley, Fl. So. Calif. 305–306 (1923); Johnston, Contr. Gray Herb. n. s. lxx. 45 (1924); Johnston, Proc. Calif. Acad. Sci. ser. 4, xii. 1143–1148 (1924).

Eritrichium § *Cryptantha* A. DC. Prodr. x. 129 (1846).

Cryptantha § *Eucryptantha* Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a. 110 (1893).

Lappula § *Cryptantha* Post & Kuntze, Lexicon 316 (1904).

Krynitzkia F. & M. Ind. Sem. Hort. Petrop. vii. 52 (1841); Ann. Sci. Nat. ser. 2, xvi. 55 (1841); Linnaea xv., Lit. 116 (1841); Endl. Gen. Pl., Suppl. 2, 59 (1842); Meisn. Gen. ii. 366 (1842?); DC. Prodr. x. 134 (1846); Gray, Proc. Am. Acad. xx. 264–277 (1885) and Synop. Fl. N. Am. ii. pt. 1, Suppl. 423–429 (1886) in part; Greene, Bull. Calif. Acad. Sci. i. 203–208 (1885); Coulter, Man. Bot. Rocky Mts. 260–261 (1885) in part; Coulter, [Fl. W. Texas] Contr. U. S. Nat. Herb. ii. 286–287 (1892).

Eritrichium § *Krynitzkia* Gray, Proc. Am. Acad. x. 58–61 (1874) and Synop. Fl. N. Am. ii. pt. 1, 193–197 (1878) in part.

Krynitzkia § *Eukrynitzkia* Gray, Proc. Am. Acad. xx. 267–275 (1885) and Synop. Fl. N. Am. ii. pt. 1, Suppl. 424–428 (1886).

Eritrichium § *Rutidocaryum* A. DC. Prodr. x. 130–132 (1846) in part.

Eritrichium in part, Benth. & Hook. Gen. Pl. ii. 850 (1876); Wats. Bot. Calif. i. 527–529 (1876); Hemsl. Biol. Cent.-Amer. ii. 378 (1882); Macoun, Cat. Canad. Pl. i. 337 (1883).

Piptocalyx Torr. in Wats. Bot. King Exped. 240 (1871); Torr. Bot. Wilkes Exped. 413, t. 12 (1874); Greene, Pittonia i. 59 (1887); Baill. Hist. Pl. x. 373 (1891); Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 109 (1893); Howell, Fl. N. W. Amer. 483 (1901); Piper, [Fl. Wash.] Contr. U. S. Nat. Herb. xi. 481 (1906); Abrams, Fl. Los Angeles ed. 1, 331 (1904); ibid. ed. 2, 305 (1917); Frye & Rigg, Northwest Fl. 326 (1912); Henry, Fl. So. Brit. Columbia 255 (1915); Davidson & Moxley, Fl. So. Calif. 305 (1923).

Eritrichium § *Piptocalyx* Gray, Proc. Am. Acad. x. 58 (1874).

Krynitzkia § *Piptocalyx* Gray, Proc. Am. Acad. xx. 275 (1885).
Lappula § *Piptocalyx* Post & Kuntze, Lexicon 316 (1904).
Cryptantha § *Piptocalyx* Johnston, Contr. Gray Herb. n. s. lxviii. 55 (1923).

Krynitzkia § *Pterygium* Gray, Proc. Am. Acad. xx. 276 (1885) and Synop. Fl. N. Am. ii. pt. 1, Suppl. 428–429 (1886) in part.
Cryptantha § *Pterygium* Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 110 (1893).
Lappula § *Pterygium* Post & Kuntze, Lexicon 316 (1904).
Eremocarya Greene, Pittonia i. 58 (1887); Baill. Hist. Pl. x. 373 (1891); Gürke in E. & P. Nat. Pflanzenf. iv. Abt. 3a, 109 (1893), Howell, Fl. N. W. Amer. 483 (1901); Abrams, Fl. Los Angeles ed. 1, 331 (1904); ibid. ed. 2, 304 (1917); Frye & Rigg, Northwest Fl. 326 (1912); Wooton & Standley, [Fl. N. Mex.] Contr. U. S. Nat. Herb. xix. 544 (1915); Rydb. Fl. Rocky Mts. 719 (1917); Davidson & Moxley, Fl. So. Calif. 306 (1923); Johnston, Contr. Grav Herb. n. s. lxviii. 56–57 (1923).
Lappula § *Eremocaryum* Post & Kuntze, Lexicon 316 (1904).
Greeneocharis Gürke & Harms in E. & P. Nat. Pflanzenf., Gesamtreg. 462 (1899); Rydb. Fl. Rocky Mts. 718 (1917).
Wheelerella Grant, Bull. So. Calif. Acad. Sci. v. 28 (1906).
Johnstonella Brand in Fedde, Repert. in press.

Artificial Key to Species.

Nutlets with margins decidedly winged or knife-like.
  Pedicels usually evident, slender, 1–4 mm. long.
    Nutlets homomorphous.....1. *C. holoptera.*
    Nutlets decidedly heteromorphous.....2. *C. racemosa.*
  Pedicels obscure or none, less than 1 mm. long.
    Nutlets heteromorphous, the odd nutlet abaxial.
      Fruiting calyx ca. 2 mm. long; nutlets 0.6–0.7 mm. long...3. *C. angelica.*
      Fruiting calyx 2.5–3 mm. long; nutlets ca. 1.7 mm. long.. 4. *C. inaequata.*
    Nutlets homomorphous or if slightly heteromorphous the odd nutlet axial.
      Nutlets lucid, somewhat bent, margin thickish; gynobase narrowly pyramidal.....5. *C. pusilla.*
      Nutlets dullish, straight, margin thin; gynobase subulate.
        Nutlets very obscurely roughened, decidedly plano-convex in cross-section (the back rounded and the face flat).....6. *C. costata.*
        Nutlets tuberculate or muricate, not noticeably plano-convex in cross-section.
          Nutlets solitary or rarely 2; calyx obliquely conical at base.....17. *C. utahensis.*
          Nutlets 4, calyx symmetrical.
            Corolla conspicuous; mature calyx obviously longer than broad.....18. *C. oxygona.*

Corolla inconspicuous; mature calyx usually almost as broad as long. . . . . 19. *C. pterocarya.*
Nutlets with margins rounded or angled, never with marginal wing or knife-like edge.
Nutlets all smooth.
Hairs on calyx uncinate or decidedly arcuate.
Style reaching 1/2–2/3 height of nutlet, this with an open areola. . . . . 53. *C. rostellata*
Style reaching less than 1/2 height of nutlet; groove of nutlet closed.
Nutlets nearly terete, rostrate; hairs on calyx usually encrusted and pale. . . . . 54. *C. flaccida.*
Nutlets decidedly compressed, acute; hairs on calyx smoothish and less pale. . . . . 55. *C. sparsiflora.*
Hairs on calyx straight.
Nutlet with excentric groove.
Nutlets 1; flowers axillary, not biserial. . . . . 57. *C. glomeriflora.*
Nutlets 4; flowers in biserial naked spikes. . . . . 56. *C. affinis.*
Nutlet with a centrally placed groove.
Spikes bracteate.
Style reaching or a little surpassing the nutlet-tips; nutlets ovate, groove usually simple or nearly so. . . . . 46. *C. leiocarpa.*
Style reaching 2/3–3/4 height of nutlets; nutlets oblong-ovate to lanceolate, groove usually broad-forked.
Stems reddish; nutlets 1, axial. . . . . 16. *C. maritima.*
Stems green; nutlets 1–4, abaxial when solitary.
Corolla less than 1 mm. broad; diffuse prostrate plants. . . . . 51. *C. Brandegei.*
Corolla 1.5–2 mm. broad; sparsely branched erect plants. . . . . 52. *C. Abramsii.*
Spikes naked or with a few bracts at base.
Nutlets broadly ovate.
Corolla conspicuous, 4–7 mm. broad; spikes commonly ternate. . . . . 36. *C. Hendersoni.*
Corolla inconspicuous, 1–2 mm. broad; spikes usually solitary or geminate.
Spikes usually geminate; inflorescence projected above the leafy mass of plant, well defined. 38. *C. Torreyana.*
Spikes usually solitary, not sharply differentiated from the leafy peduncular stems.
Nutlets homomorphous; Montana and Colorado westward. . . . . 40. *C. ambigua.*
Nutlets slightly heteromorphous; Colorado and Wyoming. . . . . 20. *C. Pattersoni.*
Nutlets oblong-ovate to lanceolate.
Style reaching 1/4–3/4 height of nutlets, these 1–4.
Calyx densely appressed hispid-villous, commonly lacking conspicuous spreading bristles; desert interior. . . . . 44. *C. gracilis.*
Calyx sparsely hispid-strigose and evidently spreading-hirsute; coastal slopes of California.
Hairs on upper part of calyx-lobes conspicuously retrorse. . . . . 49. *C. nemaclada.*

Hairs on upper part of calyx-lobes spreading or ascending.
Style reaching to 2/3–3/4 height of nutlets.
50. *C. Clevelandi.*
Style reaching to 1/4–1/2 height of nutlets.
48. *C. microstachys.*
Style almost reaching the nutlet-tips or surpassing them.
Margin of nutlets acute, at least above the middle.
Corolla conspicuous; style clearly surpassing nutlets, these 2–2.5 mm. long.....42. *C. mohavensis.*
Corolla inconspicuous; style reaching to the nutlet-tips or a trifle surpassed by them; nutlets 1.2–2 mm. long.....43. *C. Watsoni.*
Margin of nutlets rounded or obtuse.
Groove of nutlet opened below into a triangular areola; plants usually with a definite central axis; not Californian..45. *C. Fendleri.*
Groove of nutlet closed throughout; plants irregularly branched; Californian..47. *C. hispidissima.*
Nutlets all rough or at least some of them so.
Nutlets decidedly heteromorphous.
Mature calyces strongly appressed to the flattened rachis; decidedly gibbous on axial side, persistent....14. *C. dumetorum.*
Mature calyces somewhat spreading, nor at all gibbous.
Fruiting calyces widely spreading or reflexed, most hirsute on axial side.....13. *C. echinosepala.*
Fruiting calyces ascending, most hirsute on abaxial side.
Odd nutlet abaxial, surpassed by style.
Spikes bracteate throughout; calyx persistent. 7. *C. micrantha.*
Spikes naked or nearly so; calyx deciduous.
Pedicels slender, 1–4 mm. long.....2. *C. racemosa.*
Pedicels stout and obscure, less than 1 mm. long.
Nutlets 0.6–0.7 mm. long.....3. *C. angelica.*
Nutlets 1–1.7 mm. long.
Nutlets 1.3–1.7 mm. long; calyx 2–3 mm. long.....4. *C. inaequata.*
Nutlets ca. 1 mm. long; calyx 3–4 mm. long.....8. *C. angustifolia.*
Odd nutlet axial; style surpassed or occasionally reachng to the nutlet-tips.
Nutlets small 0.7–0.9 mm. long, triangular-ovate.
15. *C. micromeres.*
Nutlets larger, 1–2.3 mm. long, ovate to lanceolate.
Odd nutlet smooth and shiny.....16. *C. maritima.*
Odd nutlet tuberculate or papillate.
Spikes bracteate.....23. *C. minima.*
Spikes naked.
Odd nutlet spinular-muricate; calyx-lobes conspicuously thickened.....24. *C. crassisepala.*
Odd nutlet more or less granulate; calyx-lobes moderately thickened.
Nutlets ovate, smoothish or sparsely tuberculate, odd one ca. 1.9 mm. long.....20. *C. Pattersoni.*

Nutlets lanceolate or narrowly ovate, coarsely tuberculate, odd one 2–2.6 mm. long.....22. *C. Kelseyana.*
Nutlets homomorphous or practically so.
Calyx circumscissile.....10. *C. circumscissa.*
Calyx not circumscissile.
Style surpassing the nutlets.
Spikes bracted throughout.
Groove of nutlet broadly dilated to form a triangular areola occupying much of the ventral side of nutlet; gynobase narrowly pyramidal..11. *C. albida.*
Groove of nutlet narrow, scarcely dilated below; gynobase subulate.....7. *C. micrantha.*
Spikes sparingly if at all bracted.
Nutlets bent, lucid; gynobase narrowly pyramidal.....5. *C. pusilla.*
Nutlets straight, usually dull; gynobase subulate.
Nutlets small, 0.5–0.7 mm. long.....9. *C. Grayi.*
Nutlets larger, 1.5–3 mm. long.
Nutlets triangular-ovate, with a suggestion of a medial dorsal ridge; plant dull dark green.....32. *C. muricata.*
Nutlets ovate to lance-ovate; plants canescent.
Spikes solitary.....26. *C. patula.*
Spikes commonly ternate or occasionally geminate or quinate.....28. *C. intermedia.*
Style definitely surpassed by or about reaching to the tips of the nutlets.
Corolla conspicuous, 2–5 mm. broad.
Calyx evidently pedicellate, conspicuously long-villous, not hispid or hirsute.....34. *C. crinita.*
Calyx sessile or subsessile, hirsute or hispid, at most inconspicuously short-villous.
Normally only 1 or 2 nutlets developing; gynobase short or medium-sized.
Nutlets usually horizontal, ovate-triangular, acuminate; calyx-lobes shorter than nutlet, very loosely connivent.....35. *C. excavata.*
Nutlets always erect, ovate-oblong or narrowly ovate; calyx-lobes evidently surpassing nutlets and closely connivent over them.
Abaxial nutlet developing; gynobase reaching 1/3–1/2 height of nutlet.....25. *C. decipiens.*
Axial nutlet developing; gynobase about 2/3 height of nutlet.....17. *C. utahensis.*
Normally all 4 nutlets developing; gynobase elongate, 2/3–3/4 height of nutlets.
Plant low, spreading and widely branched; spikes solitary.....33. *C. mariposae.*
Plant erect and ascendingly branched; spikes geminate or ternate.
Hairs on calyx subinflated, extremely coarse; stem usually stiffly erect and forming a conspicuous axis, branches

usually widely divaricate.....27. *C. foliosa.*
Hairs on calyx slender, not notably coarse; stem irregularly branched.
Calyx-lobes pungent-hirsute; nutlets oblong-ovate, verrucose.....28. *C. intermedia.*
Calyx-lobes densely hispid; nutlets ovate, tuberculate.....36. *C. Hendersoni.*
Corolla inconspicuous, 0.5–2 mm. broad.
Ovules 2, nutlet and calyx bent.....12. *C. recurvata.*
Ovules 4; nutlets and calyx straight.
Nutlets very small, ca. 1.5 mm. long; spikes somewhat bracted.....37. *C. Traskae.*
Nutlets larger, 2–3 mm. long, spikes very sparingly if at all bracteate.
Nutlets usually solitary; gynobase 1/4–1/2 height of nutlet.
Nutlet persistent, axial.....21. *C. texana.*
Nutlet finally deciduous, abaxial....25. *C. decipiens.*
Nutlets usually 4.
Nutlets decidedly ovate.
Plant closely strigose, pallid, usually 2–3 dm. tall; spikes commonly geminate or ternate.....39. *C. simulans.*
Plant spreading-hispid, usually 1–1.5 dm. tall; spikes usually solitary or rarely geminate.
Nutlets with low rounded tuberculations.....40. *C. ambigua.*
Nutlets with elongate papillae or spicules.....41. *C. echinella.*
Nutlets more or less lanceolate.
Stems spreading hirsute.....29. *C. barbigera.*
Stems strigose.
Nutlets verrucose or verrucose-muriculate.....30. *C. nevadensis.*
Nutlets spinular-muricate.....31. *C. scoparia.*

Description and Classification of the Species.

Ser. I. ANGUSTIFOLIAE. Nutlets 4, muricate or tuberculate, dark with pale roughenings, triangular-ovate or triangular-oblong, with sides acute or knife-like or definitely winged, homomorphous or in most species decidedly hetermorphous with odd nutlet abaxial larger and sometimes slightly less roughened than the others; style definitely surpassing the nutlets.

Pedicels slender, 1–4 mm. long; long-lived annuals.
Nutlets homomorphous, broadly winged.....1. *C. holoptera.*
Nutlets heteromorphous, narrowly winged.....2. *C. racemosa.*
Pedicels stout and very short, less than 1 mm. long.
Nutlets with a knife-like margin.
Nutlets heteromorphous.

Fruiting calyces ca. 2 mm. long; nutlets 0.6–0.7 mm. long.....3. *C. angelica.*
Fruiting calyces 2.5–3 mm. long; nutlets ca. 1.7 mm. long. 4. *C. inaequata.*

Nutlets homomorphous.
Nutlets coarsely tuberculate, bent; gynobase narrowly pyramidal.....5. *C. pusilla.*
Nutlets very obscurely roughened, straight; gynobase subulate.....6. *C. costata.*

Nutlets with merely a sharply angled margin.
Spikes bracteate throughout; style thick.....7. *C. micrantha.*
Spikes bractless or practically so; style slender.
Nutlets heteromorphous.....8. *C. angustifolia.*
Nutlets homomorphous.....9. *C. Grayi.*

1. **C. holoptera** (Gray) Macbr. Coarse erect annual, herbaceous or rarely somewhat suffruticose towards the base, 1–6 dm. tall; branches rather numerous and ascending, hirsute as well as strigose, usually drying brownish; leaves oblanceolate to lance-linear, 3–6 cm. long, 3–8(–12) mm. broad, acute or obtuse, coarsely pustulate and hirsute beneath but less so above; racemes geminate, naked or sparsely bracteate, usually ca. 5 cm. but becoming 10 cm. long; corolla inconspicuous, tube shorter than calyx, the ovate lobes ascending and less than 1 mm. long; fruiting calyx oblong-ovate, 2.5–3.5 mm. long, subsymmetrical, rather persistent; pedicels ascending or decurved, 0.7–1.5 mm. long; mature calyx-lobes lanceolate, somewhat connivent, midrib thickened and hirsute, margins strigose; nutlets 4, homomorphous, 1.5–2.5 mm. long, body oblong-ovate or triangular-ovate, dark with pale tuberculations, margin narrowly to quite broadly winged, groove open or closed above but dilated into an areola below; gynobase slender, about equalling the nutlets; style clearly surpassing the nutlets but shorter than calyx-lobes.—Contr. Gray Herb. n. s. xlviii. 44 (1916). *Eritrichium holopterum* Gray, Proc. Am. Acad. xii. 81 (1876). *Krynitzkia holoptera* Gray, l. c. xx. 276 (1885). *Oreocarya holoptera* Greene, Pittonia i. 58 (1887).

Deserts of California and western Arizona. Not common.

ARIZONA: Ehrenberg, 1876, *Palmer* (G, TYPE); near Peach Springs, Grand Canyon, 1884, *Lemmon* (UC). CALIFORNIA: sandy places near Palm Springs, 120 m. alt., *Spencer 2066b* and *2070* (G); Marshall Canyon, 16 km. west of Coachella, 90 m. alt., *Hall 5786* and *5788* (UC); Calexico, *Davy 8007* (UC); rocky talus slopes at foot of The Needles, *Grinnell* (UC); "The Caves," sink of the Mohave River, *Parish 9855* (UC).

This species was founded by Gray on two collections cited thus: "S. Utah, Capt. F. M. Bishop; Ehrenberg, Arizona, Palmer." The material collected by Bishop is an immature scrappy specimen of *C. pterocarya.* Palmer's Ehrenberg collection consists of two mounted

sheets with fruit. As would be suspected almost the whole of Gray's original description is based upon the Arizonian plant. Subsequently Gray excluded Bishop's collection and cited only the Ehrenberg material as representative of his species. For these reasons Palmer's Ehrenberg collection is taken as the type of *C. holoptera.*

2. **C. racemosa** (Wats.) Greene. Long-lived annual often decidedly suffruticose towards the base, 1–10 dm. tall; stems single with numerous ascending branches or many and diffusely branched, younger parts green, inconspicuously strigose and commonly hirsute, older parts woody and becoming brown from the falling away of the pale bark; leaves oblanceolate, acute, hirsute, pustulate, the early ones 3–6 cm. long and 6–12 mm. broad, the later and more abundant 1.5–4 cm. long and 2.5 mm. broad; racemes apparently forked and paniculately disposed, inconspicuously and irregularly bracted, 3–15 cm. long; corolla very inconspicuous, limb ca. 1 mm. broad; fruiting calyces oblong-ovate, ascending, 2–4 mm. long, slightly asymmetrical, tardily deciduous, inconspicuously biserial; pedicels usually well developed, 1–4 mm. long, slender, frequently nodding; mature calyx-lobes lance-linear, somewhat strigose, hirsute along the thickened midrib; nutlets 4, heteromorphous, triangular-ovate, the acute tips slightly out-curved, groove open or closed above but below broadening out into a shallow broadly triangular areola; odd nutlet next the abaxial calyx-lobe, 1–2 mm. long, subpersistent, finely muricate or tuberculate or both, light or dark; consimilar nutlets 0.8–1.5 mm. long, acute, tending to be very narrowly winged, dark with pallid tuberculations; gynobase subulate, ¾ length of odd nutlet and about equalling consimilar nutlets; style much surpassing the nutlets, almost as long as the mature calyx-lobes.—Pittonia i. 115 (1887); Johnston, Proc. Calif. Acad Sci. ser. 4, xii. 1147 (1924). *Eritrichium racemosum* Wats in Gray, Proc. Am. Acad. xvii. 226 (1882). *Krynitzkia racemosa* Greene, Bull. Calif. Acad. Sci. i. 208 (1885). *Johnstonella racemosa* Brand, Fedde Repert. in press. *K. ramosissima* Gray, l. c. xx. 277 (1885). *C. suffruticosa* Piper, Proc. Biol. Soc. Wash. xxxii. 42 (1919). *C. racemosa,* var. *lignosa* Johnston, Univ. Calif. Pub. Bot. vii. 445 (1922). *J. racemosa,* var. *lignosa* Brand, Fedde Repert. in press.

Southern Nevada and western Arizona, and southwestward to middle Lower California and Carmen Island; usually growing in rocky places.

NEVADA: semishaded places, Las Vegas Mts., *Goodding 2381* (G, UC); Petrified Forest Canyon west of Logan, 540 m. alt., *Heller 10446* (G) and *10447*

(G, UC); rocks, Ash Meadows, *Purpus 6024* (UC). ARIZONA: Grand Canyon, 1885, *Gray* (G); Diamond Creek Canyon, *Wilson 170* (UC). CALIFORNIA: on and about rocks, Silver Canyon, White Mts. east of Laws, *Heller 8209* (G); Panamint Canyon, *Hall & Chandler 7034* (UC, TYPE of *C. racemosa*, var. *lignosa*); Surprise Canyon, *Parish 10125* (UC); Morongo Wash, 900 m. alt., *Parish 3337* (UC); among rocks on canyon-side, Palm Canyon, 300 m. alt., *Johnston 1002* (G); sandy places near Palm Springs, 120 m. alt., *Spencer 2079* (G); among rocks, Cathedral Canyon near Palm Springs, 150 m. alt., *Spencer 2078* (G); Borregos Springs, 1894, *Brandegee* (UC); San Felipe Creek, *Eastwood 2704* (G); Split Mt., 1905, *Brandegee* (UC); canyon near Mesquite Station, *Parish 775* (G, TYPE of *E. racemosum;* UC, ISOTYPE); desert sand, Colorado Desert, San Diego Co., *Spencer 254* (G). LOWER CALIFORNIA: Cantillas Mts., 1883, *Orcutt* (G); Cantillas Mts., 1884, *Orcutt* (G, UC); San Julio Canyon, 1889, *Brandegee* (UC); San Sebastian, 1884, *Brandegee* (UC); San Reguis, 1889, *Brandegee* (UC); Santa Maria, 1889, *Brandegee* (UC); Cajon de Santa Maria, 1889, *Brandegee* (UC); talus, Puerto Refugio, Angel de la Guarda Island, *Johnston 3374* (G); shaley slope, San Estaban Island, *Johnston 3175* (G); cobble-stone beach, South San Lorenzo Island, *Johnston 4192* (G); foot of cliff, Las Animas Bay, *Johnston 3505* (G); Santa Rosalia, *Palmer 188* (G); foot of gypsum cliff, San Marcos Island, *Johnston 3621* (G); Carmen Island, *Palmer 846* (G, UC).

A very distinctive plant to be confused only with *C. holoptera*, which has homomorphous, more broadly winged nutlets. The very diffusely branched form of *C. racemosa*, which is most common in the Mohave Desert, has been described as *C. racemosa*, var. *lignosa*. It may be worthy of recognition.

3. **C. angelica** Johnston. Much branched finely strigose herb 15–25 cm. high; stems spreading, rebranched, brown and glabrous below, strigose and canescent above; leaves linear, 8–24 mm. long, 1–2 mm. broad, loosely strigose, densely and minutely pustulate, ascending; spikes solitary, crowded, slender, naked, 4–9 cm. long, very floriferous; corolla minute, ca. 1 mm. long, ca. 0.5 mm. broad; fruiting calyces oblong-ovate, 1.5–2 mm. long, ascending, subsessile, somewhat asymmetrical; mature calyx-lobes linear, erect, ribbed, sparsely hispid, abaxial one slightly the longest and most hispid; nutlets 4, hetermomorphous, triangular-ovate, dark with small pale tuberculations, margins sharp and with a very narrow knife-edge, back convex, groove closed above but dilated below into a shallowly triangular areola; odd nutlet next the abaxial calyx-lobe, ca. 0.7 mm. long, somewhat persistent; consimilar nutlets ca. 0.6 mm. long; gynobase narrow, almost as long as the consimilar nutlets; style very much surpassing the nutlets.—Proc. Calif. Acad. Sci. ser. 4, xii. 1143 (1924).

Known only from Angel de la Guarda Island in the Gulf of California.

LOWER CALIFORNIA: on silty flats, Angel de la Guarda Island opposite Pond Island, *Johnston 4221* (G, UC, ISOTYPES).

A well marked species, probably most related to *C. racemosa*, from which it differs in such developments as smaller and sessile calyces, much smaller nutlets, and narrower leaves. To judge from the description of *C. inaequata* it differs from that species in its denser spikes, and much smaller calyces and nutlets. Except for the very narrowly winged margin, the nutlets of *C. angelica* are very suggestive of those of *C. Grayi*.

4. **C. inaequata** Johnston. Loosely and sparingly branched herb 3–4 dm. high; stems erect or ascending, hispid and strigose or hirsute towards the base; leaves oblanceolate to linear, 2–4 cm. long, acute, not numerous, more or less hispid, pustulate especially underneath; spikes geminate or solitary, 4–12 cm. long, at times sparsely bracted below; corolla inconspicuous, tube shorter than calyx; fruiting calyx ovate-oblong, 2.5–3 mm. long, ascending, pedicels less than 0.5 mm. long; mature calyx-lobes lanceolate, midrib thickened and hirsute, axial lobe most pubescent and thickened; nutlets 4, heteromorphous, triangular-ovate, dark with small pale tuberculations, margins decidedly acute, groove closed above but below gradually dilating into a shallow triangular areola; odd nutlet ca. 1.7 mm. long, somewhat persistent, slightly lighter than the others, next the abaxial calyx-lobe; consimilar nutlets ca. 1.3 mm. long; gynobase equalling the consimilar nutlets but surpassed by odd nutlet; style much surpassing the nutlets.—Univ. Calif. Pub. Bot. vii. 444 (1922). *Johnstonella inaequata* Brand, Fedde Repert. in press.

Southeastern California.

CALIFORNIA: among rocks, Pleasant Canyon, Panamint Mts., 600 m. alt., *Hall & Chandler 6925* (UC, TYPE); Baxter, *Parish 9859* (UC).

The status of this species is problematic, since the collections upon which it was based have not neen available to me for several years. The description given above is adapted from a preliminary diagnosis made in 1922. It is possible that the plant is only a form of *C. racemosa*, although it has been noted as differing in its subsessile calyces and less extended duration.

5. **C. pusilla** (T. & G.) Greene. Low plant usually with very numerous prostrate-ascending stems; these very slender, usually strictly branched, 3–15 cm. long, canescent, appressed villous-hirsute; leaves crowded near base of plant but distant above, spathulate-linear to linear, 1–3 cm. long, 1–2 mm. wide, somewhat pustulate and hispid below but less so above; spikes solitary or geminate, 2–8 cm. long, naked or with a few minute bracts; corolla inconspicuous, shorter than calyx, 1.5–2 mm. long, lobes slightly spreading oblong ca. 0.3

mm. long; fruiting calyces 2–2.5 mm. long, broadly ovate, symmetrical, sessile or subsessile, early deciduous; mature calyx-lobes lance-ovate or oblong-lanceolate, hirsute, midrib only slightly thickened; nutlets 4, homomorphous, lucid, ca. 0.8–1.2 mm. long, triangular-ovate, bent, tan-colored with low light-colored tuberculations, margin angled and beveled, groove opened or closed above but expanding below into a shallow open triangular areola; gynobase narrowly pyramidal, about equalling the nutlets; style much surpassing the nutlets, ca. ½ length of gynobase.—Pittonia i. 115 (1887). *Eritrichium pusillum* T. & G. Pacif. R. R. Rep. ii. pt. 2, 171 (1856). *Krynitzkia pusilla* Gray, Proc. Am. Acad. xx. 274 (1885).

Southern Arizona and New Mexico southward to Durango.

ARIZONA: near Nogales, 1902, *Orcutt* (UC); Douglas, 1907, *Goodding 2264* (UC). NEW MEXICO: without locality, *Wright 1571* (G, NY). TEXAS: Fort Davis, 1880, *Giard 65* (G); Kent, *Tracy & Earle 105* (UC); El Paso, *Jones 3741* (UC); Llano Estacado, *Pope* (NY, TYPE). CHIHUAHUA: hills and plains near Chihuahua, *Pringle 184* (G, UC); vicinity of Chihuahua, 1300 m. alt., *Palmer 65* (G). DURANGO: Tepehuanes, *Palmer 28* (G, UC); Durango, *Palmer 139* (G, UC) and *227* in pt. (G).

A very distinct species readily recognized by its beveled, bent, lustrous nutlets that just equal the somewhat basally constricted gynobase. The type is given as coming from "Rio Pecos to Llano Estacado, etc. in sandy soil, March." From a study of the journal in Pope's Report, the locality given is found to be within about 100 kilometers traveled between March 24th and 26th 1854. This would make the type locality lie somewhere near the juncture of Ward, Crane and Ector counties, Texas.

6. **C. costata** Brandg. Coarse stiff few-branched herb 1–2 dm. high; stems (especially younger parts) canescent, densely villous-strigose and usually somewhat hirsute as well; leaves lanceolate to linear, 1–3 cm. long, 2–4 mm. wide, broadest near base, apex acute, above villous-strigose and sparsely hispid, beneath more hispid and frequently also pustulate; spikes rigid, 2–5 cm. long, solitary or geminate, sparsely leafy-bracted; corolla inconspicuous, ca. 2 mm. long, tube shorter than calyx, lobes broad and ascending; fruiting calyces ovate-oblong, 4–6 mm. long, subsymmetrical, spreading, deciduous, subsessile; mature calyx-lobes linear-lanceolate, somewhat connivent above with tips slightly spreading, midrib thickened hirsute, margins strigose; nutlets 4, homomorphous or subheteromorphous with the nutlet next the abaxial calyx-lobe slightly the largest, ca. 1.8 mm. long, triangular oblong-ovate, back strongly convex, inconspicuously rugulose or faintly verrucose, face noticeably flat or even

slightly convex, margins sharp and narrowly winged; groove very shallow, closed above but dilating below and merging into the deltoid shallow areola; gynobase subulate, equalling the nutlets; style not sharply differentiated from the gynobase, much surpassing the nutlets.—Bot. Gaz. xxvii. 453 (1899). *C. seorsa* Macbr. Contr. Gray Herb. n. s. xlviii. 46 (1916).

Deserts of Southern California.

California: Needles, *Jones 3841* (G, type of *C. seorsa;* UC, isotype); gravelly hillside 17 km. west of Needles, 210 m. alt., *Munz & Harwood 3601a* (UC); sandy desert, Blythe Junction, 360 m. alt., *Munz & Harwood 3587* (UC); in desert sand near mouth of Tahquitz Canyon, 210 m. alt., *Spencer 1524* (G); in sand, Palm Canyon, 180 m. alt., *Spencer 1527* (G); margin of wash, Borregos Spring, 1889, *K. Brandegee* (UC); Borregos Spring, 1895, *Brandegee* (UC, type of *C. costata);* Hodges Mts., *Hall 5974* (UC); sand hills near Travertine Terrace, 52 m. below sea-level, *Parish 8429* (UC); in desert sand, Mecca, 57 m. below sea-level, *Spencer 1514* (G); Mecca, 60 m. below sea-level, *Parish 8465* (G).

A very distinct species readily recognized by its peculiar nutlets and by its rather coarse, stiff habit and very canescent herbage.

7. **C. micrantha** (Torr.) Johnston. Slender strigose ascendingly branched dichotomous herb 5–15 cm. high, drying brownish; root and lower parts of stem stained with dye; leaves oblong-oblanceolate, 3–7 mm. long, 0.8–1.4 mm. broad, canescent-strigose and occasionally short villous-hirsute, rounded at apex, uppermost scarcely reduced and extending through the inflorescence; spikes very numerous, solitary or geminate, dense, strongly unilateral, leafy-bracted throughout, 1–4 cm. long; corolla inconspicuous or medium-sized, limb 0.5–2.5 mm. broad, faucal appendages poorly developed; fruiting calyx ovate-oblong, 1.8–2.5 mm. long, slightly asymmetrical, decidedly biseriate, base broadly conical; pedicels 0.5–0.8 mm. long; mature calyx-lobes oblong-lanceolate, broad, erect, hirsute, midrib not particularly thickened; nutlets 4, homomorphous or somewhat heteromorphous, 1–1.3 mm. long, plumbeous or brown, smooth or tuberculate, abaxial one usually a trifle the largest and most persistent; groove extending full length of nutlet, narrow, scarcely broadened at base; gynobase subulate, nearly as long as the calyx, much surpassing the nutlets and bearing at its summit the sessile stigma.—Contr. Gray Herb. n. s. lxviii. 56 (1923).

Var. **genuina.** Corolla inconspicuous, 0.5–1.2 mm. broad.—*Eritrichium micranthum* Torr. Bot. Mex. Bound. 141 (1859). *Krynitzkia micrantha* Gray, Proc. Am. Acad. xx. 275 (1885). *Eremocarya micrantha* Greene, Pittonia i. 59 (1887). *C. micrantha* Johnston, l. c.

Eremocarya muricata Rydb. Bull. Torr. Bot. Cl. xxxvi. 677 (1909); Macbr. Proc. Am. Acad. li. 545 (1916).

Southeastern Oregon to Utah, southward to northern Lower California and Arizona, and eastward along the Mexican boundary to western Texas.

OREGON: without locality, 1898, *Cusick 2020a* (G). UTAH: Stansbury Island, 1290 m. alt., *Watson 856* (G); valley of the Virgin near St. George, *Parry 164* (G, ISOTYPE of *E. muricatum*). NEVADA: Logan, *Kennedy 1832* (G); dry sandy ravines, Moapa, *Goodding 2203* (G); deep sand, Beaver Dam Wash, *Goodding 2144* (G). CALIFORNIA: sandy place, Mohave Desert, 300 m. alt., *Spencer 436* (G); Barstow, *Jones 106* (G); Mohave Desert, 1880, *Lemmon* (G); Acton, *Elmer 3682* (G); Los Angeles, 1880, *Nevin* (G); sand in Arroyo Seco, Pasadena, *Allen 18* (G); dry sandy ground, San Gabriel Wash near El Monte, *Johnston 27r* (G); San Bernardino, 1876, *Parry 14* (G); sandy hills, Mesa Grande, 990 m. alt., *Spencer 1304* (G); Agua Caliente, *Parish 771* (G); sandy place near Palm Springs, 120 m. alt., *Spencer 1918* (G); desert sand, Palm Springs, 135 m. alt., *Spencer 844* (G); desert sand, Coyote Wells, *Spencer 194* (G); desert sand, Mecca, 59 m. below sea-level, *Spencer 1515* (G); desert sand, Mountain Springs, 678 m. alt., *Spencer 857* (G). LOWER CALIFORNIA: San Sebastian, 1889, *Brandegee* (UC); without locality, 1883, *Orcutt* (G). ARIZONA: near Tucson, *Greene 1112* (G); Wickinburg, *Palmer 371* (G); near Camp Lowell, 1881, *Pringle* (G); Prescott, *Rusby 745* (G). NEW MEXICO: without locality, 1851–2, *Wright 1565* (G). TEXAS: sands along Rio Grande, El Paso, *Thurber 181* (G); El Paso, *Jones 3703* (G).

Var. **lepida** (Gray) Johnston. Corolla medium-sized, 1.0–1.5 mm. broad; plants usually coarser than in var. *genuina*.—Contr. Gray Herb. n. s. lxviii. 57 (1923). *Eritrichium micranthum*, var. *lepidum* Gray, Synop. Fl. N. Am. ii. pt. 1, 193 (1886). *Krynitzkia micrantha*, var. *lepida* Gray, Proc. Am. Acad. xx. 275 (1885). *Eremocarya lepida* Greene, Pittonia i. 59 (1887). *Eremocarya micrantha*, var. *lepida* Macbr. Proc. Am. Acad. li. 545 (1916).

Southern California, most common in warm montane valleys.

CALIFORNIA: Middle Fork, Mt. Pinos, *Hall 6540* (UC); Grayback, 1880, *Wright* (G); near Pine Lake, Bear Valley, *Abrams 2904* (G); Forest Home, 1500 m. alt., 1913, *Mason* (G); Bear Valley, *Parish 771a* (G); sandy hills, Idyllwild, 1590 m. alt., *Spencer 1301* (G); woods, Idyllwild, 1620 m. alt., *Spencer 1347* (G); Warners Hot Springs, *Eastwood 2591a* (G); dry canyon floor near Campo, *Abrams 3594* (G); desert sand, Mountain Springs, 678 m. alt., *Spencer 858* (G); San Diego, 1876, *Cleveland* (G, TYPE of *E. micranthum*, var. *lepidum*). LOWER CALIFORNIA: San Pedro Martir, 1893, *Brandegee* (UC).

The nutlets of *C. micrantha* are exceptionally variable. Some plants have all the nutlets smooth, others have all of them tuberculate, while still others have the abaxial nutlet of each calyx tuberculate and the remaining ones smooth. *Eremocarya muricata* is described as differing from *C. micrantha* in having tuberculate nutlets, but in the isotype of that species contained in the Gray Herbarium I find that

although most of the calyces have roughened nutlets a few of them (and these always the oldest) have decidedly smooth nutlets. In plants characteristically smooth-fruited it is quite common to find that the oldest calyces contain three smooth nutlets and a tuberculate one. Not only is there a decided tendency towards heteromorphism in markings and roughenings, but to a slight degree also in size and firmness of attachment. The abaxial nutlet is commonly a trifle larger than the other nutlets and is somewhat more firmly attached to the gynobase. None of the nutlet-variations can be geographically correlated. Despite its variable fruit the species is readily recognized because of its densely bracteate inflorescence, deeply dye-stained root and long-protruded gynobase.

8. **C. angustifolia** (Torr.) Greene. Diffusely branched from the base, 5–20(–45) cm. tall; stems canescent, villous-hirsute, commonly somewhat strigose-villous, lowermost branches decumbent or loosely ascending; leaves linear, 1.5–4 cm. long, 1–4 mm. wide, spreading, not crowded below, hispid or strigose, somewhat pustulate especially underneath; spikes geminate, usually ca. 5 cm. long, rather dense, commonly naked; corolla usually inconspicuous, tube 1–2 mm. long, limb 1–2.5 mm. broad; fruiting calyces ovate-oblong, 3–4 mm. long, stiffly ascending, strongly biseriate, slightly asymmetrical; pedicels less than 0.5 mm. long; mature calyx-lobes lance-linear, rigid, slightly connivent, midrib thickened and hirsute, margin somewhat villous-ciliate, abaxial lobe longest and most hirsute; nutlets normally 4, heteromorphous, ovate-oblong, brown or plumbeous with pale tuberculations or rarely murications, back convex, face flattish, margin somewhat angular; odd nutlet next the abaxial calyx-lobe, a trifle larger and more persistent than the similarly colored and shaped consimilar nutlets which are ca. 1 mm. long, groove usually narrowly open above but broadening at the base; gynobase columnar, equalled by consimilar nutlets but shorter than odd nutlet; style usually surpassing even the odd nutlet.—Pittonia i. 112 (1887). *Eritrichium angustifolium* Torr. Pacif. R. R. Rep. v. 363 (1857). *Krynitzkia angustifolia* Gray, Proc. Am. Acad. xx. 272 (1885).

Southern California and southern Utah, southward to Lower California, Sonora and western Texas.

California: Death Valley, *Coville & Funston 479* (G); Danby, 1896, *Orcutt* (UC); Barstow, 1915, *K. Brandegee* (UC); sandy places near Barstow, 960 m. alt., *Spencer 2091* (G); Needles, 1884, *Jones* (G); Riverside Mt., 1910, *Grinnell* (UC); Palm Springs, 1913, *Eastwood* (G); in sandy places, Palm Springs, *Spencer 843, 849, 853, 855, 1526a, 2066a, 2071b* in pt. and *2118* (G); sand dunes, Old Beach, near Holtville, *Parish 8124* (UC); Twentynine Palms,

1902, *Brandegee* (UC); desert sand, Indio, 30 m. alt., *Spencer 1517* (G); sandy wash, Shaver's Well near Mecca, 59 m. below sea-level, *Munz & Keck 4763* (G); sands, Mecca, *Spencer 1512* and *1785* (G); Cameron Lake, *Brandegee* (UC); Yaqui Wells, *Eastwood 2632* (G); bottom lands near Colorado River, 750 m. alt., *Hall 5922* (UC); in sandy places. Colorado Desert, *Spencer 195*, *196*, *197* and *201* (G); without locality, *Coulter 500* (G). LOWER CALIFORNIA: stony ridges, Los Angeles Bay, *Palmer 606* (G); San Agueda, *Palmer 241* (G, UC); Angel de la Guarda Island, *Johnston 4227* (G). NEVADA: Moapa, *Goodding 2181* (G, UC); Overton, 450 m. alt., *Heller 10439* (G); Amargosa in moist place near station, 900 m. alt., *Heller 10976* (G); sandy wash, Meadow Valley Wash, *Goodding 2169* (G); Muddy Valley, *Kennedy & Goodding 26* (UC). ARIZONA: Fort Yuma, *Thomas* (NY, TYPE); Fort Yuma, *DuBarry* (NY, COTYPE); Gila River, *Thurber 690* (G); Tucson, 1907, *Loyd* (G); Tucson, 1884, *Parish* (G); Tucson, 1894, *Toumey* (UC); campus of University of Arizona, *Thornber 407* and *516* (UC); without locality, 1876, *Palmer* (G); without locality, 1881, *Pringle* (G). SONORA: Torres, 1902, *Purpus* (UC); dry places, Canyon of Guadaloupe, *Smith* (NY); Las Durasnillas, 1892, *Brandegee* (UC); Guaymas, *Palmer 169* (G, UC). NEW MEXICO: mesa west of Organ Mts., 1905, *Wooton* (UC). TEXAS: El Paso, 1884, *Jones* (G).

Probably the most common *Cryptantha* in the lower deserts of California. It is readily recognized by its characteristic ashy herbage, dense spikes, and heteromorphous dark nutlets which are covered with small light colored low tubercles. It is a well marked species, having its closest relation in *C. Grayi*.

9. **C. Grayi** (Vasey & Rose) Macbr. A small slender herb 5–15 (–18) cm. high; stems usually several, strict or spreading, appressed or spreading villous-hispid; leaves quite numerous, linear, 1–4 cm. long, 1–2 mm. wide, densely pustulate-setose beneath but much less so above, basal ones somewhat aggregated, upper ones reduced; spikes usually geminate, naked, densely flowered, 1–4 cm. long; corolla minute to medium-sized, tube shorter than calyx, limb 0.5–3 mm. broad; fruiting calyx oblong-ovate, 1–2 mm. long, sessile or subsessile, decidedly biseriate; mature calyx-lobes lance-linear, rigid, slightly connivent, midrib short-hirsute, margins somewhat villous-hispid, axial lobe most pubescent; nutlets 4, homomorphous, very small, 0.5–0.7 mm. long, triangular-ovate, dark colored, usually bearing light-colored low tuberculations, edges angled or rounded, areola shallow and deltoid with the groove above it commonly closed; gynobase subulate, equalling or a little shorter than the nutlets; style much surpassing the nutlets.—Contr. Gray Herb. n. s. xlviii. 43 (1916).

Var. **genuina.** Corolla conspicuous, 2–3 mm. broad; nutlets tuberculate.—*Krynitzkia Grayi* Vasey & Rose, Proc. U. S. Nat. Mus. xi. 536 (1888). *C. Grayi* Macbr. l. c.

Middle Lower California.

LOWER CALIFORNIA: Lagoon Head, *Palmer 801* (G, UC, ISOTYPES); Calmalli, *Purpus* (UC); Magdalena Island, *Orcutt 27*, *52* and *80* (G); Magdalena Bay, 1889, *Brandegee* (UC); Santa Margarita Island, 1889, *Brandegee* (UC).

Var. **nesiotica** Johnston. Corolla inconspicuous, 0.5–1 mm. broad; nutlets very sparsely or not at all tuberculate.—Proc. Calif. Acad. Sci. ser. 4, xii. 1146 (1924).

Dunes on islands in southern part of Gulf of California.

LOWER CALIFORNIA: very common on dunes, San Francisco Island, *Johnston 3947* (G, UC, ISOTYPE).

Var. **cryptochaeta** (Macbr.) Johnston. Corolla inconspicuous, 0.5–1 mm. broad; nutlets abundantly tuberculate.—Proc. Calif. Acad. Sci. ser. 4, xii. 1145 (1924). *C. micromeres*, var. *cryptochaeta* Macbr. Contr. Gray Herb. n. s. xlviii. 46 (1916). *C. filiformifolia* Macbr. l. c. 45.

Extreme southern Lower California and Sonora.

LOWER CALIFORNIA: Cape San Lucas, *Xantus 76* (G); sandy clearings, La Paz, *Johnston 3071* (G); San José del Cabo, *Anthony 347* (G, TYPE of *C. micromeres*, var. *cryptochaeta*). SONORA: Alamos, *Palmer 397* (G, TYPE of *C. filiformifolia;* UC, ISOTYPE); Alamos, *Goldman 308* (G).

Cryptantha Grayi is very closely related to *C. angustifolia*, and from the infrequent extremely slender forms of the latter it is distinguishable only by its decidedly homomorphous nutlets. Usually, however, it is readily recognized by its very slender habit, and by its herbage which usually dries a darker color than that of *C. angustifolia*.

Ser. II. CIRCUMSCISSAE. Nutlets 4, smoothish or inconspicuously muricate, dark, triangular-ovate, with acute sides, homomorphous or subheteromorphous with the abaxial nutlet just appreciably the largest; style equalling or barely surpassing the nutlets; calyx circumscissile at maturity.

10. **C. circumscissa** (H. & A.) Johnston. Low herb 2–10 cm. high, trimly erect or much branched and forming hemispherical masses; stems few to numerous, more or less branched above, strigose or hirsute, the outermost somewhat decumbent; leaves oblanceolate, 3–15 mm. long, 1–2 mm. broad, obtusish, surface siliceous especially toward the pale base, strigose or hirsute, obscurely pustulate, upper ones scarcely reduced and extending through the inflorescence as foliaceous bracts; flowers axillary, the racemose arrangement obscure; corolla more or less inconspicuous, 1–2(–3) mm. broad; fruiting calyx 2.5–4 mm. long, oblong-ovate, united to near the middle, at maturity upper half falling away by a circumscission just below the sinuses;

basal persistent part of calyx-tube siliceous, pale, cupulate, appressed-hirsute; mature calyx-lobes firm-herbaceous, linear-lanceolate, scarcely ribbed, more or less hirsute; pedicels obscure, ca. 0.5 mm. long; nutlets 4, homomorphous or with abaxial one barely the largest, smooth or obscurely muriculate, triangular-ovate or oblong-lanceolate, 1.2–1.7 mm. long, back flattened especially towards apex, margins angled, groove closed and forked below; gynobase about ⅔ height of nutlets, pyramidal-oblong; style equalling or barely exceeded by nutlets.—Contr. Gray Herb. n. s. lxviii. 55 (1923).

Var. **genuina.** Stems with short appressed hairs.—*Lithospermum circumscissum* H. & A. Bot. Beechey 370 (1840). *Piptocalyx circumscissus* Torr. in Wats. Bot. King Exped. 240 (1871); Torr. Bot. Wilkes Exped. 414, t. 12 (1874). *Eritrichium circumscissum* Gray, Proc. Am. Acad. x. 58 (1874). *Krynitzkia circumscissa* Gray, Proc. Am. Acad. xx. 275 (1885). *Wheelerella circumscissa* Grant, Bull. So. Calif. Acad. Sci. v. 28 (1906). *Greeneocharis circumscissa* Rydb. Bull. Torr. Bot. Cl. xxxvi. 677 (1909). *C. depressa* Nels. Bot. Gaz. xxxiv. 29 (1902).

Southern British Columbia and Idaho, southward to Arizona and northern Lower California.

WASHINGTON: Junction of Coal and Crab creeks, 730 m. alt., *Sandberg & Leiberg 228* (G); in dried up pools, Pasco, *Piper 2966* (G); Ainsworth, 1883, *Brandegee* (G); plains, Morgan's Ferry, Yakima River, *Suksdorf 404* (G). OREGON: open sandy places, Bend, *Nelson 859* (G); dry sandy slope along Des Chutes River, 8 km. below Bend, *Peck 9709* (G); plains between Pineville and Bear Buttes, 1110 m. alt., *Leiberg 324* (G); dry ground, Burns, *Peck 6108* (G). IDAHO: Boise, 1881, *Wilcox* (G); dry soil, 11.2 km. west of St. Anthony, *Merrill & Wilcox 873* (G, ISOTYPE of *C. depressa*); dry gravelly bottom-land, Falk's Store, *Macbride 29* (G); Snake Country, *Burke* (G); sandy slopes, Emmett, 660 m. alt., *Macbride 786* (G). UTAH: Antelope Island, 1290 m. alt., *Watson 847* (G); valley of the Virgin near St. George, *Parry 165* (G); St. George, 1880, *Jones* (UC); without locality, 1873, *Bishop* (G). NEVADA: Pyramid Lake, *K. Brandegee* (G, UC); Carson City, 1500 m. alt., *Watson 848* (G); Humboldt Plains, 1872, *Gray* (G); Carson City, *Anderson 163* (G); Lake Washoe, *Torrey 336* (G); near Empire City, *Torrey 332* (G); Reno, 1884, *Curran* (G); log railroad north of Verdi, 1590 m. alt., *Heller 10877* (G); about Carson City, 1446 m. alt., *Baker 973* (G); gravelly soil, Palmetto Range, *Purpus 5841* (G, UC). ARIZONA: Cottonwood, *Palmer 372* (G). CALIFORNIA: Sierra County, 1875, *Lemmon* (G); Tioga Road, east side of the divide, 2550 m. alt., *Smiley 820* (G); sandy plains, South Fork of Kern River, *Purpus 5712* (G, UC); base of White Mts. east of Laws, *Heller 8235* (G); sandy places, Erskin Creek, *Purpus 5304* (G); Acton, *Elmer 3705* (G); hills bordering Mohave Desert, 1882, *Pringle* (G); sand, Mohave, *Heller 7764* (G); desert sand near Victorville, 600 m. alt., 1918, *Spencer* (G); desert sand, Hesperia, *Spencer 387* (G); near Pine Lake, Bear Valley, *Abrams 2905* (G); sandy soil, Jacumba, *Abrams 3659* (G); Cottonwood Springs, *Jaeger 1846* (G). LOWER CALIFORNIA: without locality, 1884, *Orcutt* (G).

Var. **hispida** (Macbr.), comb. nov. Stems clothed with spreading bristles; plant usually coarser than in var. *genuina*.—*Greeneocharis circumscissa*, var. *hispida* Macbr. Proc. Am. Acad. li. 546 (1916). *Krynitzkia dichotoma* Greene, Bull. Calif. Acad. Sci. i. 206 (1885). *Piptocalyx dichotomus* Greene, Pittonia i. 60 (1887). *Wheelerella dichotoma* Grant, Bull. So. Calif. Acad. Sci. v. 28 (1906). *Greeneocharis dichotoma* Macbr. l. c. *C. dichotoma* Johnston, Contr. Gray Herb. n. s. lxviii. 55 (1923).

Western Nevada and adjacent California. Infrequently collected.

NEVADA: between Boca and Verdi, 1884, *Curran* (G, ISOTYPE of *K. dichotoma*); Carson City, *Anderson* (G). CALIFORNIA: Andrews Camp, Bishop Creek, 2400 m. alt., *Davidson 2700* (G); trail to Mt. Whitney, 3000 m. alt., *Culberton 4240* (G, TYPE of *G. circumscissa*, var. *hispida*); sandy plains, Erskin Creek, *Purpus 5304* in pt. (G).

A detailed study of *C. circumscissa* and *C. dichotoma* has failed to disclose any fundamental character capable of separating the two. The nutlet-characters used by Gray and Greene are not distinctive, since among plants of indubitable *C. circumscissa* the nutlets not only vary from triangular-ovate to oblong-lanceolate, but also from smooth and shiny to very finely granulate and minutely muriculate. The size of the nutlets does not separate natural groups. The only tangible character separating *C. circumscissa* and *C. dichotoma* seems to be one of pubescence. Since all the material with spreading bristles comes from a definite region along the east base of the Sierra Nevada I believe that this hirsute form is best treated as a geographical variety. Consequently Macbride's varietal name is taken up. It is to be noted that annotations in the Gray Herbarium indicate that even Gray inclined towards treating *C. dichotoma* as a mere variety.

Ser. III. ALBIDAE. Nutlets 4, coarsely tuberculate, dark, triangular-ovate, thickish, very broadly obtuse or convex on the sides, homomorphous but with the abaxial nutlet subpersistent; style much surpassing the nutlets.

11. **C. albida** (HBK.) Johnston. An erect or frequently loosely ascending herbaceous or fruticulose plant 1–3(–4) dm. high; stems solitary or usually several, simple or commonly paniculately branched, more or less villous-strigose as well as hirsute; early leaves in evanescent basal rosettes, spathulate, becoming 5 cm. long, 1.5–4 mm. wide; cauline leaves numerous and somewhat crowded, reduced above but extending as linear bracts through the inflorescence, 3 cm. or less long, hirsute, usually minutely pustulate; spikes 1–7 cm. long, solitary,

numerous, loosely bracteate; corolla inconspicuous, ca. 2.5 mm. long, tube about equalling calyx; fruiting calyx broadly ovate, 2–3 mm. long, only slightly accrescent, becoming remote, subpersistent; mature calyx-lobes oblong-ovate to lance-ovate, loosely connivent, midrib slightly thickened and short-hirsute, margin appressed-hispid; pedicels ca. 0.5 mm. long; nutlets 4, homomorphous, triangular ovate, 1–1.5 mm. long, tan or brownish, usually sparsely granulate, low-tuberculate, thickish, one next abaxial calyx-lobe subpersistent, margins rounded, ventral side occupied by a very large open triangular areola which appears to be excavated in very mature nutlets by the breaking away of the attachment-scar from the nutlet-walls; gynobase narrowly pyramidal, about equalling the nutlets; style much surpassing nutlets. —Contr. Gray Herb. n. s. lxviii. 53 (1923). *Myosotis albida* HBK. Nov. Gen. et Sp. iii. 91 (Aug. 1818). *Lithospermum ramosum* Lehm. Asperif. ii. 328 (Nov. or Dec. 1818). *Eritrichium ramosum* A. DC. Prodr. x. 132 (1846). *Krynitzkia ramosa* Gray, Proc. Am. Acad. xx. 274 (1885). *C. ramosa* Greene, Pittonia i. 115 (1887). *E. hispidum* Buckley, Proc. Acad. Philad. 1861, pg. 462 (1861). *K. mexicana* Brandg. Zoe v. 182 (1904); Macbr. Contr. Gray Herb. n. s. xlviii. 49 (1916).

Western Texas to eastern Arizona in the vicinity of the international boundary, thence south to Durango and Puebla.

Texas: Davis Mts., *Tracy & Earle 176* (G); Maxon Springs, *Havard 46* (G); valley of Limpia, 1858, *Hayes* (G); Pecos, 1858, *Hayes* (G); without locality, 1874, *Buckley* (G, fragment of type of *E. hispidum*); without locality, *Wright 1572* and *488* in pt. (G). Arizona: waste land, Douglas, *Goodding 2395* (G); sandy plain near the Mustang Mts., 1884, *Pringle* (G). Coahuila: Rio Grande Valley near Diaz, 200 m. alt., *Pringle 8301* (G, UC); mts. 10 km. east of Saltillo, *Palmer 2046* (G); Urios, 72 km. east of Saltillo, *Palmer 896* (G); vicinity of Saltillo, *Palmer 243* and *343* (G); Parras, *Purpus 2402* (G, UC); dry places southwest of Encantada, 1847, *Gregg* (G); Viesca, *Purpus 126* (UC, type of *K. mexicana*; G, isotype); without locality, *Gregg 32* (G). Chihuahua: foothills of Sierra Madra near Colonia Juarez, *Nelson 6343* (G). Durango: City of Durango, *Palmer 227* (G, UC). San Luis Potosi: San Luis Potosi, *Parry & Palmer 623* (G); San Rafael Mts., *Schaffner 731* (G). Aguas Calientes: in fields, Aguas Calientes, *Hartweg 157* (G). Hidalgo: between San Juan del Rio and Hacienda de San Antonio, *Humboldt* (G, authentic fragment of *M. albida*). Mexico: sandy fields, Amecameca, *Pringle 6648* (G, UC); San Juan Teotihuacan, District of Tezcoco, *Seler 5304* (G). Puebla: Mt. Orizaba, 3000 m. alt., *Seaton 173* (G).

The nutlets of this species are very thick in relation to their breadth. This condition, as well as the very large open (in age excavated) triangular areola, makes the species readily recognizable. It is practically confined to eastern Mexico where in Puebla it sets the southernmost outpost for the genus in North America. Not only is it the

most southerly ranging of the North American species, but it is the only North American species which appears to have its immediate relationships in the continent to the south. *Cryptantha albida* is very closely related to *C. argentinica* Brand of northern Argentina, if indeed it is not the same species.

Ser. IV. MARITIMAE. Nutlets 1–4, tuberculate or muricate, usually dark with pale roughenings, lanceolate to triangular-ovate, with rounded or obtuse sides, decidedly heteromorphous with odd nutlet (sometimes alone developing) axial and larger as well as occasionally less roughened than others; style surpassed by the nutlets or reaching their tips or rarely surpassing them.

Calyx most hirsute on axial side, conspicuously recurved or deflexed.
  Ovules 2; nutlet 1, bent; style reaching to about 1/2 height of nutlet.....12. *C. recurvata.*
  Ovules 4; nutlets 4, straight; style reaching to about the tips of the nutlets.....13. *C. echinosepala.*
Calyx most hirsute on abaxial side, spreading to strict.
  Calyx strictly and closely appressed to the flattened rhachis, gibbous on axial side due to basal prolongation of rough odd nutlet.....14. *C. dumetorum.*
  Calyx ascending or spreading, not at all gibbous; odd nutlet rather smooth.
    Nutlets triangular-ovate, 0.7–0.9 mm. long; mature calyx subglobose, minute, with lobes scarcely surpassing the nutlets.....15. *C. micromeres.*
    Nutlets oblong-lanceolate, 1–2 mm. long; mature calyx oblong, medium-sized, with lobes surpassing the nutlets. 16. *C. maritima.*

12. **C. recurvata** Cov. Ascendingly branched rather slender herb 1–3 dm. high; root frequently dye-stained; stems usually strigose, rarely appressed-hispid; leaves remote, oblanceolate or linear-oblanceolate, 1–2(–3.2) mm. long, 2–4(–5) mm. broad, rounded or obtuse, appressed-hispid, densely and minutely pustulate; spikes naked, slender, loose, 2–10 cm. long, solitary or geminate; corolla inconspicuous, subtubular, ca. 2 mm. long, not exserted, lobes short; fruiting calyces slender, subdistichously biseriate, very asymmetrical, characteristically bent and recurved, 3–4 mm. long, tardily deciduous, sessile; mature calyx-lobes linear, midrib somewhat thickened and hirsute, rarely merely strigose, axial lobe longest thickest and most hirsute; ovules 2; nutlet 1, subpersistent, oblong-lanceolate, inwardly curved, brownish, dull, granulate-muriculate, next the axial calyx-lobe, edges obtusish; groove somewhat oblique, narrow or closed, opening into a small basal areola; gynobase slender, ca. ½ length of

the matured nutlet, slightly exceeded by aborted one; style commonly much surpassed by nutlet.—Contr. U. S. Nat. Herb. iv. 165, t. 16 (1893).

Eastern Oregon to Utah and the Inyo Region of California.

OREGON: Alword Desert, 1600 m. alt., *Leiberg 2425* (G, UC). NEVADA: in open sand along water-pipe, Candelaria, 1950 m. alt., *Shockley 260* (G); sandy soil, Palmetto Range, 1800–2100 m. alt., *Purpus 5856* (UC). UTAH: sandy places, Grand River Canyon, 1230 m. alt., *Purpus 6488* (UC); Dugway, 1891, *Jones* (UC). CALIFORNIA: Surprise Canyon, Panamint Mts., 800 m. alt., *Coville & Funston 713* (G, UC, ISOTYPES); Silver Canyon in White Mts., east of Laws, *Heller 8221* (G, UC); Silver Canyon, 1913, *K. Brandegee* (G, UC); Fish Lake Valley, 1897, *Purpus*.

One of the most distinct and interesting species in the genus. It may be readily recognized by its biovulate fruit and spreading, recurved fruiting calyces.

13. **C. echinosepala** Macbr. Loosely branched herb 1–2 dm. high; stems usually reddish, strigose as well as somewhat hirsute; leaves 2–4.5 cm. long, 2–5 mm. wide, linear to linear-lanceolate, below pustulate and short villous-hirsute, above subglabrate or minutely strigose; spikes geminate or solitary, usually 2–5 cm. long, naked or rarely with a single bract; corolla inconspicuous, tube shorter than calyx, limb ca. 1 mm. broad; fruiting calyx ovate, 2–3 mm. long, sessile or subsessile, spreading or even reflexed, asymmetrical; mature calyx-lobes very unequal, lance-linear, strigose and usually hirsute along the thickened midrib, axial lobe the longest and most hirsute; nutlets heteromorphous, usually 4, pallid, groove narrow and scarcely dilated below; odd nutlet minutely muriculate-tuberculate, ovate, acute, 1.2–1.5 mm. long, subpersistent, next the axial calyx-lobe, margin angulate; consimilar nutlets ca. 1 mm. long, minutely tuberculate, lance-ovate; gynobase evidently shorter than consimilar nutlets, oblong; style longer than consimilar nutlets, equalling or just surpassed by the odd nutlet.—Contr. Gray Herb. n. s. lvi. 57 (1918); Johnston, Proc. Calif. Acad. Sci. ser. 4, xii. 1147 (1924).

Southern Lower California.

LOWER CALIFORNIA: Santa Agueda, *Palmer 242* (G); Magdalena Bay, *Lung* (UC), *Bryant* (UC), *Brandegee* (UC); Magdalena Island, *Orcutt 15* (G, TYPE); La Paz, *Palmer 26* (G).

At once distinguishable from nearly all other species of the genus by having its fruiting calyces deflexed and most heavily hirsute on the axial side. It is probably most related to *C. angustifolia*.

14. **C. dumetorum** Greene. Laxly branched closely strigose herb; stems at first erect but later commonly much elongated and sprawling

or scrambling among bushes; leaves lanceolate, thickish, 2–4 cm. long, 2–4(–8) mm. wide, sparsely appressed hirsute-villous, closely pustulate below and finely so above; spikes solitary or geminate, usually remotely flowered, 5–10 cm. long, occasionally with foliaceous bracts towards base, rhachis brittle and tortuously flattened; corolla inconspicuous, ca. 1 mm. broad; fruiting calyx closely appressed to rhachis, 2–3 mm. long, very asymmetrical, not at all deciduous, base very oblique and downwardly gibbous on axial side; mature calyx-lobes connivent and reaching about equal height; 3 abaxial lobes lanceolate, somewhat strigose, with the thickened midribs deflexed-hirsute; 2 axial lobes partly united, hirsute only on outer margins; nutlets 4, heteromorphous, granulate and muriculate; odd nutlet persistent, axil, broadly lanceolate, 2–3 mm. long, base much developed and distorting the calyx, groove open and broad; consimilar nutlets 1.5–2 mm. long, deciduous, lanceolate, groove closed or very narrow; gynobase narrow, shorter than consimilar nutlets; style shortly surpassed by nutlets or reaching to their tips.—Pittonia i. 112 (1887). *Krynitzkia dumetorum* Greene in Gray, Proc. Am. Acad. xx. 272 (1885).

Deserts from western Nevada to Southern California.

NEVADA: Muddy Valley, 510 m. alt., *Kennedy & Goodding 74* (UC). CALIF, ORNIA: half climbing among bushes at Tehachapi Pass, 1884, *Curran* (G-TYPE); Kramer, *Parish 9810* (UC); Kramer, *K. Brandegee* (G, UC); Barstow, 1909, *K. Brandegee 158* (G, UC); Lancaster, *K. Brandegee* (UC); Whitewater, 300 m. alt., 1903, *Jones* (UC); without locality, *Lemmon* (UC).

An anomalous species very peculiar in habit and in calyx and nutlet developments. Although the tips of the 4 nutlets in each calyx are of equal height, their bases are decidedly not so. The base of the axial one is more developed than that of the others causing the axial side of the calyx to be gibbously distended downwards along the pedicel and thereby making the base of the calyx conspicuously oblique. In habit the species is unique in the genus. It commonly grows about bushes and scrambles up through them, often reaching a meter in height. So sinuous and brittle are the stems that it is commonly quite impossible to disentangle from the supporting bush a perfect specimen of this plant. The pedicels are unquestionably persistent, being as decidedly so as are those of *C. micrantha*. The type of the species is given as having come from Tehachapi Pass. An annotation in the University of California Herbarium gives the type-locality as: Tehachapi Pass, probably at the "Bend," between Mohave and Tehachapi Station.

15. **C. micromeres** (Gray) Greene. Slender usually erect-growing

herb 1–5 dm. tall; stems dull dark-green, short-hirsute throughout; leaves linear to oblong-linear, somewhat hirsute on both surfaces and usually somewhat pustulate beneath, 1.5–4.5 cm. long; spikes commonly ternate, very slender, naked, 2–8 cm. long; corolla inconspicuous, subtubular, ca. 0.5 mm. broad; fruiting calyces very small, 1–2 mm. long, subglobose, fulvous, sessile or nearly so, early deciduous; mature calyx-lobes ovate-lanceolate, decidedly connivent, scarcely surpassing the fruit, margins ciliate, midrib slightly thickened, hirsute and frequently uncinate; nutlets 4, heteromorphous, triangular-ovate, 0.7–0.9 mm. long, margin subangulate; odd nutlet slightly the largest, smooth or sparsely papillate, next the axial calyx-lobe; consimilar nutlets papillate, groove open, gradually dilated into a small open areola; gynobase equalled by consimilar nutlets but somewhat surpassed by odd one; style short, equalling or bearly surpassing the odd nutlet.—Pittonia i. 113 (1887). *Eritrichium micromeres* Gray, Proc. Am. Acad. xix. 90 (1883). *Krynitzkia micromeres* Gray, Proc. Am. Acad. xx. 274 (1885).

Central California to northwestern Lower California.

California: Ione, 1886, *K. Brandegee* (UC); near Mokelumne Hill, 1885, *Rattan 6* (G); Mokelumne Hill, *Blaisdell* (G); new Coulterville Road, Mariposa Co., 1897, *Congdon 42* (G); Tamalpais, 1910, *K. Brandegee* (UC); Antioch, 1889, *K. Brandegee* (UC); moist shaded ground, Cerritos Creek near Berkeley, *Tracy 761* (UC); Boswell's, Berkeley Hills, *Tracy 2074* (G); foothills west of Los Gatos, *Heller 7341* (G, UC); Glenwood, 1900, *Eastwood* (G); Ben Lomond, *K. Brandegee* (UC); Santa Cruz, *Jones* (G, type); seaside, Monterey, *Eastwood 162* (G); on the Salinas road near Del Monte, *Heller 6698* (UC); Point Sur, 1888, *K. Brandegee* (UC); Painted Cave Ranch, Santa Barbara Co., *Eastwood 66* (G, UC); Santa Inez Mts., 1888, *Brandegee* (G); Santa Cruz Island, 1888, *Brandegee* (UC); chaparral burn, La Jolla, *Clements 109* (G, UC); Point Loma, *Brandegee 1622* (G, UC); Point Loma, *Eastwood 2518* (G); Point Loma, 1906, *K. Brandegee* (UC). Lower California: near Ensenada, 1882, *Jones* (UC).

This species develops the smallest flowering and fruiting parts known in the genus. Its occurrence is sporadic, and in the south at least somewhat determined by the presence of chaparral-burns.

16. **C. maritima** Greene. Ascending loosely branched herb becoming 1–3 dm. tall; stems commonly reddish, strigose or frequently hirsute; leaves linear to lanceolate, acutish, usually somewhat contracted at the base, 1–3.5 cm. long, 1–4 mm. wide, commonly hirsute, coarsely pustulate; spikes solitary or geminate, 1–6 cm. long, usually more or less crowded and frequently glomerate, irregularly leafy-bracted throughout; corolla inconspicuous, tubular, 1.4–2 mm. long, 0.5–1 mm. broad; fruiting calyx 1.8–3(–3.5) mm. long, ovate-oblong, stiffly ascending, slightly asymmetrical, tardily deciduous, subsessile;

mature calyx-lobes lance-linear, stiff, connivent, midrib of three abaxial lobes thickened and hirsute, margins appressed short hispid-villous or loosely villous; ovules 2 or 4; nutlets 1–4, heteromorphous; odd nutlet frequently alone developing, smooth, shiny, brownish, oblong-lanceolate, 1–2 mm. long, firmly affixed, next the axial calyx-lobe, groove narrow or closed throughout or opening below into a small areola; consimilar nutlets grayish, minutely tuberculate, readily deciduous, slightly smaller but otherwise like odd nutlet; gynobase subulate, ½–⅔ length of nutlet; style about equalling the height of consimilar nutlets.—Pittonia i. 117 (1887).

Var. **genuina.** Ovules 2; nutlets 1 or 2; calyx not conspicuously pilose.—*Krynitzkia maritima* Greene, Bull. Calif. Acad. Sci. i. 204 (Aug. 1885). *C. maritima* Greene, Pittonia l. c.; Munz & Johnston, Bull. Torr. Bot. Cl. xlix. 38 (1922). *K. ramosissima* of Greene, Bull. Calif. Acad. Sci. i. 203 (Aug. 1885); not *K. ramosissima* Gray (Jan. 1885). *C. ramosissima* of most recent authors.

Nevada to Lower California.

California: Mohave Desert, 1884, *Curran* (G); dry sand hills near Barstow, 700 m. alt., *Spencer 1950* (G); Maillard Canyon near Barstow, 700 m. alt., *Spencer 2088* (G); gravelly hillsides 17.6 km. west of Needles, 210 m. alt., *Munz & Harwood 3611* (UC); Needles, *Jones 3824* (G); desert sand, mouth of Tahquitz Canyon, 180 m. alt., *Spencer 1523* (G); sandy places near Palm Springs, 120 m. alt., *Spencer 1528, 2067, 2068* and *2071a* (G); rocks near Indian Wells, 8 m. alt., *Spencer 1520* (G); sandy places, Schaffer's Canyon near Mecca, 48 m. below sea-level, *Spencer 2069* (G) and *Munz & Keck 4755* (G); Signal Mt., *Abrams 3177* (G); Mason's, Colorado Desert, 1899, *Brandegee* (UC); in sand, Colorado Desert, *Spencer 195a* and *198* (G); Colorado Desert, 1890, *Wright* (UC); Point Loma, 1884, *Orcutt* (G, UC); windswept arroyos, San Nicolas Island, *Trask 56* and *57* (G); Santa Barbara Island, *Trask* (UC); Catalina Island, 1884, *Lyon* (G); Catalina Island, 1890, *Brandegee* (UC). Lower California: northern Lower California, *Orcutt 2257* (UC); Lagoon Head, *Palmer 781* (G, UC); Guadalupe Island, *Palmer 879* (G), *Anthony 241* (G, UC), *Palmer 67* (G), *Greene* in 1885 (G, UC, isotypes of *K. maritima*), *Anthony* in 1896 (UC), *Brandegee* in 1897 (UC); San Benito Island, *Palmer 912* (G), *Pond 21* (G), *Anthony 276* (UC), *Brandegee* in 1897 (UC); Natividad Island, 1897, *Brandegee* (UC); Santa Margarita Island, 1889, *Brandegee* (UC).

Var. **cedrosensis** (Greene), comb. nov. Ovules 4; nutlets 1–4; otherwise as in preceeding variety.—*Krynitzkia cedrosensis* Greene, Bull. Calif. Acad. Sci. i. 204 (1885). *C. cedrosensis* Greene Pittonia i. 117 (1887); Brandg. Bot. Gaz. xxvii. 454 (1899).

Endemic to Cedros Island.

Lower California: Cedros Island, *Palmer 691* (G), *Greene* in 1885 (G, UC, isotypes), *Veatch* (G), *Anthony 289* (G, UC).

Var. **pilosa** Johnston. Ovules 2; nutlets 1 or 2; calyx conspicu-

ously clothed with long white villous pubescence.—Univ. Calif. Pub. Bot. vii. 445 (1922).

Nevada to Lower California, occurring with var. *genuina* but less common.

NEVADA: Logan, 1909, *Kennedy* (UC). CALIFORNIA: Death Valley, *Coville & Funston 480* (G); Furnace Creek, *Parish 10005* and *10050* (UC); Calico, *Parish 9798* (UC); Inyo County, *Rixford* (UC); Kane Springs, Ord Mts., *Hall & Chandler 6807* (UC); Needles, 1884, *Lemmon* (UC); Signal Mt., 1901, *Brandegee* (UC). ARIZONA: Tempe, 1892, *Ganong & Blaschka* (G). LOWER CALIFORNIA: stony ridges, Los Angeles Bay, *Palmer 551* (UC, TYPE; G, ISOTYPE); Santa Agueda, *Palmer 2142* (UC).

A well defined and common species in the Californian deserts and on the coastal islands. The usual form is readily recognized by being biovulate and having reddish strigose stems. It has generally gone as *C. ramosissima* but that name being based on a renaming of *C. racemosa* properly falls into synonymy.

Ser. V. PTEROCARYAE. Nutlets 1–4, tuberculate or papillate or verrucose, lanceolate, with knife-like or conspicuously winged sides, homomorphous or frequently heteromorphous and with the odd nutlet (sometimes alone developing) axial and usually lacking a thin margin; style reaching to tip of nutlet-body or definitely beyond.

Nutlets solitary or rarely 2, usually with a knife-like margin; calyx obliquely conical at base.....17. *C. utahensis.*
Nutlets 4; calyx symmetrical.
  Corolla conspicuous; mature calyx obviously longer than broad; nutlets always homomorphous.....18. *C. oxygona.*
  Corolla inconspicuous; mature calyx nearly as broad as long; axial nutlet frequently wingless.....19. *C. pterocarya.*

17. **C. utahensis** (Gray) Greene. Erectly branched herb 1–3 dm. high; stems closely strigose or more or less appressed short-hirsute; leaves not numerous, strongly reduced above, linear to oblance-linear, 1-5(–7) cm long, 1–4 mm. wide, rounded at apex, commonly pustulate and short-hirsute especially beneath; spikes geminate or sometimes solitary, commonly 0.8–2.5(–5) cm. long, dense, naked; corolla evident, 2–3 mm. broad; fruiting calyces ovate or ovate-oblong, 2–3(–4) mm. long, quite asymmetrical, subsessile by a broadly conic oblique base, spreading or somewhat recurved, deciduous, usually densely appressed-hirsute and notably silky; mature calyx-lobes lanceolate, strongly connivent, midrib thick and usually brownish and infrequently bearing spreading or recurved hairs; ovules 4; nutlets 1 or rarely 2, next the abaxial calyx-lobe, 1.7–2.5 mm. long, 1–1.5 mm. broad, pale, broadly lanceolate, granulate, muricate-

papillate or rarely spinulose, back low-convex or flat, margins sharp-angled or with a very narrow knife-like margin; groove open, narrow, opening into a small areola below; gynobase subulate, ca. ⅔ height of nutlet, not markedly differentiated from style; style usually a trifle shorter than the nutlet.—Pittonia i. 120 (1887). *Krynitzkia utahensis* Gray, Synop. Fl. N. Am. ii. pt. 1, Suppl. 427 (1886). *Eritrichium holopterum*, var. *submolle* Gray, Proc. Am. Acad. xiii. 374 (1878). *C. submollis* Cov. Contr. U. S. Nat. Herb. iv. 166 (1893).

Southern Utah and western Arizona and westward into the deserts of California.

UTAH: volcanic rocks and ashes, Diamond Valley, *Goodding 828* (G, UC); St. George, *Palmer 352* (G, TYPE). ARIZONA: Yucca, *Jones* (G); Yucca, *Jones 3910* (UC). NEVADA: Candelaria, *Shockley 347* (G) and *650* (UC); foot of cliffs, Meadow Valley Wash, *Goodding 2165* in pt. (G); rocky slopes, Mesquite Well, *Goodding 2252* (G); Rhyolite, 1080 m. alt., *Shockley 69* (UC); Gold Mt., *Purpus 5986* (UC). CALIFORNIA: Inyo County, 1891, *Brandegee* (UC); Surprise Canyon, Panamint Mts., 800 m. alt., *Coville & Funston 714* (G); without locality, *Purpus 5433* (G); Providence Mts., *Munz, Johnston & Harwood 4241* (UC); Daggett, 1914, *K. Brandegee* (UC); sandy places near Barstow, *Spencer 2082* and *2093* (G); in sandy places, Palm Springs, *Spencer 1526, 2073, 2074, 2075* and *2076* (G); in sandy places, Mission Canyon, 180 m. alt., *Spencer 1782* (G); Colorado Desert, 1889, *Orcutt* (UC).

A very neat species most readily distinguished by the appressed silky indument on the calyx. It seems to be an ally of *C. pterocarya*. Its rough nutlets at once distinguish it from *C. gracilis* and *C. Watsoni* with which it has been frequently confused.

18. **C. oxygona** (Gray) Greene. Sparsely branched herb 1–4 dm. tall; stems usually solitary with several well-developed ascending branches from near base, appressed villous-hispid or strigose, often sparsely hispid, leaves linear or lance-linear, 1–4(–6) cm. long, 1–2(–3) mm. broad, strigose or short-hispid, ascending, obtusish, densely and inconspicuously pustulate, upper ones evidently reduced; spikes geminate or ternate, usually short and dense, 1–3(–6) cm. long, naked; corolla conspicuous, limb 4–7 mm. broad; fruiting calyces ovate or oblong-ovate, ascending, 2.5–4 mm. long, deciduous, obscurely biserial, symmetrical, base rounded, pedicel ca. 0.5 mm. long; mature calyx-lobes lanceolate, somewhat connivent above, margin more or less silky-strigose, midrib slightly thickened and frequently sparsely hirsute; nutlets 4, homomorphous; body of nutlets oblong-ovate, 2 or rarely 3 mm. long, only slightly shorter than the calyx-lobes, muricate or tuberculate, back low convex; margin of nutlet narrowly winged or knife-like; groove closed or rarely open, broadly forked below where always opened to form a triangular areola; gynobase columnar-

subulate, about ⅔ height of nutlets; style clearly surpassing the nutlets.—Pittonia i. 120 (1887). *Eritrichium oxygonum* Gray, Proc. Am. Acad. xix. 89 (1883). *Krynitzkia oxygona* Gray, Proc. Am. Acad. xx. 277 (1885).

Borders of the San Joaquin Valley and southward along the desert margins to the northern end of the Colorado Desert.

California: Alcalde, 1892, *Brandegee* (UC); Estrella, 1897, *Jared* (UC); open places in rich ground, McKittrick, *Heller 7789* (G, UC); northern slope of Tehachapi, 1905, *K. Brandegee* (UC); Tehachapi, *K. Brandegee* (G, UC); hills bordering the Mohave Desert, 1882, *Pringle* (G, type); mountain slopes, San Bernardino Co., 1200 m. alt., *Spencer 415* (G); without locality, *McLean* (UC); near Minerets, Madera Co., 1899. *Congdon* (UC); hillsides, Erskin Creek, *Purpus 5369* (G, UC); Deep Spring, *Purpus 5825a* (UC); Coyote Canyon, 150 m. alt., *Hall 2849* (UC); between San Jacinto and El Toro Mts. at Van Deventer Ranch, 1350 m. alt., *Hall 1161* (UC). Nevada: Palmetto Range, *Purpus 5897* in part (UC).

This species, although having the gross habit of *C. muricata*, is clearly related to *C. pterocarya* and particularly to the variety *cycloptera*. In fact, decisive characters for separating the two species appear to be lacking. As a general rule, however, *C. oxygona* differs in having conspicuous corollas, narrower usually more silky calyces, and brownish nutlets rarely if ever with scolloped or lobed wings. It is maintained as a species largely because of its natural range, which, generally speaking, is apart from that of *C. pterocarya*. The most satisfactory character for separating *C. oxygona* from *C. pterocarya* seems to be corolla-size. It is significant, however, that a specimen (*Purpus 5715a*) from the South Fork of the Kern River, occurring within the range of *C. oxygona* and having the characteristic habit, calyx and nutlets of that species, nevertheless has minute corollas. For practical purposes this specimen has been refered to *C. pterocarya*.

19. **C. pterocarya** (Torr.) Greene. Erect ascendingly branched herb 1–5 dm. high, finely strigose or short-hirsute; leaves broadly linear or the reduced, upper ones somewhat lanceolate, 1–2.5(–4) cm. long, 1–3(–5) mm. broad, obtuse, strigose or hispid, coarsely pustulate below but usually finely so above, spikes geminate or rarely ternate or solitary, naked or inconspicuously bracted below, 2–6(–12) cm. long, becoming loosely flowered; corolla inconspicuous, 0.5–1(–2) mm. broad; fruiting calyces becoming notably accrescent, usually broadly ovate, (2–)3–5 mm. long and usually about ¾ as broad, tardily deciduous, symmetrical, base obtuse or rounded, pedicels 0.5–1 mm. long; mature calyx-lobes ovate to lanceolate, connivent, only a little surpassing the nutlets, margins more or less tawny appressed-hispid, midrib slightly thickened and weakly and sparsely hispid; nutlets 4,

homomorphous and all winged, or heteromorphous with axial nutlet wingless; body of nutlet oblong-lanceolate or lanceolate, 2–2.5(–3) mm. long, muricate or verrucose; wing-margin of nutlet broad or narrow, entire or crenate or lobed, extending completely around the nutlet or only down the sides; groove open or closed (even in the same plant) and dilated below into an open excavated areola; gynobase slender, about ⅔ height of nutlets; style subulate, slightly surpassing or somewhat surpassed by the wing-margin of the nutlets but always exceeding the body proper.—Pittonia i. 120 (1887).

Var. **genuina.** Nutlets heteromorphous, axial one wingless.—*Eritrichium pterocaryum* Torr. Bot. Mex. Bound. 142 (1859); Bot. Wilkes Exped. 415, t. 13 (1873). *Krynitzkia pterocarya* Gray, Proc. Am. Acad. xx. 276 (1885). *C. pterocarya* Greene, l. c. *E. pterocaryum*, var. *pectinatum* Gray, Proc. Am. Acad. x. 61 (1874). *K. pterocarya*, var. *pectinata* Gray, Proc. Am. Acad. xx. 276 (1885). *C. pectocarya* Frye & Rigg, Northwest Fl. 328 (1912).

Eastern Washington and southern Idaho and southward to Southern California and Utah. Sporadic in Arizona.

WASHINGTON: junction of Crab and Wilson creeks, *Sandberg & Leiberg 260* (G, UC); in sand, Pasco, *Piper 2961* (G); Walla Walla, *Brandegee 995* (G, UC) and *994* (UC); rocky bank of Columbia River near Columbus, *Suskdorf 889* (UC); without locality, *Vasey 421* (G). OREGON: clay bank, Mathew Butte, 750 m. alt., *Leiberg 2041* (G, UC); near Lexington, 400 m. alt., *Leiberg 41* (G, UC). IDAHO: dry open slope, Castleford, *Nelson & Macbride 1739* (G). UTAH: St. George, 1880, *Jones* (UC); southern Utah, 1873, *Bishop* (G); Stansbury Island, *Watson 859* (G). NEVADA: Peavine Hills, 1895, *Hillman* (UC); Pyramid Lake, *Kennedy 998* (UC); Truckee Lake, *Kennedy 1345* (UC); Lawton's Springs, 1894, *Hillman* (UC); Reno, 1890, *Hillman* (UC); Reno, 1884, *Curran* (UC); Reno, 1885, *K. Brandegee* (UC); about Carson City, 1446 m. alt., *Baker 975* (G, UC); Carson City, *Watson 859* (G); Carson City, *Anderson 165* (G); Candelaria, *Shockley 282* (UC); ravine among hills near Mina, *Heller 8365* (G); on scoria on mesa west of Goldfield, *Heller 10971* (G); Gold Mt., *Purpus 5986* (UC); boulder slopes, Moapa, *Goodding 2202* (G, UC); Indian Spring, Clarke Co., 1020 m. alt., *Tidestrom 9026* (G); foot of cliff, Meadow Valley, *Goodding 2165* in pt. (G); stony hillsides, Meadow Valley Wash, *Goodding 974* (G). ARIZONA: near Needles, 1886, *Clark* (UC); Yucca, *Jones 3906* (UC); near Camp Lowell, *Pringle 366* in pt. (G). CALIFORNIA: Honey Lake, 1892, *Brandegee* (UC); Sierra County, *Lemmon* (G); foothills west of Bishop, *Heller 8275* (G); Andrews Camp, Bishop Creek, *Davidson 2698* (G); Andrews Camp near Bishop, *K. Brandegee* (UC); McGee's Meadow near Bishop, *K. Brandegee* (UC); sandhills west of Laws, *Heller 8205* (G); sand, Kramer, *Heller 7668* (G, UC); Keeler, 1891, *Brandegee* (UC); Barnwell, *K. Brandegee* (UC); Leastalk, *Parish 10238* (UC); Granite Wells, *Parish 10138* (UC) and *Johnston 6494* (UC); sand near Barstow, *Spencer 2084* (G); Ord Mts., *Hall & Chandler 6803* (UC); Acton, *Elmer 3716* (G); Descanso, *K. Brandegee* (G, UC).

Var. **cycloptera** (Greene) Macbr. Nutlets homomorphous, all winged.—Contr. Gray Herb. n. s. xlviii. 44 (1916). *Krynitzkia*

cycloptera Greene, Bull. Calif. Acad. Sci. i. 207 (1884). *C. cycloptera* Greene, Pittonia i. 120 (1887).

Southern California to western Texas and sporadic in southern Nevada and Utah and in eastern Colorado.

CALIFORNIA: Inyo, 1891, *Brandegee* (UC); Surprise Canyon, Panamint Mts., 800 m. alt., *Coville & Funston 720* (G); Ord Mts., *Hall & Chandler 6807a* (UC); rocky places, Snow Creek near Palm Springs, 150 m. alt., *Spencer 2065a* (G); desert sand, Palm Springs, 135 m. alt., *Spencer 846* and *847* (G); rocky places, Cathedral Canyon near Palm Springs, 120 m. alt., *Spencer 2079* (G); Coyote Canyon, 150 m. alt., *Hall 2839* (UC); desert sand, Mountain Springs, *Spencer 200* and *856* (G); San Felipe, 1895, *Brandegee* (UC); Colorado Desert, 1896, *Brandegee* (UC); Colorado Desert, *Wright 1764* and *1770* (UC); Colorado Desert, *Spencer 190* (G). NEVADA: sandy places, Charleston Mts., *Purpus 5825* (UC); shade of rocks, Muddy Range, *Goodding 2227* (G); Muddy Valley, *Kennedy & Goodding 24* (UC). ARIZONA: Diamond Creek Canyon, 1893, *Wilson* (UC); northern Arizona, 1893, *Wilson* (UC); Verde River, *Smart 132* (G); hills near Tucson, 1884, *Pringle* (G, ISOTYPE); Tucson, 1894, *Toumey* (UC); Rio Cienega, *Greene 1111* (G); Nogales, 1892, *Brandegee* (UC); Lowell, *Parish 167* (G); Fort Whipple, *Palmer 346* (G). COLORADO: Grand Junction, 1892, *Eastwood* (G). NEW MEXICO: rocky hillsides, south end of Black Range, 1380 m. alt., *Metcalfe 1573* (G). TEXAS: El Paso, *Jones 3753* (UC); Fronteras, *Wright 1570* (G).

This is one of the most interesting species in the genus. Its conspicuously winged nutlets and broad large fruiting calyces are very distinctive. Although for the most part readily determined, it has some forms that are very puzzling. The outstanding variation is the well understood one regarding nutlet-form. As a general rule, the northern material has heteromorphous nutlets, whereas the southern has them homomorphous. Actual intergrades connecting the two forms are rare. In these the axial nutlet is frequently smallest and is more narrowly and less completely winged than the others. The northern plant with heteromorphous nutlets has been commonly taken as the typical form. The specific name was first published in the Mexican Boundary Report. The few notes there given clearly apply to the southern homomorphous form. From internal evidence, however, it is very clear that the Mexican Boundary Report was written subsequently to the Botany of the Wilkes Expedition. Hence the much later publication in the Wilkes Report is primarily considered in typifying the species, especially since in that work the plant was illustrated and fully described. The material from Walla Walla, Washington, collected by Pickering & Brackenridge and illustrated by Torrey is accordingly taken as the type. This material has heteromorphous nutlets. The southern plant with homomorphous nutlets was named *C. cycloptera* by Greene and was subsequently reduced to a variety of *C. pterocarya* by Macbride. It is possible that the

varietal name *pectinata* should be taken up in place of var. *cycloptera*. Gray originally published it as *Eritrichium pterocaryum*, var. *pectinatum*, basing it upon material collected by Parry (numbers *168* and *169*) in the Virgin River Valley near St. George, Utah. Unfortunately, however, Gray hastily mounted collections by Greene and by Palmer on the type sheet of the var. *pectinatum* and it is now quite impossible to decide just which are the original Parry collections. Since both var. *genuina* and var. *cycloptera* are represented on the mixed sheet it seems best to drop the varietal name *pectinatum* as a *nomen confusum*, particularly so since the lobing of the nutlet-wing seems to be too hopelessly variable and unimportant to justify nomenclatorial recognition.

The most puzzling forms of *C. pterocarya* come from southern Nevada and Southern California. Purpus has collected material in the Gold Mountains of Nevada which have very small, scarcely accrescent calyces and a habit suggesting that of *C. utahensis* or *C. gracilis*. The nutlets, though small, are quite like those of typical *C. pterocarya* and it seems best to refer the specimens to that group.

A specimen collected by Munz (number *5746*) above Cactus Flats in the San Bernardino Mts. of California, although clearly related to *C. pterocarya*, may represent an unnamed species. The calyces are rather small and quite hirsute, although with the characteristic broad form of *C. pterocarya*. The nutlets are heteromorphous, but instead of having the odd nutlet wingless, it is winged and the consimilar nutlets are wingless and suggest those of *C. utahensis*. More material of this peculiar variation is greatly desired.

I doubtfully refer to the var. *cycloptera* a collection made by Purpus (number *5715a*) in the South Fork of the Kern River. The specimen has the habit of *C. holoptera*, in fact appears to differ from thoroughly typical members of that species only in having inconspicuous corollas. Since flower-size seems to be the only character capable of separating *C. holoptera* and *C. pterocarya* in a manner that is at all practical and satisfying, I am arbitrarily referring Purpus's collection to *C. pterocarya* although it is realized that in range and habit it unmistakably suggests *C. holoptera*.

Ser. VI. TEXANAE. Nutlets 1–4, tuberculate or papillate, ovate to lanceolate or oblong, with obtuse or rounded sides, decidedly heteromorphous with the odd nutlet (sometimes the only one developing) axial, larger than and usually roughened very differently from the others; style surpassed by odd nutlet.

Nutlets smooth or nearly so.....20. *C. Pattersoni.*
Nutlets coarsely granulate or tuberculate.
Nutlet 1, axial one alone developing; ascendingly branched, usually 2–4 dm. tall.....21. *C. texana.*
Nutlets 4; spreading, usually 1–1.5 dm. tall.
Consimilar nutlets lance-ovate, acuminate, 1.8–2.3 mm. long; areola small and suprabasal; calyx-lobes only moderately thickened.....22. *C. Kelseyana.*
Consimilar nutlets ovate or oblong, acute, ca. 1.5 mm. long; areola large and ventral; calyx-lobes conspicuously thickened, hard.
Spikes bracteate throughout; odd nutlet papillate-granulate.....23. *C. minima.*
Spikes naked; odd nutlet finely granulate and spinular-muricate.....24. *C. crassisepala.*

20. **C. Pattersoni** (Gray) Greene. Loosely branched hirsute herb 1–1.5 dm. high; stems usually several, ascending, branched, hirsute and usually somewhat strigose; leaves oblanceolate 1–3 cm. long, 2–4 mm. wide, rather firm, obtuse, hirsute, more or less pustulate, upper ones little reduced; spikes solitary or geminate, naked, 2–5(–7) cm. long; corolla inconspicuous, 1–1.5 mm. broad; fruiting calyx oblong-ovate, 4–5 mm. long, spreading, slightly asymmetrical, evidently biserial, lowermost becoming 2–6 mm. distant; pedicels ca. 0.5 mm. long; mature calyx-lobes linear-lanceolate, tips more or less connivent, midrib thickened and hirsute, margins appressed hispid; nutlets 4, heteromorphous; odd nutlet next axial calyx-lobe, slightly the largest, ca. 1.9 mm. long, ovate, acute, smooth or obscurely rugulose or sparsely tuberculate, somewhat persistent, standing off slightly from the gynobase; consimilar nutlets oblong-ovate, ca. 1.6 mm. long, deciduous, closely appressed to gynobase, smooth, back convex, sides rounded or obtuse, groove opened or closed and abruptly broadening below into a small triangular areola; gynobase narrow, reaching to ca. ⅔ height of consimilar nutlets; style exceeded by odd nutlet, equalling or a little shorter than consimilar nutlets.—Pittonia i. 120 (1887). *Krynitzkia Pattersoni* Gray, Proc. Am. Acad. xx. 268 (1885).

Mountains of Colorado and Wyoming. Rarely collected.

WYOMING: very dry sandy soil, 32 km. east of Point of Rocks, *Payson 2546* (G); on dry roadsides, Junction Butte, *Nelson 5887* (G). COLORADO: Kremling, *Osterhout 3464* (G); Sulphur Springs, *Osterhout 3559b* (G); without locality, 1875, *Patterson* (G, TYPE); without locality, 1877, *Hooker & Gray.*

This species is related to *C. Kelseyana* and *C. ambigua* and seems to intergrade with both. In habit it is quite like *C. ambigua,* and with immature material alone available it is scarcely possible to distinguish

it from that species. The most troublesome intergrades come from northwestern Wyoming. Certain material from this region has the nutlet next the axillary calyx-lobe slightly more persistent and more erect than the others, and hence suggesting a relationship with *C. Pattersoni*. Despite these suggestive developments the specimens are referred to *C. ambigua*, since for all practical purposes the nutlets are similar in size and shape, and usually indistinguishable in markings and hence quite like those of *C. ambigua*.

The type of *C. Pattersoni* probably came from the Rocky Mountains near Golden, Colorado. The species appears to occur at altitudes somewhat higher than those affected by *C. Kelseyana* and *C. minima*.

21. **C. texana** (A. DC.) Greene. Ascendingly branched hirsute herb 1.5–4 dm. high; stems usually several, with few short branches; leaves oblanceolate 2–5(–7) cm. long, 2–5(–8) mm. wide, obtuse or rounded, not particularly firm, uppermost little reduced; spikes solitary or occasionally geminate or ternate, naked or at times sparsely bracted at base, 4–7(–11) cm. long, not sharply differentiated from leafy mass of plant; corolla inconspicuous, ca. 1 mm. broad; fruiting calyces ovate-oblong, 4–5 mm. long, somewhat asymmetrical, widely spreading or subdeflexed, becoming remote; pedicels short but evident, 0.5–1 mm. long; mature calyx-lobes lance-linear, more or less connivent with the herbaceous tips spreading, midrib indurated and strongly hirsute, margin sparsely short-hispid; ovules 4, only the one next the axial calyx-lobe maturing; nutlet solitary, persistent, broadly ovate, acute, ca. 2 mm. long, pale, densely and evenly coarse-granulate, back convex, sides rounded; gynobase short-oblong, ⅓–¼ as long as the style; style reaching to above the middle of the nutlet.—Pittonia i. 112 (1887). *Eritrichium texanum* A. DC. Prodr. x. 130 (1846). *Myosotis texanae* Hook. Kew Jour. Bot. iii. 295 (1851). *Krynitzkia texana* Gray, Proc. Am. Acad. xx. 268 (1885).

Central and western Texas.

Texas: Llano County, 1885, *Reverchon* (G); dry ground, Austin, *Hall 469* (G); valleys among hills beyond Limpia Pass, *Wright 488* (G); without locality, *Drummond* (G, UC, isotypes); without locality, *Wright* (G).

Evidently related to *C. crassisepala* but quite distinct, since it differs in its more restricted easterly range, looser and taller habit of growth, and coarsely granulate solitary nutlets. Although *C. texana* has four ovules only one nutlet develops, that being the one next the axial calyx-lobe and clearly the homologue of the odd nutlet in *C. crassisepala*. The type of *C. texana* was collected by Drummond probably in the vicinity of Austin.

22. **C. Kelseyana** Greene. Spreading or ascending hirsute herb 5–25 cm. high; stems one to several, hirsute and also hispid-strigose; leaves 1.5–3(–4) cm. long, 2–4 mm. wide, rounded or obtuse, thickish, linear-oblanceolate, hirsute, pustulate, the upper ones scarcely reduced; spikes usually solitary, 4–9 cm. long, naked or with a few bracts near base; corolla inconspicuous, 1–2 mm. broad; fruiting calyx 4–6 mm. long, ovate-oblong, spreading, somewhat asymmetrical, loose or dense; pedicels short but definite, ca. 0.8 mm. long; mature calyx-lobes linear, slightly connivent above, midrib thickened and hirsute, margins inconspicuously villous-strigose; nutlets 4, heteromorphous; odd nutlet next the axillary calyx-lobe, broadly lance-ovate, 2–2.6 mm. long, smoothish or granulate or granulate-muriculate or rarely somewhat tuberculate, standing off slightly from the gynobase; consimilar nutlets lance- or oblong-ovate, 1.8–2.3 mm. long, coarsely tuberculate and commonly granulate, darker than odd nutlet, sides rounded; groove narrow or closed, near base abruptly dilated to form a small triangular areola; gynobase subulate, a little longer than style, ½–⅔ height of consimilar nutlets; style surpassed by odd nutlet and just surpassing or even exceeded by consimilar ones.—Pittonia ii. 232 (1892); Macbr. Contr. Gray Herb. n. s. xlviii. 49 (1916).

Saskatchewan and Montana southward through Wyoming to northern Colorado and Utah.

Saskatchewan: Medicine Hat, *Macoun 5803* in pt. (G); without locality, 1858, *Bourgeau* (G). Montana: scratch gravel near Helena, 1898, *Brandegee 26* (UC); Boulder Desert, 1898, *Brandegee 36* (UC); Elliston, Aug. 1889, *Greene* (G. isotype); Northern Boundary, French Creek to Rocky Mts., 1874, *Coues* (G). Wyoming: Teton National Forest, 1897, *Brandegee* (UC); snow-drift beds, Powder River, *Nelson 9377a* and *9415* (G); C. Y. Horse Ranch, Natroma Co., *Goodding 234* (G); open woods near the river, Ft. Steele, *Nelson 9049* (G); waste ground, Bates Creek, *Goodding 197* (G); sandy plains, Laramie, *Nelson 3171* and *7280* (G, UC); under ledges, Cow Creek, *Nelson 8897* (G, UC); Pole Creek, *Nelson 1335* (G, UC); Laramie Hills, *Nelson 412* (G); Sherman, 1893, *Greene* (UC); Gorfield Peak, *Nelson 672* in pt. (UC); sandy roadside 5 km. north of Saratoga, *Payson 2535* (G). Utah: deep sand, Ogden, *Goodding 1176* (G). Colorado: Kremling, *Osterhout 3464* (G); mountain side near Georgetown, 1885, *Patterson* (G, UC); Castle Rock in foothills near Golden, *Patterson 111* (G); west of Craig, *Osterhout 6188* (G); Rocky Mts., lat. 40°–41°, *Vasey 434* (G).

This plant has been often confused with *C. crassisepala* although quite distinct in range and in structures. It is a larger more loosely branched plant with more elongate less indurated calyx-lobes, narrower ventrally less excavated nutlets, and a range separated from true *C. crassisepala* by half the width of Colorado and Utah. Although frequently growing with *C. minima* it is at once separable by its ebracteate inflorescence and very different nutlets.

23. **C. minima** Rydb. Erect or widely spreading hirsute herb 1–1.5(–2) dm. high; stems usually numerous, branched, finely strigose and coarsely hirsute; leaves oblanceolate, thickish, 1–3 cm. long, 2–4 (–5) mm. broad, obtuse or rounded, hispid or hirsute and usually pustulate, upper ones little reduced and continuing through inflorescence as evident foliaceous bracts; spikes solitary or rarely geminate, bracted, 2–8(–15) cm. long, frequently springing from even the lowest axils; corolla inconspicuous, 1–1.5 mm. broad; fruiting calyces oblong-ovate, 5–7(–9) mm. long, spreading, asymmetrical; pedicels short but definite, 0.5–1.2 mm. long; mature calyx-lobes linear-lanceolate, connivent above, midrib hirsute and strongly indurated and thickened, margins sparsely appressed-hispid; nutlets 4, heteromorphous; odd nutlet persistent, next the axial calyx-lobe, 2–3 mm. long, brownish, very finely and closely papillate-granulate, ovate, acute; consimilar nutlets 1.2–1.5 mm. long, ovate, thickish, strongly tuberculate, not granulate; groove broadly dilated at least to beyond middle, commonly excavated, not forked; gynobase oblong, slightly more than ½ length of consimilar nutlets; style evidently surpassed by odd nutlet, equalling or surpassing consimilar nutlets.—Bull. Torr. Bot. Cl. xxviii. 31 (1901).

Plains east of continental divide from Saskatchewan southward to northern Texas; occuring west of the mountains only in southwestern Colorado.

Saskatchawan: Medicine Hat, *Macoun 5803* in pt. (G). Montana: Great Falls, 1887, *Anderson* (UC). Wyoming: Blue Grass Hills, *Nelson 304* (G, UC). Colorado: Castle Rock near Golden, 1800 m. alt., *Patterson 111* in pt. (G); near Golden, *Greene 301* (G); Ft. Collins, 1896, *Crandall* (UC); lat. 39°–41°, *Hall & Harbour 433* and *434* (G); 10 km. north of Pueblo, *Johnston & Hedgcock 509* (G); Canyon City, *Brandegee 406* (G, UC); Cuchara River, above La Veta, 2100 m. alt., *Rydberg & Vreeland 5697* (NY, type); dry adobe flats and foothills, Paradox, 1620 m. alt., *Walker 155* (G); dry hillsides, Naturita, 1620 m. alt., *Payson 296* (G); without locality, 1842, *Fremont* (G). South Dakota: Bad Lands, 1881, *Hatcher* (UC). Nebraska: Kennedy, 1890, *Bates* (G); Callaway, 1901, *Bates* (G); Harrison, 1890, *Bates* (G); top of butte, Ft. Robinson, 1200 m. alt., *Bessey 1* (G). Kansas: Ellis, 1876, *Watson* (G); plains, Ellis, *Hitchcock 346* (G). Oklahoma: low waste place, Waynoka, *Stevens 598* (G); sandy waste places, Alva, *Stevens 245, 616, 664* and *3040* (G); waste place, Shattuck, *Clifton 3083* and *3139* (G); waste place, Hornbeck's, *Stevens 282* (G). Texas: sandy plains, upper Colorado, *Reverchon 2120* (G); Big Wichita, 1880, *Ball* (G).

Although a very readily recognized species, *C. minima* has not been distinguished from its southerly ranging relative, *C. crassisepala*. *Cryptantha minima* has thick, hardened calyx-lobes and a gross habit very similar to that possessed by *C. crassisepala*, but differs very sharply in having definitely bracted inflorescences and in the fact that

the odd nutlet is simply papillate-granulate rather than covered with spiculate murications. The ranges of *C. minima* and *C. crassisepala* overlap only in southwestern Colorado. In the northern part of its range *C. minima* grows with *C. Kelseyana*, and, strange to say, has been frequently confused with it, although *C. minima* can at once be separated by its stockier nutlets with larger areolae, and, of course, by its bracteate inflorescence.

The name *C. minima* was originally proposed to cover certain material thought to be related to *C. pusilla*. An examination of the type, however, shows clearly that it is a very reduced form of the species here treated, and that though inappropriate, it is the name to be taken up for the bracteate material from the Great Plains until now passing as *C. crassisepala*.

24. **C. crassisepala** (T. & G.) Greene. Erect or widely spreading herb 5–15 cm. high; stems commonly numerous, loosely ascending, branched, hirsute or rarely hispid; leaves oblanceolate, 2–3(–6) cm. long, 3–4(–6) mm. wide, rounded or obtuse, thickish, hirsute, pustulate, the upper scarcely reduced; spikes solitary or rarely geminate, naked or few-bracted below, 5–8(–15) cm. long, frequently produced from the lowest axils; corolla inconspicuous, 1–1.5 mm. wide; fruiting calyces 6–7(–10) mm. long, oblong-ovate, somewhat asymmetrical, becoming distant below; mature calyx-lobes linear-lanceolate, connivent above, midrib very hirsute and strongly thickened and indurated, margins inconspicuously short-hispid; pedicels short but definite, 0.5–1.2 mm. long; nutlets 4 (1 or 2 rarely aborted), decidedly heteromorphous; odd nutlet next the axial calyx-lobe, persistent, 2–2.5(–3) mm. long, brownish, ovate, acute, finely granulate and spinular-muricate; consimilar nutlets readily deciduous, 1.2–1.5(–2) mm. long, oblong-ovate, thickish, coarsely tuberculate, very obscurely if at all granulate, groove usually dilated and commonly excavated to form an areola occupying much of the ventral face of the nutlet; gynobase narrowly oblong, usually about ⅔ height of consimilar nutlets; style equalling or a trifle exceeding the consimilar nutlets, surpassed by odd nutlet.—Pittonia i. 112 (1887). *Eritrichium crassisepalum* T. & G. Pacif. R. R. Rep. ii. pt. 4, 171 (1855). *Krynitzkia crassisepala* Gray, Proc. Am. Acad. xx. 268 (1885). *C. dicarpa* Nels, Proc. Biol. Soc. Wash. xvi. 30 (1903).

Southwestern Colorado and southern Utah southward to western Texas, Arizona and adjacent Mexico.

COLORADO: Deer Run, Gunnison Watershed, 1380 m. alt., *Baker 75* (G); Grand Junction, 1892, *Eastwood* (G, UC); dry sandy flat, Grand Junction,

Macbride & Payson 689 (G). UTAH: Cisco, 1890, *Jones* (G, UC); Price, 1895, *Stokes* (UC); Green River, 1890, *Jones* (UC). NEW MEXICO: Ft. Wingah, *Mathews 40* (G); Gila River bottom near Cliff, 1350 m. alt., *Metcalfe 52* (G, UC); Santa Fe, *Fendler 640* (G); Hueco Mts., *Thurber 61* (G); Albuquerque, *Jones 3709* (UC); mesa west of Organ Mts., 1200 m. alt., 1905, *Wooton* (G, UC); Silver City, *Eastwood 8401* (G). ARIZONA: Camp Lowell, 1883, *Pringle* (UC); Chino Valley, *Tuomey 240a* (UC); Clifton, *Davidson 501a* (UC); Aztec Ruins, Little Colorado, 1905, *Purpus* (UC); Verde Mesa, *Smart 141* (G); Douglas, 1200 m. alt., *Goodding 2273* (G, UC); Tucson, 1907, *Loyd* (G); Bernardino, 1902, *Orcutt* (UC); without locality, 1882, *Pringle* (UC). TEXAS: vicinity of permanent camp on Rio Pecos, April 6–7, 1856, *Pope Exped.* (G, ISOTYPE?); abundant on sandy hills northeast of El Paso, *Hanson 402* (G, NY); western Texas, March 9th, *Wright* (G). CHIHUAHUA: sandy soil, Juarez, 1905, *Purpus* (UC); San Diego, 1800 m. alt., *Hartman 612* (G, UC).

Cryptantha crassisepala is a very interesting and readily recognized species most related to *C. minima*. Although it usually produces four nutlets some forms of it regularly mature only two or three. It is one of these forms, indistinguishable in other respects, that was made the type of *C. dicarpa*. The consimilar nutlets of *C. crassisepala* and *C. minima* are rather thick for their breadth. In this respect, as well as in general contour, they strikingly simulate the nutlets of *C. albida*, a species not closely related. The only material suggestive of a condition intermediate between *C. minima* and *C. crassisepala* is Eastwood's collection from Grand Junction. In that collection nutlets typical of *C. minima* are associated with the naked inflorescence and habit of *C. crassisepala*.

Ser. VII. BARBIGERAE. Nutlets 1–4, verrucose or muricate, lanceolate to ovate-lanceolate, dorsally convex, laterally rounded or obtuse, homomorphous with the abaxial one always developing; style reaching only to ⅓ height of nutlets or in varying degrees longer, sometimes even somewhat surpassing them.

Nutlets normally solitary or rarely 2; style reaching 1/3–1/2 height of nutlets.....25. *C. decipiens.*
Nutlets normally 4; style reaching 2/3 height of nutlets or beyond.
  Spike solitary; style evidently surpassing nutlets.....26. *C. patula.*
  Spike geminate or ternate; style almost always shorter than nutlets.
    Hairs arming calyx-lobes very coarse, subobese; plant usually with an erect central axis; insular endemic....27. *C. foliosa.*
    Hairs arming calyx-lobes slender, not conspicuously thickened; plant irregularly branched.
      Corolla conspicuous; hirsute plants almost confined to coastal drainage of California.....28. *C. intermedia.*
      Corolla inconspicuous; plants of the Great Basin and Californian deserts.
        Plant spreading hirsute.....29. *C. barbigera.*

Plant with appressed hairs.
Nutlets verrucose or verrucose-muriculate.....30. *C. nevadensis*
Nutlets spinular-muricate.....31. *C. scoparia.*

25. **C. decipiens** (Jones) Heller. Loosely branched herb 1–4 dm. high, slender, strigose and frequently short-hispid; leaves rather few, linear, obtuse, 1–3 cm. long, 1–3(–4) mm. broad, strigose and sometimes hispid, minutely pustulate; spikes geminate or rarely ternate or solitary, slender, becoming loosely flowered or congested, 4–10 cm. long, naked; corolla inconspicuous to conspicuous, 0.8–3.5 mm. broad; fruiting calyces ovate to ovate-oblong, strictly ascending, asymmetrical, 2.5–7(–9) mm. long, deciduous, sessile; mature calyx-lobes lance-linear, decidedly connivent above with the tips frequently spreading or even recurving, midrib thickened and usually evidently hirsute, margins strigose, abaxial lobe evidently the longest and most hirsute; ovules 4; nutlets 1 or rarely 2, next the abaxial calyx-lobe, ovate-lanceolate or occasionally narrowly ovate, 1.5–2.4 mm. long, usually granulate or muriculate-granulate, muricate-papillate or low-tuberculate, usually brownish, back convex, sides rounded, groove open or closed but always dilated below to form a definite areola; gynobase short, ⅓–½ height of nutlet; style much surpassed by nutlet, ½–⅔ the height of nutlet.—Muhlenbergia viii. 48 (1912).

Var. **genuina.** Corolla inconspicuous, less than 1 mm. broad.—*Krynitzkia decipiens* Jones, Contr. W. Bot. xii. 6 (1910). *C. decipiens* Heller, l. c.

Southern Nevada, western Arizona and Southern California.

Nevada: Logan, *Kennedy 1838* (G, UC); Rhyolite, 1072 m. alt., *Heller 9632* (G). Arizona: Hot Springs, 1892, *Toumey* (UC). California: Kernville, *Brandegee* (UC); sandy places near Palm Springs, 120 m. alt., *Spencer 2072* (G); desert sand, mouth of Tahquitz Canyon, 210 m. alt., *Spencer 1522* (G); Whitewater, 300 m. alt., *Jones* (UC); without locality, *Palmer 150* (G).

Var. **corollata,** var. nov., a varietate genuina differt corolla conspicua 2–3.5 mm. lata.

Extreme western margin of the Mohave Desert and the adjacent coastal slopes.

California: Fort Tejon, *Xantus 85* (G); Sespe Creek near Ten Sycamore Flat, *Abrams & McGregor 173* (G); Matilija Canyon, Ojai Valley, 1896, *Hubby 20* (G); towards foothills, Ojai Valley, 1896, *Hubby 21* (G, type); Roble Canyon, San Rafael Mts., 1020 m. alt., *Hall 7408* (G, UC); Santa Inez Mts., 1888, *Brandegee* (UC); Huron, Fresno Co., *Brandegee* (UC); without locality, *Brandegee* (UC).

This species is probably most related to *C. intermedia* and *C. nevadensis* and has been somewhat confused with them. It differs, how-

ever, in having a very short style and gynobase and normally but one or rarely two nutlets.

26. **C. patula** Greene. Sparsely and loosely branched herb 5–15(–30) cm. high; stems strigose and sparsely short-hispid; leaves linear or lance-linear, 1–5 cm. long, 1–3 mm. broad, acutish, appressed-hispid, minutely pustulate; spikes solitary, with a few leafy bracts towards the base; corolla medium-sized, tube ca. 2 mm. long, limb 1.5–3 mm. broad, lobes short-oblong, ascending, ca. 1 mm. long, throat funnelform, appendages hemispherical; fruiting calyces ovate-oblong, 5–6 mm. long, obscurely biserial, subsessile, asymmetrical, base broadly conical or rounded; mature calyx-lobes lance-linear, connivent above with the herbaceous tips spreading, margins shortly white-villous, midrib thickened and densely tawny-hispid, abaxial lobe evidently the longest; nutlets 4, homomorphous, ca. 1.9 mm. long, oblong-ovate, acute, finely tessellate-granulate, tuberculate or muricate, base somewhat truncate, back convex, groove closed or nearly so and divaricately forked at base, at times open at the fork to form a small triangular areola; gynobase subulate, almost as long as the nutlets; style evidently surpassing nutlets.—Pittonia i. 265 (March 1889). *C. Pondii* Greene, l. c. 291 (April 1889).

Middle western Lower California and adjacent islands.

Lower California: San Bartolomé, 1889, *Pond* (G, isotype of *C. Pondii*); San Benito Island, 1897, *Brandegee* (G, UC).

Although probably most related to *C. intermedia* this species is readily separated by its solitary spikes and extreme southern range. *Cryptantha Pondii* is clearly a synonym. Although Greene described it as having "smooth and shiny" nutlets and ternate or quadrinate spikes the isotype sent Gray has granulate and tuberculate nutlets and solitary spikes as described above.

27. **C. foliosa** Greene. A stiffly erect divaricately branched herb 6–20 cm. high; stems solitary, straight, usually forming a conspicuous central axis, short-hispid below but becoming somewhat strigose above, branches well developed, widely spreading; leaves lanceolate to broadly linear, obtuse or rarely acutish, 2–6 cm. long, 2–5(–7) mm. broad, appressed-hispid, abundantly and minutely pustulate; spikes dense, 1–4 cm. long, geminate or ternate, naked; corolla evident, limb 2–3 mm. broad; fruiting calyces ovate-oblong, stiff, 5–7 mm. long, strongly biseriate, subsessile, subpersistent, base roughly conical; mature calyx-lobes lance-linear, towards the tips herbaceous and somewhat spreading, towards base indurated, thickened midrib armed with short

excessively coarse almost inflated pungent tawny hairs, margin strigose; nutlets 4, homomorphous, narrowly ovate, acute, ca. 1.5 mm. long, brownish and somewhat mottled, finely tessellate-granulate, tuberculate or muricate, back convex, edges obtusely angled, base rounded, groove narrowly dilated towards base where divaricately forked and closed; gynobase narrow, ca. 0.8 mm. long, ca. ⅔ height of nutlets; style reaching tip of nutlets.—Pittonia i. 113 (1887). *Krynitzkia foliosa* Greene, Bull. Calif. Acad. Sci. i. 205 (1885).

Endemic to Guadalupe Island, off the west coast of Lower California.

Lower California: Guadalupe Island, *Palmer 68, 842* and *877* (G), *Anthony 238* (G, UC), *Greene* in 1885 (G, UC, isotypes), *Townsend* (UC), *Brandegee* in 1897 (UC).

Readily recognized because of its peculiar habit of branching, congested spikes, coarsely armed calyx-lobes and small nutlets.

28. **C. intermedia** (Gray) Greene. Erectly branched commonly stiff and very hirsute herb 1.5–5 dm. high; stems several or solitary, erect, commonly hirsute but frequently more or less strigose; leaves lanceolate to linear or rarely somewhat oblanceolate, acute to obtuse, 2–6(–7.5) cm. long, 1–5(–7) mm. broad, hirsute or strigose, usually inconspicuously pustulate; spikes naked, geminate to quinate but commonly ternate, 5–15 cm. long, usually stiff; corolla conspicuous, 2–8 but commonly about 5 mm. broad; fruiting calyces ovate-oblong, 2–7 but commonly 4–6 mm. long, ascending or strict, deciduous, slightly asymmetrical, lowermost not conspicuously biserial, pedicels ca. 0.5 mm. long; mature calyx-lobes lance-linear, connivent above with tips usually spreading or recurving, margin appressed-hispid or short-villous, midrib thickened and pungently hirsute, abaxial lobe longest and most hirsute; nutlets commonly 4, homomorphous, lance-ovate, ca. 2 (1.5–2.3) mm. long, more or less coarsely and decidedly tuberculate or verrucose, frequently somewhat granulate, grayish or brownish, margins slightly angled, back convex, groove narrow or closed but gradually dilated towards base into a small triangular areola; gynobase ⅔–¾ height of nutlets, narrow; style usually about reaching the nutlet-tips or rarely slightly surpassing or surpassed by them.—Pittonia i. 114 (1887). *Eritrichium intermedium* Gray, Proc. Am. Acad. xvii. 225 (1882). *Krynitzkia intermedia* Gray, Proc. Am. Acad. xx. 273 (1885); Synop. Fl. N. Am. ii. pt. 1, Suppl. 426 (1886). *C. quentinensis* Macbr. Contr. Gray Herb. n. s. lvi. 58 (1918). *C. barbigera*, var. *Fergusonae* Macbr. l. c. 59. *C. intermedia*, var. *Johnstonii* Macbr. l. c. 59.

Coastal drainage from northern California to northern Lower California, and infrequent along the desert borders.

BRITISH COLUMBIA: probably introduced in ballast, vicinity of Victoria, *Macoun 672* (G). CALIFORNIA: Scott River Valley, 1899, *Gilbert* (UC); Castilla, *Eastwood 1366* (G); McCloud River near fish hatchery, *Heller 13021* (G); near Redding, *Heller 7883* in pt. (G); Hyampom, 1883, *Rattan* (G); Berry Canyon near Clear Creek, *Heller & Brown 5510* (G); 16 km. east of Alder Springs, *Heller 11461* (G); Colusa Co., 1884, *Curran* (G); Stony Creek, Colusa Co., *Rattan 43* (G); north side of Marysville Butte, *Heller 11368* (G); St. Helena, 1896, *Jepson* (G); Oakley, 1900, *The Postmaster* (UC); table hills near Sheepranch, *Davy 1622* (UC); San Antonio Creek, *Davy 1567* (UC); Rancho Encinal, Monterey Co., 1903, *Kellogg* (G); Carmel River above Mission, *Heller 6587* (G); Soledad, 1881, *Congdon* (UC); Aliso Canyon, 1897, *Barber* (UC); Cuyama, 1896, *Eastwood* (UC); Ellwood, *Eastwood 10* (G, UC); Painted Cave Ranch, *Eastwood 67* (G, UC), Santa Barbara, *Rothrock 88* (G); Santa Barbara, *Elmer 3866* (G); Ojai Valley, 1896, *Hubby 22* (G); Saugus, 1889, *Brandegee* (UC); Saugus, 1901, *Davy* (UC); San Fernando Wash, 1913, *Eastwood* (G); San Fernando Mts., 1882, *Nevin* (G, UC); San Fernando, *Nevin* (UC); Los Angeles, *Nevin* (UC); Los Angeles, *Gambel* (G); Los Angeles, 1880 to 1882, *Nevin* (G, including TYPE of *C. intermedia*); sandy creek margin, Verdugo Canyon, *Macbride & Payson 748* (G); Elysian Park, 1901, *Setchell* (UC); Santa Monica Experiment Station, *Barber 48* (UC); Topango Canyon, 1916, *Crawford & Hiatt 257* (G); Playa del Rey, *Abrams 2512* (G, UC); San Pedro, 1889, *Brandegee* (UC); dry hillsides back of Laguna Beach, 150 m. alt., *Johnston 1934* (G); Santa Catalina Island, 1890, *Brandegee* (UC); Santa Catalina Island, *Grant 242* (UC); Santa Clemente Island, 1880, *Nevin & Lyon* (G, a peculiar form); hills near Pomona, *Baker 4744* (G); Claremont, *Chandler* (UC); Claremont, *Baker 4137*, *4769* and *4773* (G); Claremont, *Johnston 1938* (G, TYPE of *C. intermedia*, var. *Johnstonii*); San Antonio Canyon, *Johnston 2046*, *2047*, *2048* and *2049* (G); near Upland, *Parish 11154* (G, UC), *Johnston 1957*, *1959* and *1960* (G); east of Victorville, *Spencer 838* (G); rocky hillside, Victorville, 900 m. alt., *Munz & Harwood 3472* (UC); near Barstow, *Spencer 290*, *294* and *2083* (G); Mohave Desert, *Lemmon 207* (G); vicinity of San Bernardino, *Parish 929* (UC), *1215* (G), *3660* (G, UC), *6940* (UC), *11117* (UC), *11299* (UC); San Bernardino, *Wright 98* (G); Colton, 1882, *Cleveland* (UC); Highland, *Spencer 1112* (G); vicinity of Riverside, *Hall 2991* (UC); San Jacinto Valley, 1897, *Reinhardt* (UC); Winchester, *Hall 399* (UC); Thomas Valley, *Hall 2180* (UC); Hemet Valley, 1890, *Orcutt* (UC); Hemet Valley, *Munz 5784* (G); Van Deventers, *Hall 1161* (UC); Saunders Meadow, San Jacinto Mts., *Spencer 2275* (G); Maillard Canyon near Banning, *Spencer 2087* and *2063* (G); Snow Creek near Palm Springs, *Spencer 2065b* (G); Cabazon Station, *Abrams 3214* (G); Palm Springs, *Spencer 850*, *851*, *852* and *863* (G); Palm Springs, *Ferguson 42* (G, TYPE of *C. barbigera*, var. *Fergusonae*); Tahquitz Canyon, *Spencer 1518* (G); Mission Canyon, *Spencer 1783* (G); dry hills 5 km. east of Murietta, 450 m. alt., *Munz & Johnston 5317* (UC); Moro Hills near Fallbrook, *Abrams 3317* (G); Foster, *Hall 3883* (UC); Mesa Grande, *Spencer 1179* (G); Ramona, 1894, *Brandegee* (UC); Witch Creek, 1894, *Alderson* in pt. (G); Descanso Grade, 1906, *K. Brandegee* (UC); Del Mar, 1894, *Brandegee* (UC); La Jolla, *Clements 106* (G, UC); and *107* (G); Point Loma, *Eastwood 2937* (G); Point Loma, 1903, *K. Brandegee* (UC); San Diego, *K. Brandegee* (UC); San Diego, *Greene* (UC); San Diego, *Spencer 36*, *37*, *1348*, *1349* and *1350* (G); San Diego, *Palmer 257* (G); San Diego, *Brandegee 3416* (G, UC) Laguna Mts., *Spencer 922*, *923*, *929* and *938* (G); Laguna, 1885, *Cleveland 920*, *921* and *2275* (G); near Campo, 1885, *Orcutt 1278* (UC); near Campo, *Abrams 3556* (G). LOWER CALIFORNIA: Todos

Santos Island, *Anthony 213* (G, UC) and *204* (G); Ensenada, 1889, *K. Brandegee* (UC); Burro Canyon, 1895, *Brandegee* (UC); Cariso Creek, 1893, *Brandegee* (UC); San Quentin Bay, *Palmer 608* (UC) and *695* (G, TYPE of *C. quentinensis;* UC, ISOTYPE); without locality 1883, *Orcutt* (G).

A variable and perplexing species the sharp delimitation of which seems quite impossible. At the northern extreme of its range it passes into *C. Hendersoni*. But outside the zone of intergradation in the northernmost counties of California, *C. intermedia* is readily distinguished from the more northerly ranging *C. Hendersoni* by having narrower, lance-ovate, strongly verrucose nutlets and decidedly pungent hairs on stem and calyx. In the southern part of its range *C. intermedia* passes even more completely into *C. barbigera* and *C. nevadensis*. The two latter species inhabit the desert and probably represent modifications of the *C. intermedia*-stock as adaptations to that extreme environment. Material transitional between *C. intermedia, C. barbigera* and *C. nevadensis* comes from the western margin of the Californian deserts or from the hot interior coastal valleys more or less connected with the desert proper. *Cryptantha barbigera* and *C. nevadensis* differ from *C. intermedia* primarily in their minute corollas. *Cryptantha barbigera* appears to be a derivative of *C. intermedia* with bristly stems and evidently villous as well as hirsute calyces. On the other hand, *C. nevadensis* has tended to develop a wiry habit, strigose pubescence and very elongate nutlets. Intergradation among them being beyond question, *C. Hendersoni, C. intermedia* and *C. nevadensis*, with much justification, might be treated as mere varieties of *C. barbigera*. It seems best to adhere to the traditional classification, however, and retain the four groups as specific, since such an extended concept as their union would be unwieldy. As various other species in this genus are more or less connected by local intergradation an unfortunate precedent might be set if, in the present instance, drastic reductions were made because of the occurrence of local transition.

The species varies considerably in pubescence. Though the plant is sometimes closely short-strigose, the common form is densely pungent-hirsute throughout. In some forms the calyx is appressed-hispid, in others hispid-villous or even somewhat silky, though the midrib of the calyx-lobe is practically always more or less pungent-hirsute. *Cryptantha quentinensis* is a form which is not hirsute and has a rather silky calyx. It is clearly a phase of *C. intermedia* and is not a relative of *C. oxygona* as its author suggests. *Cryptantha barbigera*, var. *Fergusonae* is a form of *C. intermedia* with rather long-villous calyx-lobes. The type is one of the suite of puzzling plants from the desert

border which connect *C. barbigera* and *C. intermedia*. *Cryptantha intermedia*, var. *Johnstonii* differs from *C. barbigera*, var. *Fergusonae* only by not being conspicuously villous on the calyx. It appears to be one of the very large-flowered, coarse phases of *C. intermedia*. Material of *C. intermedia* from the eastern margin of the Colorado Desert not infrequently has the style definitely surpassing the nutlet-tips whereas that from other regions seems uniformly to have the style not reaching beyond the nutlets.

29. **C. barbigera** (Gray) Greene. Erectly branched hirsute herb 1–4 dm. high; stems solitary or several, very bristly and sparsely if at all strigose; leaves oblong to lance-linear, obtuse, 1–5(–7) cm. long, 3–7(–13) mm. broad, hirsute, inconspicuously pustulate; spikes geminate or rarely solitary or ternate, naked, becoming as much as 15 cm. long; corolla inconspicuous, limb 1–2 mm. broad; fruiting calyx 5–10 mm. long, ovate-oblong or oblong-lanceolate, ascending, asymmetrical, deciduous; pedicels 0.3–0.7 mm. long, villous; mature calyx-lobes lanceolate to linear-lanceolate, connivent above with tips recurved, margin conspicuously long white-villous, midrib thickened and hirsute, abaxial lobe slightly the longest; nutlets 1–4, homomorphous, lance-ovate, 1.5–2.5 mm. long, strongly verrucose, usually brownish, back convex, edges obscurely angled or rounded, groove opened or closed but towards base gradually dilated to form a triangular areola; gynobase narrow, $\frac{2}{3}$–$\frac{3}{4}$ height of nutlets; style reaching to or slightly beyond the nutlet-tips.—Pittonia i. 114 (1887). *Eritrichium barbigerum* Gray, Synop. Fl. N. Am. ii. pt. 1, 194 (1878). *Krynitzkia barbigera* Gray, Proc. Am. Acad. xx. 273 (1885). *K. mixta* Jones, Contr. W. Bot. xiii. 6 (1910).

Southern California and southern Utah, to Arizona and northern Lower California.

UTAH: deep sand, Diamond Valley, *Goodding 889* (G, UC); St. George, 900 m. alt., *Jones 5106* (UC, ISOTYPE of *K. mixta*); Utah, *Parry 171* (G, TYPE of *E. barbigerum*); without locality, *Palmer 348* (G). CALIFORNIA: floor of canyon, Silver Canyon in White Mts. east of Laws, *Heller 8270* (G, UC); Providence Mts., *Munz, Johnston & Harwood 4281* (UC); Baxter, *Parish 9869* (UC); sandy places near Barstow, 900 m. alt., *Spencer 2089* and *2092* (G); Victor, 780 m. alt., 1903, *Jones* (UC); Mohave Desert, 1880, *Lemmon* (G); sandy canyon floor, Palm Canyon, 300 m. alt., *Johnston 1053* (G); Palm Canyon, 210 m. alt., *Spencer 1513* (G); crevices of rocks near Indian Wells, 105 m. alt., *Spencer 1519* (G); Canyon Springs, *Hall 5856* (UC); desert sand, Indio, 90 m. alt., *Spencer 1516* (G); sandy wash and among rocks in lower hillsides, Shavers Well near Mecca, 75 m. alt., *Munz & Keck 4757* (G, UC); San Felipe Creek, *Eastwood 2710* (G); San Felipe Creek, 1894, *Brandegee* (UC); desert sand, Mountain Springs, 780 m. alt., *Spencer 187, 200a* and *862* (G); sandy p'aces, Colorado Desert, *Spencer 189* and *191* (G); Colorado Desert, 1889, *Brandegee* (G); Colorado Desert, *Orcutt 2264* (UC). ARIZONA: Diamond

Creek, 1893, *Wilson* (UC); near Tempe, 1897, *Bolton* (UC); Verde Mesa, *Smart 126* (G); Nogales, 1892, *Brandegee* (UC); Benson, 1882, *Dunn* (UC); Patagonia Mts., 1902, *Orcutt* (UC); Clifton, *Rusby 285* (UC); Clifton, *Davidson 174a* (UC); mesas near Camp Lowell, 1881, *Pringle* (G); Tucson, 1894, *Toumey* (UC); Sabino Canyon, 1894, *Toumey* (UC); Tucson Mts., *Thornber 532* (UC); Tucson, 1907, *Loyd* (G); Yucca, 1912, *Wooton* (G); without locality, 1876, *Palmer* (G). LOWER CALIFORNIA: San Telmo, 1893, *Brandegee* (UC); San Esteban, 1889, *Brandegee* (UC); Lagoon Head, *Palmer 780* (G, UC); San Luis, 1889, *Brandegee* (UC); San Sebastian, 1889, *Brandegee*.

When Gray originally described *Eritrichium barbigerum* he had before him materal now referred to *C. barbigera*, *C. nevadensis* and *C. intermedia*. The plant here treated as *C. barbigera* constituted the bulk of the material first described as *E. barbigerum* and almost wholly that which he later designated as *Krynitzkia barbigera*. Parry's number 171, which is taken as type, is a large and very fine example of the species, having coarse leaves, and very elongate, apically recurved, long-villous calyx-lobes. In some of its forms the species is scarcely more than a minute-flowered phase of *C. intermedia*. When typically developed it is very characteristic because of its large leaves and conspicuously villous, elongate calyx-lobes.

30. **C. nevadensis** Nels. & Kenn. Slender, strigose herb 1–5 dm. high; stems erect or becoming flexuous, solitary or several, closely short-strigose and at times sparsely hirsute, closely or laxly branched; leaves linear-oblanceolate to linear, acute or obtuse, 1–4 cm. long, 1–5(–7) mm. broad, not numerous, appressed-hispid, more or less pustulate; spikes geminate or ternate, occasionally bracted toward the base, congested and somewhat glomerate or elongate and becoming 15 cm. long; corolla inconspicuous, limb 1–2 mm. broad; fruiting calyx oblong-ovate to lanceolate, 5–12 mm. long, ascending, slightly asymmetrical, pedicels ca. 0.5 mm. long; mature calyx-lobes lanceolate or linear, connivent above with the slender tips usually recurving, margins more or less villous, midrib thickened and hirsute; nutlets 4, homomorphous, verrucose or towards the tip muriculate, lance-ovate to lanceolate, 2–2.9 mm. long, back convex, margins somewhat angled, groove open or closed but below dilated into a small areola; gynobase narrow, ⅔–¾ length of nutlets; style reaching to or almost to the tips of the nutlets.—Proc. Biol. Soc. Wash. xix. 157 (Nov. 1906).

Var. **genuina**. Stems very slender, usually flexuous, strigose; calyx 8–12 mm. long; nutlets lanceolate, long acuminate, back verrucose but conspicuously muricate towards the apex, ca. 2.5 mm. long. —*C. nevadensis* Nels. & Kenn. l. c. *Krynitzkia barbigera*, var. *inops* Brandg. Zoe v. 228 (Sept. 1906). *C. barbigera*, var. *inops* Macbr. Proc. Am. Acad. li. 548 (1916). *C. arenicola* Heller, Muhl. ii. 242

(Dec. 1906). *C. leptophylla* Rydb. Bull. Torr. Bot. Cl. xxxvi. 678 (1909).

Deserts from Utah and Nevada to Arizona and northern Lower California.

UTAH: St. George, *Palmer 350* (NY, TYPE of *C. leptophylla*). NEVADA: Trinity Mts., 1500 m. alt., *Watson 850* (G); stony north slope, Moapa, *Goodding 2201* (G, UC); Rhyolite, 1072 m. alt., *Heller 9657* (G); foot of cliffs, Meadow Valley, *Goodding 2165* (G); open sand, Candelaria, 1800 m. alt., *Shockley 288* (UC). ARIZONA: Grand Canyon, 1888, *Gray* (G); Diamond Creek, 1893, *Wilson* (UC); Yucca, 1912, *Wooton* (G); without locality, 1876, *Palmer* (G). CALIFORNIA: Swansea, *Hall & Chandler 7178* (UC); Panamint Canyon, *Hall & Chandler 7038* (G, UC); sand hills west of Laws, *Heller 8203* (G, UC); Surprise Canyon, 640 m. alt., *Coville & Funston 700* (G); The Needles, 1884, *Jones* (UC); Kramer, 1905, *K. Brandegee* (UC); Tehachapi, 1905, *K. Brandegee* (UC); around and under small bushes, Barstow, *K. Brandegee 157* (G, UC); 16 km. east of Daggett, 600 m. alt., *Munz & Harwood 3672* (UC); Hesperia, 1050 m. alt., *Parish 4850* (UC); sandy places, Mohave Desert, 300 m. alt., *Spencer 438* (G); dry sandy plain, 5 km. east of Warren's Well, 960 m. alt., *Munz & Johnston 5176* (G); deep sand at mouth of Tahquitz Canyon, 210 m. alt., *Spencer 1525* (G); deep sand, Palm Springs, 135 m. alt., *Spencer 848* (G); San Felipe, 1898, *Purpus* (UC); desert sand, Mountain Springs, 678 m. alt., *Spencer 188* and *859* (G); sand, Colorado Desert, *Spencer 184* (G); gravelly hills, Colorado River, 1854, *Bigelow* (G). LOWER CALIFORNIA: mountains of northern Lower California, *Orcutt 1279* (UC).

Var. **rigida**, var. nov., erecta non rariter plus minusve hirsuta; calycibus 5–10 mm. longis; nuculis oblongo-ovatis acutis verrucosis ca. 2 mm. longis.

Western portion of Mohave Desert and neighboring coastal slopes; also in western Arizona.

CALIFORNIA: Bakersfield, *Davy 1875* (UC); Poso Creek, *Hall & Babcock 5014* in pt. (UC); sandy soil, Pampa Station, *Heller 7645* (G, UC); high ridge west of McKittrick, *Heller 7788* (G, UC); Fort Tejon, *Xantus 85* (UC); Mohave, *Davy 2161* (UC); Palmdale to Little Rock, *Davy 2291* (UC); Llano Verde, *Davy 2306* (UC); desert sand, Hesperia 930 m. alt., *Spencer 389*, *403* and *419* (G); sand, Mohave Desert, *Spencer 411* and *555* (G); hills bordering Mohave Desert, 1882, *Pringle* (G, TYPE). ARIZONA: Wickenburg, *Jones 343* (G); Verde Mesa, *Smart* (G).

This species was first described as *Krynitzkia barbigera*, var. *inops*. If the varietal name is to be accepted it is only after *C. intermedia* has been reduced to a variety of *C. barbigera*. *Cryptantha nevadensis*, var. *genuina* is a striking plant on account of its wiry, strigose, usually flexuous stems, very elongate calyces and lanceolate attenuate nutlets. Its habit is suggestive of *C. dumetorum*, since it grows in shelter of shrubs and frequently scrambles up through them. The stems are also very brittle. The variety *rigida*, with which the var. *genuina* is confluent, has the habit and nutlets of some forms of *C. intermedia*.

From that species it differs in its small corollas and in invariably having strigose pubescence. The variety intergrades with *C. intermedia* and through it *C. nevadensis*, var. *genuina* is related to *C. intermedia* and eventually to *C. barbigera*. The axial nutlet of *C. nevadensis*, var. *genuina* is frequently somewhat smoother than the others and usually has a closed groove.

31. **C. scoparia** Nels. Erectly branched stiff usually strigose herb 1–3.5 dm. high; stems closely short-strigose and frequently also sparsely hispid; leaves linear to lance-linear, obtuse, 2–4 cm. long, 1–3 mm. broad, strictly ascending, strigose or appressed-hirsute, finely pustulate; spikes stiff, naked, solitary or geminate, 2–10 cm. long; corolla inconspicuous, tube about equalling calyx, limb ca. 1 mm. broad; fruiting calyx ovate-oblong, 5–6 mm. long, strictly ascending, subsessile, slightly asymmetrical, becoming rather obscurely biserial at maturity and 5–10 mm. distant; mature calyx-lobes lance-linear, stiffish, usually subconnivent above with the herbaceous tips somewhat spreading, midrib thickened and hirsute, margins shortly canescent-villous, axial lobe slightly the longest; nutlets 4, homomorphous, lanceolate to broadly lanceolate, 1.8–2.2 mm. long, antrorsely spinulose-muriculate especially towards apex, margins and base rounded, groove narrow and forked below where occasionally open to form a small triangular areola; gynobase subulate, about ¾ height of nutlets; style reaching to tip of nutlets.—Bot. Gaz. liv. 144 (1912); Macbr. Contr. Gray Herb. n. s. xlviii. 48 (1916). *C. muriculata*, var. *montana* Nels. Erythea vii. 69 (1899).

Southwestern Wyoming, southern Idaho and eastern Washington.

WYOMING: Granger, 1898, *Nelson* (G, ISOTYPE of *C. muriculata*, var. *montana*). IDAHO: loose, disturbed soil near road, Challis, 1620 m. alt., *Macbride & Payson 3221* (G); Big Butte Station, *Palmer 204* (G); Aberdeen, *Piper 5030* (G); sagebrush land, Minidoka, *Nelson & Macbride 1801* (G), *1311* (G, ISOTYPE of *C. scoparia*); dry slopes, Castleford, *Nelson & Macbride 2231* (G); Buhl, *Nelson & Macbride 1703* (G). UTAH: Ogden Hot Springs, 1903, *Stokes* (UC). WASHINGTON: plains, Morgan's Ferry, *Suksdorf 405* (G) and *1494* (UC).

In gross habit much suggesting *C. nevadensis*, but differing in its shorter fruiting calyces and particularly in its spinulose nutlets. In addition to these morphological differences the ranges of *C. nevadensis* and *C. scoparia* are separated by the northern half of Nevada.

Ser. VIII. MURICATAE. Nutlets 4, verrucose or coarsely tuberculate, triangular-ovate, decidedly homomorphous, back obtuse and bearing a suggestion of a medial ridge, with sides evidently

angled and beaded; style usually surpassing the nutlets though rarely only equalling them.

32. **C. muricata** (H. & A.) Nels. & Macbr. A tawny-green erect hirsute herb 1–10 dm. tall; stems solitary or several, conspicuously hirsute and rarely also short appressed-hirsute, usually stiff, branches few and ascending or paniculate; leaves linear to oblance-linear, 1–5(–9) cm. long, 2–4 mm. broad, villous-hirsute, usually inconspicuously pustulate; spikes few to very numerous, naked, geminate to quinate, 2–15 cm. long; corolla minute to conspicuous, 1–7 mm. broad; appendages well developed; fruiting calyx, ovate, 2–4 mm. long, deciduous, subsessile, older ones obscurely biserial; mature calyx-lobes lanceolate, decidedly connivent, once to twice length of nutlets, margins short-hispid, midrib thickened and tawny-hirsute; nutlets 4, homomorphous, ovate-triangular, 1.5–2.5(–3) mm. long, lucid or dull, verrucose or tuberculate, frequently somewhat granulate, margin angled and usually beaded, base truncate, back frequently obtuse-angled, groove narrow or closed and towards base broadly forking or dilated into a small areola; gynobase elongate, about $^4/_5$ length of nutlets; style much surpassing the nutlets or rarely scarcely reaching them.—Bot. Gaz. lxi. 42 (1916).

Var. **genuina.** Corolla conspicuous, 2–7 mm. broad; stems with (usually a few) well developed terminally floriferous lateral branches; spikes for the most part not especially numerous.—*Myosotis muricata* H. & A. Bot. Beechey 369 (1840). *C. muricata* Nels. & Macbr. l. c. *Eritrichium muriculatum* A. DC. Prodr. x. 132 (1846). *Krynitzkia muriculata* Gray, Proc. Am. Acad. xx. 273 (1885). *C. muriculata* Greene, Pittonia i. 113 (1887). *C. horridula* Greene, Pittonia v. 55 (1902).

Western California in and along the Coast Ranges from Monterey to Los Angeles counties.

California: Point Sur, 1888, *Brandegee* (UC); Sur River, 1893, *Eastwood* (UC); Salinas River, 1885, *Curran* (UC, isotype of *C. horridula?*); Santa Lucia, 1897, *Plaskett* (UC); Pine Mts. back of San Simeon Bay, *Palmer 376* (G, UC); San Simeon, 1888, *Brandegee* (UC); Salinas River near Poza, 1902, *Eastwood* (G, UC); Painted Cave Ranch, *Eastwood 66a* (G); Santa Barbara, 1889, *K. Brandegee* (UC); dry hills near sea, Ventura, *Brewer 232* (G, UC); Topatopa Mts., 1650 m. alt., *Abrams & McGregor 94* (G); Santa Clara River, 1885, *Gray* (G); creek arroyo, Ojai Valley, *Hubby 24* (G); Sulphur Mt., *Hubby 23* (G); Oakgrove Canyon, Liebre Mts., 900–1200 m. alt., *Abrams & McGregor 343* (G); Leonis Valley, Antelope Valley, *Davy 1648* (UC); creek bed, Saugus, *K. Brandegee* (G, UC); Topango Canyon, Santa Monica Mts., *Crawford & Hiatt 326* (G); Sepulveda Canyon, Santa Monica Mts., *Abrams 2555* (G, UC); South Beach, 1898, *Barber* (UC); Los Angeles, 1880, *Nevin* (G); Pasadena, *Grant 238* in pt. (G); without locality, *Douglas* (G, isotype of *M. muricata*).

Var. **Jonesii** (Gray) Johnston. Corolla inconspicuous, 1–2.5 mm. broad; stems commonly solitary and erect or several and fastigiate, clothed to below middle with numerous very short floriferous branchlets; spikes usually short, very numerous, grouped to form an elongate leafy paniculate inflorescence.—Plant World xxii. 114 (1919). *Krynitzkia Jonesii* Gray, Proc. Am. Acad. xx. 274 (1885). *C. Jonesii* Greene, Pittonia i. 113 (1887). *C. vitrea* Eastw. Proc. Calif. Acad. Sci. ser. 3, ii. 292 (1902); Fl. S. Fk. Kings River 77 (1902).

Middle and Southern California and the northern part of Lower California.

California: gravelly slopes, Alder Springs, Glenn Co., *Heller 11449* and *11450* (G); Lake County, 1898, *Purpus* (UC); Mt. St. Helena, *K. Brandegee* (G, UC); Tamalpais, 1892, *Bioletti* (G); along railroad above West Point, Tamalpais, 1907, *K. Brandegee* (UC); Mt. Tamalpais, 1899, *Congdon 40* (G); Tamalpais, 1892, *K. Brandegee* (UC); above Whitlocks, Mariposa Co., 1897, *Congdon 52* (G); Yosemite, 1897, *Congdon 41* (G); Leavitts Meadow, 1898, *Congdon* (G); Bubbs Creek, S. Fk. of Kings River, 1899, *Eastwood* (G, part of type of *C. vitrea*); Tenaya Trail, Yosemite Nat. Park, 1650 m. alt., *Hall 8940* (UC); Ben Lomond, Santa Cruz Co., 1890, *Brandegee* (UC); Soledad, 1882, *Jones* (G); Santa Cruz, *Jones 2810* (G, type of *K. Jonesii*); above Alma Soda Springs near "French Settlement," Santa Clara Co., *Heller 7491* (G, UC); Santa Cruz Island, 1888, *Brandegee* (UC); Santa Cruz Island, 1886, *Greene* (UC); dry sandy ground near Upland, 360 m. alt., *Johnston 1958* (G); side of road, San Antonio Canyon, 720 m. alt., *Johnston 2048a* (G); Summit of Cajon Pass, *Spencer 345* (G); sandy wash, Highland, 300 m. alt., *Spencer 1306* (G), dry sandy ground, San Bernardino, 360 m. alt., *Johnston 1886* (G); foothills, San Bernardino, *Parish 929* (G); dry mesas, San Bernardino Valley, 300 m. alt., *Parish 11118* (G, UC); stony sandy slopes, Banning, 692 m. alt., *Spencer 1781* (G); San Jacinto Valley, 1897, *Reinhardt* (UC); Chalk Hill, San Jacinto Mts., 1500 m. alt., *Hall 2052* in pt. (UC); Palamar Mts., 1200 m. alt., *Chandler 5355* (UC); Ramona, 1894, *Brandegee* (UC); Mesa Grande, 1220 m. alt., *Spencer 1178, 1302* and *1303* (G); Witch Creek, 1894, *Anderson* (G); Lakeside, 1894, *Brandegee* (UC); mesa, La Jolla, *Clements 108* (G, UC); in chaparral, vicinity of San Diego, 520 m. alt., *Spencer 38* (G, UC); Mission Hills, San Diego, *Abrams 3418* (G); Point Loma, 1906, *K. Brandegee* (UC); Point Loma, 1902, *Brandegee 1646* (G, UC). Lower California: Todos Santos Bay, 1885, *Greene* (UC); near U. S. border, 1884, *Orcutt 1022* (G); near Jamul, 1885, *Orcutt 1281* (G); Topa, 1884, *Orcutt 1127* (G); Vallederos, 1893, *Brandegee* (UC).

Var. **denticulata** (Greene), comb. nov. Corolla inconspicuous, 1–2 mm. broad; plant with a few well developed loose branches; spikes not numerous; nutlets usually larger than in var. *Jonesii*.—*Krynitzkia denticulata* Greene, Bull. Calif. Acad. Sci. i. 205 (1885). *C. denticulata* Greene, Pittonia i. 114 (1887). *C. densiflora* Nels. & Kenn. Proc. Biol. Soc. Wash. xix. 156 (1906).

Western Nevada and adjacent California, southward to western Arizona and the mountains of Southern California

NEVADA: Dog Valley Road, 1895, *Hillman* (UC); Clear Creek Canyon, 2000–2615 m. alt., *Baker 1381* (G, UC); Reno, 1884, *Curran* (G); near Reno, 1893, *Hillman* (UC); along railroad above Laughton's, 1894, *Hillman* (UC), Verdi, 1904, *Kennedy 952* (UC, ISOTYPE of *C. densiflora*); Hunter Creek, Washoe Co., 1800 m. alt., *Kennedy 1917* (G); western Nevada, 1884, *Curran* (G, UC, ISOTYPES of *K. denticulata*). ARIZONA: mesas near Camp Lowell, 1881, *Pringle;* Skull Valley, 1290 m. alt., 1903, *Jones 7028* (UC); Yucca; 1884, *Jones 26* (G). CALIFORNIA: Truckee, 1887, *Sonne* (UC); Donner Lake, 1888, *Curran* (UC); Summit Station, Placer Co., 2083 m. alt., *Heller 12886* (G); Mammoth, 1913, *K. Brandegee* (UC); open pine woods, Mt. Wilson, *Abrams 2590* (G); dry rocky canyon floor, Coldwater Fk. of Lytle Creek, 2100 m. alt., *Johnston 2073* (G, UC); rocky ground under pines near head of N. Fk. Lytle Creek, 2250 m. alt., *Johnston 2077* (G, UC); sunny rocky summit, Telegraph Peak, 2700 m. alt., *Johnston 1542* (G); open place on canyon floor, N. Fk. San Antonio Canyon, 2400 m. alt., *Johnston 1598* (G, UC); dry sunny canyon side, San Antonio Canyon, 1110 m. alt., *Johnston 1950* (G); Little Green Valley, *Hall 12* (UC).

A species readily recognized by its ovate-triangular nutlets, tawny pubescence, and characteristic yellowish-green herbage. It breaks up into three intergrading varieties. The var. *genuina*, characterized by its large corollas, occurs in western California. It varies noticeably in the size of the nutlets and fruiting calyces. The type of *C. muricata* is one of the coarse, large-flowered forms and was probably collected by Douglas somewhere between Monterey and Santa Barbara. The other varieties are small-flowered. The var. *Jonesii* commonly assumes a peculiar erect habit by which it can be distinguished at a glance from all other forms in the genus. The stems are usually single or several and fastigiate, and are erect, producing in the upper half or two-thirds abundant very short floriferous branchlets. Rarely the plant becomes diffusely branched. The distribution of var. *Jonesii* is peculiar. It occurs in the Coast Ranges from Santa Cruz to Glenn County, and in the middle Sierra Nevada. Jumping the several hundred kilometers occupied by the var. *genuina* it reappears in the vicinity of San Bernardino and is frequent from there south into Lower California. The var. *denticulata* is perhaps unworthy of recognition since it is frequently distinguishable from the var. *Jonesii* only with difficulty. It differs chiefly in habit, being sparsely and loosely long-branched. It grows in western Nevada in the general region of Reno, in California about Truckee, in western Arizona and in the pine belt of Southern California. The material from Nevada usually has coarsely granulate nutlets and perhaps might be separable from the southern material that I have associated with it.

Ser. IX. AMBIGUAE. Nutlets 1–4, smooth to papillate or tuberculate, ovate, dorsally low-convex, laterally rounded or obtuse

or occasionally acutish, homomorphous, no particular nutlet always developing; style reaching to $^2/_3$–$^3/_3$ height of nutlets.

Corolla conspicuous.
- Plant low, stiff, spreading, widely branched; spikes solitary..33. *C. mariposae.*
- Plant erectly branched, less rigid; spikes ternate or geminate.
  - Pedicels slender, evident, 2–3 mm. long; pedicels and calyx conspicuously long white-villous.....34. *C. crinita.*
  - Pedicels stout, inconspicuous, less than 1 mm. long; pedicels and calyx more or less hispid.
    - Nutlets usually single, commonly horizontal, equalling or longer than the short loosely connivent calyx-lobes.....35. *C. excavata.*
    - Nutlets usually 4, erect, evidently shorter than the decidedly connivent calyx-lobes.....36. *C. Hendersoni.*

Corolla inconspicuous.
- Nutlets minute, less than 1.5 mm. long; spikes bracted throughout.....37. *C. Traskae.*
- Nutlets usually 2–2.5 mm. long; spikes naked or bracted only at base.
  - Nutlets smooth, rarely finely granulate; spikes usually geminate; plant commonly 2–4 dm. tall.....38. *C. Torreyana.*
  - Nutlets somewhat tuberculate, densely granulate or granulate-muricate as well as more coarsely roughened.
    - Plant closely strigose, pale, usually 2–3 dm. tall; spikes commonly geminate or ternate.....39. *C. simulans.*
    - Plant spreading-hispid, usually 1–1.5 dm. tall; spikes usually solitary or rarely geminate.
      - Nutlets with low rounded tubercules.....40. *C. ambigua.*
      - Nutlets with elongate papillae or spicules.....41. *C. echinella.*

33. **C. mariposae**, sp. nov., humilis saepe basaliter ramosa 5–15 cm. alta; ramis paucis laxe ascendentibus breviter strigosis; foliis paucis firmis oblanceolatis vel oblongo-oblanceolatis 0.8–1.8 mm. longis 2–5 mm. latis obtusis integerrimis adpresse breviter hispidis inconspicue pustulatis, superioribus paullo reductis, inferioribus oppositis subpersistentibus; spicis solitariis vel geminatis 3–10 cm. longis rigidis ebracteatis vel basem versus pauce folioso-bracteatis; floribus obscure biseriatis, inferioribus 5–10 cm. distantibus; calycibus fructiferis oblongo-ovatis 5–7 mm. longis ascendentibus subsessilibus; lobis calycis lineari-lanceolatis in costa infra medium cum setis flavescentibus horridis et in marginibus adpresse hispidis, supra medium breviter hirsutis et saepe recurvatis; corolla conspicua 3–6 mm. lata; nuculis homomorphis 4 (rare 1–2 abortis) ovatis acuminatis 2–2.5 mm. longis saepe granulatis basi truncatis margine rotundis vel obtusis ventre $^2/_5$–$^1/_2$ longitudinis ad gynobasem quadrangulari-columnarem ca. 1 mm. longam affixis; sulcis basem versus paullo gradatim ampliatis ad imam basem divaricato-furcatis et areolam triangularem profundam formantibus; stylo ca. 0.8 mm. longo quam nuculae evidenter breviori.

Known only from Mariposa County, California.

CALIFORNIA: Mariposa, April 27, 1898, *Congdon* (UC); Mariposa, May 1903, *Congdon* (UC); Mariposa County, May 2, 1890, *Congdon C59* (TYPE, Gray Herb.).

A peculiar plant with small, broad, thickish leaves and low, loosely branched, coarse, rigid stems. It has passed as *C. ambigua* and *C. barbigera* but is distinct from both, differing in its large corollas, low stiff habit, strigose stems and in the shape and attachment of the nutlets. In having basally truncate and acuminate nutlets it somewhat suggests *C. muricata*, var. *denticulata*, but is very different in its low habit, strigose pubescence and short style and gynobase. The young spikes are not so tawny as are those of *C. muricata*.

34. **C. crinita** Greene. Erectly branched herb 2–3 dm. high; stems appressed and spreading-hispid, branches numerous; leaves oblanceolate to oblance-linear, 2–4 cm. long, 2–4 mm. broad, obtuse, hirsute, evidently pustulate; racemes ternate or geminate, naked, 3–6 cm. long; corolla conspicuous, 3–5 mm. broad; fruiting calyces 5–6.5 mm. long, spreading, ovate-oblong, obscurely biserial, deciduous, divided, conspicuously villous, hairs very long and white, oldest calyces 5–10 mm. distant; pedicels well developed, 2–3 mm. long, long-villous; calyx-lobes linear, erect, slightly unequal, without a thickened midrib and pungent bristles; ovules 4; nutlet 1, next the axial calyx-lobe, ca. 3 mm. long, 1.3 mm. broad, erect, dull, brownish, ovate-lanceolate, densely muriculate-granulate, frequently coarsely tuberculate especially above the middle, apex attenuate, base obtusish, back convex, margin rounded or obtuse, groove opened towards base to form a small deep triangular areola; gynobase elongate, about half length of nutlet; style reaching to about ¾ height of nutlet.—Erythea iii. 66 (1895).

Known only from Shasta County, California.

CALIFORNIA: bed of Stillwater Creek at Leightone, 1900, *Baker* (G, UC); Cow Creek, 1894, *Baker & Nutting* (UC); Stillwater, *Nutting* (UC); Shasta County, 1894, *Baker & Nutting* (UC, "Dup. of type").

Distinguished from all other members of the genus by its unusually long white hairs on the calyx and on the well developed pedicels. Very distinct from, but probably most related to, *C. Hendersoni*.

35. **C. excavata** Brandg. Loosely and ascendingly branched herb 1–2 dm. tall; stems short hispid-villous and usually appressedly so; leaves not numerous, 1.5–3 cm. long, 1–2 mm. broad, linear or spathulate-linear, obtuse, appressed-hispid, minutely pustulate, upper ones evidently reduced; spikes ternate or geminate, 3–8 cm. long, naked; corolla conspicuous, ca. 4 mm. broad; fruiting calyx, broadly ovate, 2–2.5 mm. long and nearly as wide, asymmetrical, sessile, spreading,

base rounded or very broadly conic, becoming remote and obscurely biserial; mature calyx-lobes lanceolate, subequal, erect or loosely connivent, frequently one displaced by the tip of the decumbent nutlet which they barely exceed in length, margin short hispid-villous, midrib scarcely thickened and somewhat short-hirsute; ovules 4; nutlet 1 and usually horizontal or infrequently 2–3 and then erect, ovate-triangular, recurved-acuminate, ca. 2.5 mm. long, densely granulate or granulate-muriculate, commonly sparsely tuberculate, base decidedly truncate, sides obtuse or rounded, back convex, groove dilated towards base and forming a broad deep narrowly triangular suprabasal areola; gynobase narrow, ca. 1 mm. long, about $\frac{1}{3}$–$\frac{1}{2}$ length of nutlet; style reaching to $\frac{2}{3}$–$\frac{3}{4}$ height of nutlets.—Bot. Gaz. xxvii. 452 (1899).

Inner North Coast Ranges of California; rare.

CALIFORNIA: occasional on shelving slopes of sand, Cache Creek, Yolo Co., *Baker 2886* (G, UC); Lake County, April, *K. Brandegee* (UC).

The solitary, decumbent, triangular nutlet and short calyx are distinctive of this species. It appears to be related to *C. Hendersoni* on one hand, and apparently to *C. decipiens* on the other. No particular nutlet seems to develop, even in the same spike, for adjacent calyces may each develop its nutlet in a very different position relative to the spike-axis.

36. **C. Hendersoni** (Nels.) Piper. Ascendingly branched hispid herb 1.5–5 dm. tall; stems single or numerous, sparsely and loosely branched above, hispid; leaves oblanceolate or linear, 2–5(–7) cm. long, 2–5 mm. broad, acute or obtuse, appressed-hispid, lower ones somewhat persistent and pustulate, upper ones reduced; spikes usually ternate, rarely geminate or quadrinate, naked or at times bracted toward very base, 2–8 or rarely even 20 cm. long; corolla conspicuous, tube about equalling calyx, limb 4–7 mm. broad; fruiting calyx ovate-oblong or narrowly ovate, 3–6 mm. long, ascending, slightly asymmetrical, lowermost becoming obscurely biserial and distant, base rounded or broadly conic; pedicels ca. 0.5 mm. long; lobes lance-linear or linear, somewhat connivent above with herbaceous tips usually somewhat spreading, margins densely appressed villous-hispid, midrib obscurely thickened and hispid; nutlets 4 or by abortion rarely fewer, broadly ovate or very rarely lance-ovate, 2–2.8(–3) mm. long, smooth or more or less coarsely granulate, frequently coarsely tuberculate and at times finely papillate-muricate, back low convex, sides rounded or rarely obtuse, base rounded or somewhat truncate; groove

closed or very narrow, broadly forked below; gynobase narrow, ca. 1.3 mm. long, becoming ½–⅔ as high as nutlets; style reaching to about $^4/_5$ height of nutlets or barely exceeding them.—Piper ex J. C. Nelson, Torreya xx. 44 (1920). *Allocarya Hendersoni* A. Nelson, Erythea vii. 69 (1899); Piper, Contr. U. S. Nat. Herb. xxii. 113 (1920). *C. monosperma* Greene, Pittonia v. 53 (1902). *C. incana* Greene, Leaflets i. 79 (1904). *C. grisea* Greene, l. c. *C. trifurca* Eastw. Bull. Torr. Bot. Cl. xxxii. 203 (1905). *C. grandiflora* Rydb. Bull. Torr. Bot. Cl. xxxvi. 679 (1909). *C. Torreyana*, var. *grandiflora* Nels & Macbr. Bot. Gaz. lxi. 43 (1916). *A. dichotoma* Brand in Fedde, Repert. xviii. 313 (1922). *C. scabrella* Piper, Proc. Biol. Soc. Wash. xxxvii. 95 (1924).

Western Idaho to southwestern British Columbia and south to the Sierra Nevada and northern parts of California.

IDAHO: sandy hillsides in open places or amongst trees, Juliaetta, *Henderson 4815* (G); hills about Lewiston, *Henderson 2811* (G); Lewiston, 1895, *Piper* (G); about Lewiston, 450–600 m. alt., *Heller 2998* (UC); Valley of Clearwater River, *Sandberg, MacDougal & Heller 10* (G, ISOTYPE of *C. grandiflora*); Clearwater, *Spalding* (G); abundant all over wooded and unwooded hills, Palouse Country, *Henderson 2811* in pt. (G); lava soil slope, Big Willo, 900 m. alt., *Macbride 109* (G, UC). BRITISH COLUMBIA: Fort Vancouver, *Tolmie* (G). WASHINGTON: Wawawai, *Piper 1941* and *1944* (G); Tacoma, 1894, *Van Renselaer* (G); Steilacoom, *Piper 372* (G); Cape Horn, *Piper 5018* (G); Falcon Valley, *Suksdorf 456* (G) and *3278* (UC); dry hillsides, Columbia River, western Klickitat County, *Suksdorf 180* (UC, ISOTYPE of *C. monosperma*). OREGON: along Hood River, *Heller 10112* (UC); Lone Rock, 890 m. alt., *Leiberg 116* (G, UC); rocky bank, 1.6 km. north of Tonquin, *Nelson 3093* (G); Willamette River below Portland, *Sheldon S10866* (G); dry rocky bank by roadside, Coalca, *Nelson 2109* (G); rocky hillside, 5 km. north of McNary, *Nelson 2083* (G); dry open ground in Bush's Pasture, Salem, *Nelson 3253* (G); dry soil by roadside, 5 km. south of Salem, *Nelson 2166* (G); Bridge Creek, *Howell 501* (G); loose basaltic rock on wall of canyon, Silver Creek Falls, Marion Co., *Nelson 4869* (G); 3.2 km. east of Curry-Douglas county-line on trail from Marial to West Fork, *Peck 3995* (G); dry soil along trail, Marial, *Nelson 1414* (G); rocky woods, Elk Rock, *Nelson 1254* (G); dry soil along trail near mouth of Mule Creek, Curry Co., *Nelson 1369* (G); steep seaward slope, The Heads, Port Oxford, *Peck 8473* (G); Grant Pass, *Piper 5105* and *5106* (G); Grant Pass, *Piper 5043* (G, ISOTYPE of *C. scabrida*); Applegate, *Durden* (UC); near Stinking Water, 1200 m. alt., *Leiberg 2362* (G, UC); Steins Mt., *Howell 500* (G); adobe soil, Steins Mt. opposite Devines Ranch, 1500 m. alt., *Leiberg 2465* (G, UC); without locality, hillsides, 1881, *Howell* (G, part of TYPE of *A. dichotoma*). CALIFORNIA: Hupa Valley, 1900, *Manning* (UC); Hupa Indian Reservation, 150 m. alt., *Chandler 1302* (G, UC); mountain slopes along road between Three Creeks and mouth of Willow Creek, Humboldt Co., 750 m. alt., *Tracy 3335* (UC); in chaparral in hills about Scotts Valley, 420–600 m. alt., *Tracy 1744* (UC); between Mud Flat and Bennet Springs on Newville-Covelo road, *Heller 11928* (G); Hough's Spring, Lake Co., 1882, *Cleveland* (UC); southeast side of Snow Mt. above Bonnie View, *Heller 13236* (G); Rush Creek, Trinity Co., *Yates 402* (UC); Klamathon, *Copeland 3550* (G, ISOTYPE of *C. trifurca*); dry hills near Yreka, *Butler 733*

(UC) and *1416* (G, UC); Edgewood, 1887, *Curran* (UC); Siskiyou County, 1890, *Edmonds* (UC); along streams in meadows, Parker Creek, Warner Mts., 1650 m. alt., 1910, *Taylor & Bryant* (UC); Goose Lake Valley, 1884, *Austin* (UC); Milford, 1892, *Brandegee* (UC); Mormon Bar, 1897, *Congdon 50* (G); Salmon Creek, Tulare Co., 2100 m. alt., *Hall & Babcock 5132* (UC); Nine Mile Creek, Tulare Co., *Culberton 4537* (G, ISOTYPE of *C. incana*); Redrock Meadows, Tulare Co., 2610 m. alt., *Hall 8394* (UC). NEVADA: Reno, 1898, *Purpus* (UC); Dog Valley Road, 1895, *Hillman* (UC).

In northwestern United States, where this plant appears to be rather common, it is almost the only species of *Cryptantha* with conspicuous corollas. In the past it has been much confused with *C. ambigua* and *C. Torreyana*, although in fact it seems to be most closely related to *C. intermedia*. In Idaho it tends to intergrade with *C. Torreyana*, but over most of its range it is readily separated by its conspicuous corollas, commonly ternate spikes and usually tuberculate nutlets. Occasional plants are hard to separate from *C. ambigua* although *C. Hendersoni* is for the most part pretty easily recognized by its large-flowered, ternate spikes projected above the leafy mass of the plant. *Cryptantha intermedia* completely intergrades with *C. Hendersoni* in northern California, although the overwhelming mass of material of *C. Hendersoni* is readily distinguished from its relative by its less stiff and scarcely pungent pubescence, and broader tuberculate nutlets. It has been found expedient to admit considerable range of nutlet-variation in *C. Hendersoni*. Among plants quite similar in gross habit, and commonly from within a small natural region, the nutlets frequently (from plant to plant) vary from entirely smooth and shiny, to simply granulate or decidedly tuberculate. Roughly it can be said, however, that more of the northern than southern material is smooth-fruited. *Cryptantha incana* and *C. grandiflora* are names applied to the phase with smooth and shiny nutlets. The other names cited apply to forms with roughened fruit. *Cryptantha scabrella* was based on a phase of *C. Hendersoni* from southern Oregon in which the nutlets are papillate-muricate. *Cryptantha monosperma* has similar though less abundant and less well developed papillae, and appears to be a form in which only 1 or 2 nutlets develop. The aborted nutlets appear to be the abaxial ones.

37. **C. Traskae**, sp. nov., pumila sparse laxeque ramosa 8–10 cm. alta; caulibus gracilibus strigosis ca. 1 mm. crassis; foliis paucis linearibus 1–2 cm. longis 1–1.5 mm. latis acutis strigosis rare hispidis inconspicue pustulatis; spicis solitariis vel geminatis 1–5 cm. longis cum bracteis linearibus 2–5 mm. longis numerosis ornatis; floribus obscure biseriatis maturitate 5–10 mm. separatis; corolla inconspicua ca. 1.5

mm. lata; calycibus fructiferis ovatis subsessilibus deciduis 2–3 mm. longis; lobis calycis maturi lanceolatis saepe acutis in costa cum setis flavescentibus brevibus horridis et in marginibus adpresse hispidis; nuculis 4 homomorphis ovatis vel anguste ovatis vix 1.5 mm. longis minutissime granulatis apicem versus plus minusve tuberculatis dorso convexis margine obtusis ventre ¾ longitudinis ad gynobasim angustam ca. 0.9 mm. longam adfixis; sulcis clausis basi in areolam minutam deltoideam dilatatis; stylo nuculas vix superante.

Known only from San Nicolas Island off the Californian coast.

CALIFORNIA: one locality, bare windswept cliffs, San Nicolas Island, April, 1901, *Trask* (G, TYPE); infrequent on bare windswept heights, April 1897, *Trask 57* (UC).

This endemic of San Nicolas Island was reported by Eastwood, Proc. Calif. Acad. Sci. ser. 3, i. 109 (1898), as *C. Torreyana*. It is evidently quite distinct from that species in its low habit, pubescence, bracteate inflorescence and small tuberculate nutlets. In habit it somewhat suggests *C. leiocarpa*. Its nutlets are about the same size and shape as those of that species, but differ in being tuberculate and in having a broadly forked groove and a small areola.

38. **C. Torreyana** (Gray) Greene. Commonly scantily and more or less strictly branched hispid herb, 1–4 dm. tall; stems solitary or frequently several, usually inconspicuously short-strigose as well as hispid; leaves oblanceolate or linear, strict or ascending, 2–5(–7) cm. long, 3–6(–8) mm. wide, obtuse or rounded, hispid, inconspicuously pustulate if at all so; spikes usually geminate, naked, 4–8(–15) cm. long, more or less projected from the leafy mass of the plant, very elongate and loosely flowered or congested and glomerate; corolla inconspicuous, ca. 1 mm. broad; fruiting calyces oblong-ovate or ovate-lanceolate, 2–7 mm. long, ascending, asymmetrical, base rounded or broadly conic, pedicels ca. 0.5 mm. long; mature calyx-lobes lanceolate to lance-linear, connivent above with tips usually spreading, midrib slightly thickened and hispid-hirsute, margins hispid-strigose; nutlets 4 (occasionally 1 or more aborted), usually broadly ovate, 1.5–2.2(–2.5) mm. long, 0.8–1.3 mm. broad, smooth and polished, usually mottled, rarely finely granulate, back very low-convex, sides rounded or obtuse, groove broadly forked below and closed throughout; gynobase about ½ height of nutlets, ca. 1 mm. tall; style reaching to ⅔ height of nutlets or rarely even to their tips.—Pittonia i. 118 (1887).

Var. **genuina.** Fruiting calyx 3.5–8 mm. long; style clearly surpassed by nutlets; plants usually over 2 dm. tall, not conspicuously

hispid.—*Krynitzkia Torreyana* Gray, Proc. Am. Acad. xx. 271 (1885). *C. Torreyana* Greene, l. c. *K. Torreyana*, var. *calycosa* Gray, l. c. *C. Torreyana*, var. *calycosa* Greene, l. c. 119. *C. calycosa* Rydb. Mem. N. Y. Bot. Gard. i. 331 (1900). *C. affinis*, var. *flexuosa* Nels. Bot. Gaz. xxx. 195 (1900). *C. flexuosa* Nels. New Man. Bot. Cen. Rocky Mt. 416 (1909).

Extreme western Wyoming and northern Utah, westward to Washington and California, and northward through British Columbia to southern Alaska.

ALASKA: Skagway, *Macoun 78736* and *Eastwood 802* (G). BRITISH COLUMBIA: Lytton, 1885, *Fletcher;* dry ground, Spences Bridge, 1889, *Macoun* (G); Cascade, *Macoun 66580* (G). WYOMING: open dry slopes, Nez Perces Creek, *Nelson 6224* (G); under sagebrush, 32 km. west of Big Piney, *Payson 2628* (G); on cobblestone flat, Jackson Lake, *Nelson 6546* (G, UC, ISOTYPES of *C. affinis*, var. *flexuosa*); Teton Forest Reservation, 1897, *Brandegee* (UC); abandoned field, Alpine, *Payson & Armstrong 3392* (G); dry hillside, hills east of Afton, 1980 m. alt., *Payson & Armstrong 3324* (G). UTAH: waste sandy ground, Juab, *Goodding 1068* (G, UC); dry plains, Red Butte Canyon, *Garrett 1869* (G); Dry Canyon near Salt Lake City, 1908, *Clemens* (G); dry gravelly soil, Peterson, Weber River, 1950 m. alt., *Pammel & Blackwood 3895* (G). IDAHO: slightly moist shady slopes, Salmon, 1350 m. alt., *Payson 1756* in pt. (G); dry soil, St. Anthony, *Merrill & Wilcox 842* in pt. (G); arroyos, Pocatello, *Henderson 4877* (G); dry lands, Montpelier, *Macbride 1690* (G); moist grassy bottoms, Ketchun, 1764 m. alt., *Nelson & Macbride 1215* (G); about Lake Waha, *Heller 3255* (G); moist ground, Moscow, 1899, *Henderson* (G); valley of North Fork of Coeur d'Alene River, 930 m. alt., *Leiberg 1539* (G, UC); near Juliaetta, *Sandberg, MacDougal & Heller 351* (G); lava rock hillside, Tamarack, 1260 m. alt., *Clark 165* (G); Palouse Country, *Henderson 2811* in pt. (G); Snake Country, *Burke* (G); slopes, loose soil, Silver City, 2100 m. alt., *Macbride 373* (G). WASHINGTON: Sprangle, *Piper 4140* (G); Clark Springs, *Kreager 93* (G); Cheney, *Tucker 127* (G); Pullman, *Piper 1945* (G); Kamiak Butte, *Piper 3091* (G); Rock Lake, 540 m. alt., *Sandberg & Leiberg 121* (G, UC); dry stony hillsides, Blue Mts., 1897, *Horner* (G); dry hillsides along Touchet River, Blue Mts., *Horner 380* (G); open woods, Falcon Valley, *Suksdorf 789* (UC); Falcon Valley, *Suksdorf 593* (G); western Klickitat County, 1886, *Suksdorf* (G); Yakima Region, 1882, *Brandegee* (UC). OREGON: hillsides near Snake River, *Cusick 1913* (G, UC); dry ground, Rock Creek, 10 km. west of Haines, *Peck 3609* (G); dry woods on West Fork, *Peck 1369½* and *1416* (G); Pelican Bay, *Copeland 3481* (G); Klamath Falls road, 41 km. east of Ashland, *Peck 9295* (G); dry stony hilltop 3.2 km. southeast of Klamath Falls, *Peck 9447* (G); Grant Pass, *Piper 5044* (G). NEVADA: steep dry hillsides, Bieroth's Ranch, McDonald Creek, 1950 m. alt., *Nelson & Macbride 2151* (G); East Humboldt Mts., 2100 m. alt., *Watson 858* (G, UC); near Carson City, 1866, *Anderson 12* (G); Sprucemont, *Jones 6838* (UC); Incline Road, Lake Tahoe, 1890 m. alt., *Kennedy 1428* (UC); Peavine Foothills, 1895, *Hillman* (UC); foothills near Peterson's Ranch, Truckee Valley, 1894, *Hillman* (UC). CALIFORNIA: Hupa Indian Reservation, 150 m. alt., *Chandler 1303* (G, UC); Supply Creek, Hupa Valley, *Davy & Blasdale 5730* (UC); Kneeland Prairie, 750 m. alt., *Tracy 3071* (UC); High Prairie on Bald Mt., 1650 m. alt., *Tracy 4560* (UC); Afton, 30-90 m. alt., *Tracy 3655* (UC); open places on brushy slopes, 1650 m. alt., *Tracy 3944* (UC); dry hillside at Alder Point on Eel River, 150 m. alt., *Tracy 1879* (UC); Eel

River, 1893, *Blankinship* (UC); Ukiah, *Bolander 3916* (UC); gravelly slope about 16 km. east of Alder Springs, *Heller 11450* (UC); gravelly places, Alder Springs, 1260 m. alt., *Heller 12759* (G); gravel near trees, between Bartlett and Allen Springs, *Heller 12372* (G); Kelsey, 1889, *K. Brandegee* (UC); Camp Badger, 1892, *Holway* (UC); Snow Mt., 1892, *K. Brandegee* (UC); among chaparral, 10 km. northwest of Lakeport, *Tracy 1653* and *1731* (UC); moist shady ground, Lake County, *Rattan 42* (G); Napa Valley, *Torrey 330* (G); brushy places near stream, 13 km. above Ruth, Trinity Co., *Tracy 4301* (UC); Yreka, *Heller 7995* (G, UC); dry land near Yreka, *Butler 762* and *1310* (UC); Sisson, 1887, *Brandegee* (UC); Sisson, 1902, *Setchell & Dobie* (UC); Ager, 1887, *K. Brandegee* (UC); Fort Bidwell, *Manning 160* (UC); red gravelly hillside, Modoc Co., 1893, *Baker* (UC); Montgomery Creek, Shasta Co., *Eastwood 622* (G); Burney, *Eastwood 689* (G); Battle Creek Meadows, Lassen Butte Region, *Eastwood 1894* (G); Pine Creek, Lassen Co., 1894, *Baker & Nutting* (UC); ridge east of Red Clover Valley, Plumas Co., *Heller & Kennedy 8718* (G); Red Clover Valley, *Heller & Kennedy 8754* (G, UC); Prattville, *Heller & Kennedy 8773* (G, UC); open places in the chaparral near Cohasset, *Heller 11912* (G); open places in pine forest, Butte Meadows 1380 m. alt., *Heller 12818* (G); edge of forest about Chico Meadows, 1200 m. alt., *Heller 11642* (G); lower end of Donner Lake, *Heller 6888* (G, UC); Donner, 1889, *Brandegee* (UC); Truckee, 1913, *K. Brandegee* (UC); Placer County, 1892, *Carpenter* (UC); Angel Canyon, Calaveras Co., *Davy 1476* (UC); Yosemite Valley, *Torrey 337* (G); Yosemite Valley, *Bolander 6283* (UC); Yosemite Valley, *Hall 9168* (UC); Mariposa Big Tree Grove, 1893, *Eastwood* (UC); Mt. Bullion, 1889, *Congdon* (G); Sherlock's, *Congdon* (G, UC); Agua Fria Mt., 1898, *Congdon* (UC); Bloody Canyon, Mono Co., 1889, *Chestnut & Drew* (UC); Lost Valley, South Fork of San Joaquin River, 2280 m. alt., *Hall & Chandler 650a* in pt. (UC); Natural Bridge of Volcano Creek, 2250 m. alt., *Hall & Babcock 5439* (G, UC); Volcano Creek, *Culbertson 4327* (G); Old Colony Mill, Tulare Co., 1905, *K. Brandegee* (UC); Poso Creek, Greenhorn Range, *Hall & Babcock 5014* (G).

Var. **calistogae**, var. nov., varietatem genuinam simulans differt stylo nuculis subaequilongo vel rare eis longiore.

Vicinity of Calistoga, California, in the southern part of the North Coast Ranges.

CALIFORNIA: bushy hillside near Calistoga, 120 m. alt., *Tracy 1865* (UC); hills east of Calistoga, 240 m. alt., *Tracy 2094* (TYPE, U. C. Herb. no. 175,784); Santa Rosa Creek Canyon, *Baker 620* (UC); ? La Honda, 1890, *Brandegee* (UC).

Var. **pumila** (Heller), comb. nov. Fruiting calyx 2–3.5 mm. long; style shorter than nutlets; plant usually rather conspicuously hispid-hirsute, usually under 2 dm. tall.—*C. pumila* Heller, Muhl. ii. 242 (1906).

Middle Coast Ranges of California from Marin to Santa Clara County.

CALIFORNIA: Mt. Tamalpais, *Heller 8403* (G, ISOTYPE of *C. pumila*); Mt. Tamalpais, 1894, *Eastwood* (G); Tamalpais, 1893, *Brandegee* (UC); in brush at Sugar Loaf Peak, Berkeley Hills, 300 m. alt., *Tracy 2060* (G, UC); in shade, Strawberry Canyon, 150 m. alt., *Tracy 793* and *2054* (UC); wooded slope,

Smith Creek at foot of Mt. Hamilton, *Heller 8588* (G); foothills west of Los Gatos, *Heller 7458* (G, UC); shady hillside, Searsville, *Bolander 39* (G); without locality, *Kellogg & Harford 770* (G).

This species is at once the most widely distributed and the most northerly ranging of all the North American species. It has been generally accepted and well understood, being readily recognized by its erect loosely branched rather slender habit and broadly ovate smooth nutlets. Although it may intergrade with *C. Hendersoni*, possible intergrades are few and the ranges of the two species are such as to suggest specific difference. *Cryptantha Torreyana* differs from *C. Hendersoni* in having much smaller corollas, prevailingly geminate rather than ternate spikes, and always smooth rather than smooth or tuberculate nutlets. Except in California and Alaska *C. Torreyana* occurs in the dryish interior east of the high mounains, whereas *C. Hendersoni*, while occurring east of the mountains, is very common in the moister valleys of western Oregon and Washington.

Piper, Contr. U. S. Nat. Herb. xi. 484 (1906), has given the type locality of *C. Torreyana* as "Grassy hills near San Luis Rey, California," which is a locality quite beyond the known range of the species and in a region in which it is not to be expected. I have been unable to locate in the Gray Herbarium a collection of this species made by Torrey at the locality mentioned. There appear to have been only two of Torrey's collections of this species available to Gray. Gray based his species on a number of specimens and had no "type" in mind. If a type must be selected it seems better to choose either *Torrey 330* from Napa Valley, or preferably *Torrey 337* from Yosemite Valley since the latter is more characteristic of the species.

Most recent botanists, following Gray, have maintained the variety *calycosa*, a variation distinguished by its glomerate spikes and usually elongate calyx-lobes. This variation occurs throughout the range of the species, and although an obvious sort of variety seems to be a trivial one better treated as a mere *forma* or phase of the species worthy of no particular nomenclatorial attention.

In California the typical form of the species pushes southward along the length of the Sierra Nevada, the most southerly undoubted station being in Tulare County. In the herbarium of the University of California there is a specimen of *C. Torreyana* labeled as having been collected by G. F. Reinhardt in the San Jacinto Valley of Riverside County in Southern California. The data accompanying this specimen I doubt, since no other of the numerous collectors visiting the San Jacinto Valley has detected the species, and since the hot plains

and buttes about San Jacinto seem scarcely a likely locality for the southern outpost of a species which over most of its range in California is confined to the mountains and chiefly to the pine belt.

In the Coast Ranges of California the species occurs in its typical form as far south as Lake and Napa counties. Just south of these counties it is replaced by var. *calistogae* and var. *pumila*. Over its extensive range *C. Torreyana* is very constant in having styles evidently shorter than the nutlets. This condition is departed from in the available material from the vicinity of Calistoga, Sonoma County, California; the styles in this material clearly reaching to or slightly beyond the nutlet-tips. To this variation, because of its geographical correlation, the varietal name *calistogae* has been applied. The var. *pumila* is of different character. In the Middle Coast Range the plants representing *C. Torreyana* are more hispid and smaller in all parts. This plant has been confused with *C. leiocarpa* but is quite distinct, for, like the typical *C. Torreyana*, it differs in its broadly ovate nutlets, shorter style, and ebracteate spikes. Macbride, Contr. Gray Herb. n. s. xlviii. 43 (1916), confused the plant with *C. hirsutissima*, a close relative of *C. leiocarpa*. From *C. hirsutissima* the variety differs in its broad nutlets, somewhat shorter style, and different habit. Although the plant was described as a distinct species by Heller it is at most a weak geographical variety of *C. Torreyana* and perhaps not worthy of recognition at all.

39. **C. simulans** Greene. Erect strigose pallid herb with few strictly ascending branches, 1.5–3(–4.5) dm. high; scantily and loosely strigose or below rarely shortly and loosely appressed-hispid; leaves not numerous, oblanceolate or oblance-linear, 2–5(–7.5) cm. long, 2–5(–7) mm. wide, strigose, pustulate (especially the lower ones), frequently extending into the lowermost part of the spikes; cotyledons and early leaves frequently persistent at anthesis; spikes solitary or frequently geminate or ternate, slender, usually elongate and sparsely flowered but at times glomerate; corolla inconspicuous, ca. 2 mm. broad; fruiting calyx 3–8 mm. long, oblong-ovate, slightly asymmetrical, strict or ascending, obscurely biserial, base rounded or broadly conic, pedicels ca. 0.5 mm. long; mature calyx-lobes lance-linear, connivent above with the green tips spreading, midrib slightly thickened and shortly arcuate-hirsute, margins white villous-hispid; nutlets 4, homomorphous, broadly ovate, 2–2.5 mm. long, 1–1.5 mm. broad, densely granulate or granulate-muriculate, sparsely broad-tuberculate, back low-convex, margins rounded, groove broadly forked below and usually closed throughout; gynobase ca. 1–1.5 mm. high; style reaching to about $^{3}/_{4}$–$^{4}/_{5}$ height of nutlets.—Pittonia v. 54 (1902).

In the pine forests from southern Oregon to Southern California, and local in northern Idaho and middle southern Washington.

IDAHO: dry pine woods, Mt. Moscow, *Henderson 2811½* (G). WASHINGTON: open woods, Falcon Valley, *Suksdorf 46* and *595* (G), *181* (UC). OREGON: Klamath Valley, 1260 m. alt., 1864, *Cronkhite* (G); summit of Cascade Mts., along Ashland-Klamath Falls road, *Peck 9264* (G); without locality, 1883, *Howell* (UC). NEVADA: Incline Road, Lake Tahoe, 1890 m. alt., *Kennedy 1446* (UC); Kings Canyon, Ormsby Co., 1700–2000 m. alt., *Baker 1194* (G, UC); Dog Valley Road, 1895, *Hillman* (UC); log railroad north of Verdi, 1590 m. alt., *Heller 10873* (G, UC). CALIFORNIA: in coniferous forests near Sisson, *Heller 8035* (G); Goose Valley, *Eastwood 765* (G); Milford, 1892, *Brandegee* (UC); Prattville, *Heller & Kennedy 8776* (G); Prattville, 1892, *Brandegee* (UC); American River at Strawberry, 1650 m. alt., *Hall 11388* (G); Truckee, *Heller 7060* (G, UC); Placer County, 1892, *Carpenter* (UC); Jackson, 1892, *Hansen* (UC); beneath pines in vicinity of Hog Ranch, Yosemite Park, *Hall & Babcock 3318* and *3444* (UC); Hog Ranch above Hetch-Hetchy, *Congdon 51* (G); Yosemite Valley, 1200–1350 m. alt., *Abrams 4379* (UC) and *4471* (G, UC); Fortman Mt., Mariposa Co., 1885, *Congdon* (UC); Mt. Buckingham, 1898, *Congdon* (UC); Calaveras Big Tree Groove, 1891, *Brandegee* (UC); foothills of Fresno County, 900 m. alt., *Hall & Chandler 56* (UC); Jordan Hot Springs on Nine-mile Creek, 2010 m. alt., *Hall 8393* (UC); Giant Forest, 1905, *Brandegee* (UC); Sequoia Mills, 1892, *Brandegee* (UC); Sportsman Hall, Fyffe P. O., 20 km. above Placerville, *K. Brandegee* (UC); Region of Tehachapi Peak, *Dudley 347* (UC); open pine woods, Mt. Wilson, *Abrams 2578* (G, UC); Swarthout Canyon, 1800 m. alt., 1900, *Hall* (UC); Lytle Creek Canyon, 1725 m. alt., 1899, *Hall* (UC); Lytle Creek Canyon, 1725 m. alt., *Hall 1230* (UC); on dry gravelly canyon-floor, Coldwater Fork of Lytle Creek, 1725 m. alt., *Johnston 2035* (G); dry rocky ground under pines, Icehouse Canyon, 1650 m. alt., *Johnston 2035* (G); San Bernardino Mts., 1800 m. alt., 1899, *Hall* (UC); brushy places, Tahquitz trail above Idyllwild, 2100 m. alt., *Spencer 2117* (G); Onstatt Valley, 1500 m. alt., 1901, *Hall* (UC); Cuyamaca Peak, 1894, *Brandegee* (UC); Southern California, 1880, *Wright 11* (G); southeastern California, 1876, *Parry & Lemmon 279½* (G); Southern California, 1888, *Palmer 41* (G).

This readily recognized species, so characteristic of the Yellow Pine forests of California, has passed as *C. ambigua*, although very different from the low hispid plant of the Northwest properly bearing that name. The pallid strigose pubescence and the broad granulate and tuberculate nutlets readily distinguish it from *C. Torreyana* with which it grows and somewhat approaches in habit.

40. **C. ambigua** (Gray) Greene. Ascending hirsute herb 1–2.5 dm. tall; stems usually loosely branched from the base, hirsute and somewhat short-strigose; leaves narrowly lanceolate to linear, 2–3(–5) cm. long, 1–4(–5) mm. broad, obtuse or subacute, usually somewhat appressed hispid-hirsute, commonly inconspicuously pustulate; spikes usually solitary, 5–15 cm. long, naked or with the lowermost flowers bracted, commonly not projected clear of the leafy mass of the plant and usually not sharply differentiated from the leafy peduncular

branches; corolla inconspicuous, 1–2 mm. broad; fruiting calyces ovate-oblong or oblong, 4–7 mm. long, slightly asymmetrical, spreading, crowded or distant and obscurely biserial, base rounded or broadly conic; pedicels 0.5–0.9 mm. long; mature calyx-lobes linear or lance-linear, usually more or less connivent above, midrib slightly thickened and tawny hirsute, margins evidently short strigose-villous, nutlets 4, broadly ovate, 1.6–2 mm. long, granulate and coarsely tuberculate or very rarely tending to be smooth especially towards base, back low convex, sides obtuse and rounded, groove closed or rarely somewhat dilated but always broadly forked at base; gynobase narrow, 1–1.2 mm. long, ⅔ height of nutlets; style reaching $^4/_5$–$^5/_5$ height of nutlets.—Pittonia i. 113 (1887). *Eritrichium muriculatum*, var. *ambiguum* Gray, Synop. Fl. N. Am. ii. pt. 1, 194 (1878). *Krynitzkia ambigua* Gray, Proc. Am. Acad. xx. 273 (1885). *Eritrichium muriculatum* of Torr. Bot. Wilkes Exped. 416, t. 13 (1874). *C. polycarpa* Greene, Pittonia i. 114 (1887). *C. multicaulis* Nels. Bot. Gaz. xxx. 194 (1900).

Southern Washington to southwestern Montana and thence southward to northern Colorado, extreme western Nevada and northeastern California.

MONTANA: mountains near Indian Creek, *Rydberg & Bessey 4885* (G); Spanish Basin, *Rydberg & Bessey 4886* and *4887* (G); canyon from Rose Hole to Bitterroot Valley, *Watson 286a* (G, UC); Bridger Mts., *Rydberg & Bessey 4889*. WYOMING: on dry loose soil of a road-grade, Snake River, *Nelson 6440* (G, ISOTYPE of *C. multicaulis*); on steep slopes of river-bank, Yellowstone River near Junction Butte, *Nelson 5761a* (G); under granite cliff, Cow Creek, Albany Co., *Nelson 8888* (G); dry loose soil, Centennial, *Nelson 8731* (G). COLORADO: mountain side near Georgetown, 1885, *Patterson* (G). IDAHO: roadside, Bear Creek below Parker Mt., 1800 m. alt., *Macbride & Payson 3305* (G); sagebrush covered hillside, Corral, 1650 m. alt., *Macbride & Payson 2936* (G); abandoned field, Martin, 1800 m. alt., *Macbride & Payson 3044* (G); dry hills, Castle Rock, 1500 m. alt., *Macbride & Payson 2861* (G); Boise, 1892, *Mulford* (G); dry soil, 1650 m. alt., Twilight Gulch, *Macbride 465* (G); loose dry soil, House Creek, *Nelson & Macbride 1773* (G); dry soil, St. Anthony, *Merrill & Wilcox 842* in pt. (G). UTAH: Thistle, 1590 m. alt., *Jones 5370* (UC). NEVADA: upper end of Star Valley near Deeth, 1680 m. alt., *Heller 9074* (G); Franktown, 1500 m. alt., *Heller 9794* (G); Galena Creek, 2400 m. alt., *Kennedy 1293* (UC); Lake Washoe, *Torrey 335* (G); Palisade, 1903, *Stokes* (UC). WASHINGTON: north of Brickleton, *Suksdorf 406* (G); White Salmon, *Suksdorf 594* (G); Klickitat, *Howell 337* (G); Walla Walla Region, 1883, *Brandegee* (UC); Washington Territory, 1883, *Brandegee 994* (G). OREGON: dry ground, Sisters, *Peck 3607* (G); Bend, *Nelson 851* (G, UC); dry slope along Des Chutes River 8 km. below Bend, *Peck 9710* (G); Stein's Mt., *Howell 498* and *499* (G); in sagebrush, Swan Lake Valley, *Applegate 370* (G). CALIFORNIA: Portola, *K. Brandegee* (UC); lake shore, Modoc Co., *Austin & Bruce 2267* (UC); ice pond below Truckee, 1887, *Sonne* (UC, ISOTYPE of *C. polycarpa*).

In the past this species has been greatly confused and the name has been used in a variety of applications. The plant treated here is that figured and described by Torrey in the Botany of the Wilkes Expedition, 416, t. 13 (1874), since Gray appears to have based his *Eritrichium muriculatum*, var. *ambiguum* largely upon Torrey's plate and description. Torrey gives his plant as from Nisqually, but since it represents a species characteristic of the dry interior of Washington it seems likely that, as with other material collected by the Wilkes Expedition, the data had become confused and the plant was probably collected in the Walla Walla Region of southeastern Washington, cf. Piper, Contr. U. S. Nat. Herb. xi. 15 (1906).

Although usually distinguishable by its habit, *C. ambigua* approaches *C. Kelseyana* and *C. Pattersoni* very closely in Idaho and Wyoming, and is occasionally distinguishable from them only with difficulty. Doubtful intermediate plants with homomorphous or subhomomorphous nutlets I have referred to *C. ambigua* even though some so referred have one nutlet subpersistent and occasionally somewhat less tuberculate than the others. Some plants from Idaho referred to *C. ambigua* have nutlets smooth quite like those of *C. Torreyana*. These plants are so referred because their habit is that of *C. ambigua*. *Cryptantha Hendersoni* usually agrees with *C. ambigua* in the size, shape and roughenings of the nutlets, but has a very different habit and inflorescence.

41. **C. echinella** Greene. Usually low and loosely branched hispid herb 5–20 or rarely 40 cm. tall; stems short-hispid, sparsely branched; leaves oblanceolate or oblance-linear, 1–2.5(–4.5) cm. long, 1–4(–6) mm. broad, obtusish, appressed-hispid, minutely pustulate, not numerous; spikes solitary or at times geminate, 1–5 cm. long, slender, commonly leafy-bracted towards base; corolla inconspicuous, 1–1.8 mm. broad; fruiting calyx oblong-ovate, 5–6 mm. long, deciduous, spreading, obscurely biseriate; pedicels 0.1–0.5 mm. long; mature calyx-lobes linear-lanceolate, connivent above and usually recurved, midrib slightly thickened and pale-tawny hirsute, margins appressed short-hispid; nutlets 4, homomorphous, broadly ovate, 2–2.2 mm. long, more or less finely granulate, conspicuously and narrowly papillate, back convex, margin rounded, groove very narrow or closed and widely forked at base; gynobase about ⅔ height of nutlets; style shortly but definitely surpassed by tips of nutlets.—Pittonia i. 115 (1887).

Central Sierra Nevada to the mountains of Southern California and the Charleston Mts. of southern Nevada.

NEVADA: Densmore Camp, Hunte Creek Canyon, 1800 m. alt., *Kennedy 1606* in pt. (UC); Peterson's Ranch near Reno, 1894, *Hillman* (UC); Peavine Foothills, 1895, *Hillman* (UC); Charleston Mts., *Purpus 6077* (UC). CALIFORNIA: Mt. Stanford, 2640 m. alt., 1886, *Sonne* (UC, ISOTYPE); Castle Peak near highest point, *Heller 7079* (G); Tahoe, 1901, *Boring* (UC); Lake Tahoe Region, 1901, *Setchell & Dobie* (UC); Luthers Pass, 2340 m. alt., *Abrams 4759* (G); Yosemite Valley, 1200–1350 m. alt., *Abrams 4379* in pt. (G); dry situations, Yosemite Valley, *Brewer 6284* (UC); Alta Meadows, 1905, *K. Brandegee* (UC); Andrews Camp above Bishop, 1913, *K. Brandegee* (G, UC); sawmill, Mt. Pinos, 2490 m. alt., *Hall 6523* (UC); rocky ground under pines, Prairie Fork of San Gabriel River, 2100 m. alt., *Johnston 2071* (G); on flats, Kelly's Cabin, Ontario Peak, 2460 m. alt., *Johnston 1620* (G, UC); dry ridge east of Ontario Peak, 2520 m. alt., *Munz 6076* (UC); Coldwater Fork of Lytle Creek, 1725 m. alt., *Johnston 2057* in pt. (G); Mare Flat, 2400 m. alt., *Crawford 934* (G); Little Green Valley, 2160 m. alt., *Hall 24* (UC).

This characteristic species has been greatly misunderstood, and repeatedly confused with *C. ambigua* and *C. intermedia.* It grows in dry sunny clearings in the Yellow Pine belt of the California mountains usually in the company of *C. simulans*, *C. affinis* and *C. Torreyana*.

Ser. X. MOHAVENSES. Nutlets 4, smooth, oblong-ovate or lanceolate-ovate or lanceolate, clearly angled at the sides, decidedly homomorphous; style usually equalling height of nutlets or shorter than latter.

Corolla conspicuous; style clearly surpassing the nutlets, these 2–2.5 mm. long.....42. *C. mohavensis.*
Corolla inconspicuous; style about equalling the nutlets in height or a trifle surpassed by them; nutlets 1.2–2 mm. long.....43. *C. Watsoni.*

42. **C. mohavensis** Greene. Ascendingly branched herb 1–4 dm. tall; stems usually freely branched, short-hispid to hispid strigose; leaves linear or lance-linear, 1–4 cm. long, 1–3 mm. broad, appressed-hispid or strigose, minutely and densely pustulate, obtusish, upper ones reduced; spikes ternate or geminate, usually crowded, 2–6 cm. long, naked; corolla conspicuous, 4–7 mm. broad; fruiting calyces oblong-ovate, 3–5 mm. long, ascending, becoming obscurely biserial, symmetrical, base rounded, deciduous, pedicels ca. 0.5 mm. long; mature calyx-lobes lanceolate, connivent above, midrib somewhat thickened and frequently sparsely hirsute, margins usually more or less silky strigose; nutlets 4, homomorphous, smooth and shiny, rarely obscurely granulate, oblong-ovate or lance-ovate, 2–2.5 mm. long, back low-convex or flattish, margins definitely angled especially towards the apex, groove closed above but forked below and opened at the fork to form a small triangular areola; gynobase columnar-subulate, about ¾ height of nutlets; style clearly surpassing tips of

nutlets.—Pittonia i. 120 (1887). *Krynitzkia mohavensis* Greene, Bull. Calif. Acad. Sci. i. 207 (1885).

Southern Sierra Nevada of California, best known from the vicinity of Tehachapi Mountains.

CALIFORNIA: Andrews Camp, mountains above Bishop, 1913, *K. Brandegee* (G, UC); sand hills near Pampa Station, *Heller 7642* (G); Water Canyon, Tehachapi Mts., 1800 m. alt., *Abrams & McGregor 474* (G); between Mohave and Cameron, 1905, *K. Brandegee* (UC); Mohave Desert, 1884, *Curran* (G, ISOTYPE).

In habit quite similar to *C. oxygona*, and like that species much suggesting *C. muricata* in gross aspect. Although having smooth, wingless nutlets it seems very closely related to *C. oxygona*.

43. **C. Watsoni** (Gray) Greene. Slender strictly branched hispid herb 1–3 dm. high; stems solitary, sparsely to loosely branched, spreading short-hispid; leaves linear to oblanceolate, 1–4(–5) cm. long, 1–4(–5) mm. wide, obtuse or rounded, ascending, hispid and rarely pustulate; spikes solitary or geminate, 1–4(–6) cm. long, occasionally leafy-bracted below; corolla inconspicuous, ca. 1 mm. broad; fruiting calyx ovate or oblong-ovate, 2–3.5(–4) mm. long, subsessile, rounded at base, early deciduous, oldest ones becoming distant; mature calyx-lobes lanceolate, tips usually connivent, midrib hispid and scarcely thickened, margins appressed short-hispid; nutlets 4, homomorphous or practically so, lanceolate, 1.5–2 mm. long, ca. 0.8 mm. broad, smooth, shiny or at times dulled by minute granulations, back nearly flat, margins definitely angled, groove closed or nearly so and forked at base; gynobase subulate, ca. $\frac{2}{3}$ height of nutlets; style equalling nutlets or a trifle surpassed by them.—Pittonia i. 120 (1887). *Krynitzkia Watsoni* Gray, Proc. Am. Acad. xx. 271 (1885). *C. vinctens* Nels. & Macbr. Bot. Gaz. lxii. 143 (1916).

Eastern Washington to western Montana, southward to Nevada and northern Colorado.

MONTANA: Canyon Ferry, 1898, *Brandegee 30* (UC). WYOMING: steep slopes of river banks, Yellowstone River near Junction Butte, *Nelson 5761* (G); Centennial Hills, *Nelson 1684* (G, UC); Point of Rocks, *Nelson 3080* (G, UC); Gorfield Peak, *Nelson 672* in pt. (UC); Rocky Mts., *Nuttall* (G). COLORADO: along railroad tracks near Hot Sulphur Springs, Middle Park, 2280 m. alt., *Ramaley & Robbins 3575* (UC). IDAHO: loose disturbed soil near road, Challis, 1620 m. alt., *Macbride & Payson 3222* (G); dry granite slopes, Mackay, 1750 m. alt., *Nelson & Macbride 1527* (G, UC); sandy slopes New Plymouth, 660 m. alt., *Macbride 81* (G, UC). UTAH: Wasatch Mts., 1800 m. alt., *Watson 858* (G, TYPE of *K. Watsoni*). NEVADA: canyon on southwest base of Mt. Grant, 1410 m. alt., *Heller 10905* (G, UC); Mesia near Goldfield, *Heller 10970* in pt. (G, UC); Tonopah, 1800 m. alt., *Shockley 81* (UC). WASHINGTON: junction of Crab and Wilson creeks, 390 m. alt., *Sandberg &*

Leiberg 249 (G, UC). OREGON: dry ground, Narrows, *Peck 3587* (G); Juniper Springs, 1350 m. alt., *Leiberg 2271* (G, UC); rocky slopes, Mathew Valley near Harper's Ranch, 1100 m. alt., *Leiberg 2235* (G, TYPE of *C. vinctens*; UC, ISOTYPE); clay banks, Mathew Butte, 750 m. alt., *Leiberg 2041* (G).

An interesting species characterized by its four, lanceolate, angled nutlets and well developed style. Although it has been confused with *C. gracilis* it is really quite distinct from that plant in the angling and number of nutlets, length of style, and shape and pubescence of calyx. *Cryptantha vinctens* is a peculiar form of this species having somewhat appressed-pubescent and inconspicuously hispid calyces. The segregate is not separated geographically, and appears to be merely an extreme form whose characters of pubescence are rather completely obliterated by transitional forms clearly referable to *C. Watsoni.*

Ser. XI. GRACILES. Nutlets 1 or rarely 2, smooth, lanceolate, laterally rounded or obtuse, subhomomorphous, axial one always developing and in general slightly larger than the second nutlet when that develops; style reaching to ⅔–¾ height of nutlet.

44. **C. gracilis** Osterh. Slender erectly branched herb 1–2 dm. high; stems usually solitary, sparsely branched, densely spreading short-hispid; leaves not numerous, linear to narrowly oblanceolate, 1–3 cm. long, 1–3 mm. broad, obtuse or rounded, ascendingly short-hispid, usually minutely pustulate, upper leaves reduced; spikes solitary or geminate, usually dense, 1–2 cm. long, naked; corolla inconspicuous, limb 0.6–1 mm. broad; fruiting calyx ovate, divaricate, 2–2.8 mm. long, promptly deciduous, base decidedly conical, sessile; mature calyx-lobes lanceolate, rather densely appressed tawny hispid-villous, tips erect, midrib slightly thickened and inconspicuously short-hispid; nutlets 1 or rarely 2–3 and then more or less unequally developed, lanceolate, 1.5–2 mm. long, ca. 0.8–1 mm. broad, smooth and shiny, acute, back nearly flat, sides rounded at least towards apex, groove usually opened to above middle and scarcely forked below; gynobase ca. ½ height of nutlet; style reaching to ⅔–¾ height of nutlet.—Bull. Torr. Bot. Cl. xxx. 236 (1903). *C. Hillmanii* Nels. & Kenn. Proc. Biol. Soc. Wash. xix. 157 (1906). *C. gracilis*, var. *Hillmanii* Munz & Johnston, Bull. Torr. Bot. Cl. xlix. 39 (1922).

Southern Idaho and eastern Colorado to northern Arizona and southeastern California.

IDAHO: plains of the Snake River, *Palmer 72* (G, UC); without locality, *Henderson 2561* (G). COLORADO: Glenwood Springs, 1920, *Osterhout* (G); dry mesa among junipers, Nucla, 1800 m. alt., *Payson 395* (G). UTAH:

Gold Hill, 1891, *Jones* (UC); without locality, 1875, *Ward 1231* (G). NEVADA: Palmetto Range, *Purpus 5921* (UC); near Reno, 1894, *Hillman* (UC); Candelaria, *Shockley* (UC); Mesia west of Goldfield, 1860 m. alt., *Heller 10970* (G). ARIZONA: Ash Fork, *Rusby 747* (UC); Grand Canyon, 2100 m. alt., *Mac Dougal 184* (G, UC); Grand Canyon, *Macbride & Payson 947* (G); El Tovar, Grand Canyon, 1907, *Setchell* (UC). CALIFORNIA: near Bonanza King Mine, Providence Mts., *Munz, Johnston & Harwood 4222* (UC); Barnwell, *K. Brandegee* (UC); Silver Canyon near Laws, *K. Brandegee* (UC).

This is a very distinct species and is scarcely to be confused with any other once its characters are understood. The calyx is notably conical at the base, densely covered with short appressed hairs, and apparently lacking pungent hairs on the lobes. One nutlet commonly develops; this is obscurely if at all angled on the edges; and evidently surpasses the style. Occasionally two or even three nutlets are matured, and then they appear to be unequal in length and development. The normal and fully developed nutlet is always near the axial calyx-lobe.

Ser. XII. RAMULOSISSIMAE. Nutlets 4, smooth, lanceolate, laterally rounded or obscurely angled, practically homorphous but with the axial one minutely and obscurely though definitely larger than the others and always present when for any reason less than the normal number develop; style reaching the tips of the nutlets or barely surpassed by them.

45. **C. Fendleri** (Gray) Greene. Herb 1–5 dm. high, usually with a definite straight erect axis (commonly simple below but producing numerous ascending laterals above), more or less densely hispid and frequently appressedly so; leaves narrowly oblanceolate, acute, 2–5 cm. long, 2–4 mm. broad, appressed-hispid, frequently pustulate beneath; spikes solitary or geminate, 2–12 cm. long, sparsely if at all bracteate, loosely flowered; corolla inconspicuous, ca. 1 mm. broad; fruiting calyces ovate-oblong, 4–5(–7) mm. long, ascending, slightly asymmetrical, obscurely biserial; pedicels ca. 0.5 mm. long; mature calyx-lobes linear to lance-linear, usually loosely connivent with the tips somewhat spreading, midrib thickened and hirsute, margins strigose; nutlets homomorphous, 4 (exceptionally with 1–3 aborted, but then the axial nutlet always present), smooth, somewhat shiny, lanceolate, acuminate, 1.5–2 mm. long, back convex, sides rounded or obscurely obtuse, groove closed or nearly so but at base opening into a definite deltoid areola; gynobase subulate, twice length of style, at least ⅔ height of nutlets; style equalling or barely surpassing the nutlets.—Pittonia i. 120 (1887). *Krynitzkia Fendleri* Gray, Proc. Am. Acad. xx. 268 (1885). *Eritrichium hispidum*, var. *leiocarpum*

Kuntze, Rev. Gen. ii. 437 (1891). *C. ramulosissima* Nels. Erythea vii. 68 (1899). *C. wyomingensis* Gandoger, Bull. Soc. Bot. France lxv. 62 (1918).

Southern Alberta and Saskatchewan to eastern Nebraska, northern New Mexico and Arizona; also in eastern Washington and western Nevada.

ALBERTA: Hand Hills, *Macoun 165* (G). SASKATCHEWAN: Crane Lake, *Macoun 5804* (G). WYOMING: sandy dry bottom lands, Dunn's Ranch, *Nelson 7611* (G); sandy plains, Laramie, *Nelson 6886* and *7670* (G); Laramie, *Nelson 5275* (G, UC, ISOTYPES of *C. ramulosissima*); Pine Bluff, *Nelson 3510* (G); Sherman 1878, *Phillips & Sargent* (G); Cummins, *Nelson 1523* (G, UC, ISOTYPE of *C. wyomingensis*). NEBRASKA: sandy prairie, Dismal River south of Thedford, *Rydberg 1429* (G). COLORADO: dry places in Clear Creek Canyon, Georgetown, *Patterson 112* (G, UC); common on plains, Denver, *Eastwood 50* (G, UC); Denver, 1872, *Porter* (G); Rocky Mts., lat. 40°–41°, 1868, *Vasey 434a* (G); Rocky Mts., lat. 39°–41°, 1862, *Hall & Harbour 434* in pt. (G); Colorado Springs, 1873, *Greene* (G, UC); Sierra Mojado, 1877, *Brandegee* (UC); Fort Garland, 1867, *Parry* (G); Salida, *Osterhout 3425* (G); Gunnison, *Baker 780* (G). NEW MEXICO: between Santa Fe and Canoncito, 2190 m. alt., *Heller 3786* (G); without locality, 1847, *Fendler* (G, TYPE of *K. Fendleri*). UTAH: Montezuma Canyon, east of Monticello, *Rydberg & Garrett 9681* (G); sandy soil, La Sal Mts., *Purpus 6610* (UC); below Thurber, *Jones 5648* (UC). ARIZONA: Cosnino, *Rusby 750* (G); openings in yellow-pine forest, east base of San Francisco Mts., 2190 m. alt., 1920, *Hall* (G); Flagstaff, 1894, *Toumey* (UC); San Francisco Mts., 1884, *Lemmon* (UC); sand dunes, Navaho Reservation, *Vorhies 124* (G, UC). WASHINGTON: drifting sand, Pasco, *Piper 2951* (G); without locality, *Henderson 2562* (G). NEVADA: Palisade, *Brandegee* (G).

Cryptantha Fendleri is the most easterly ranging of the smooth-fruited series of *Cryptantha*. In its common typical form the erect habit and paniculate branching are very characteristic, and as a general thing the species has been well understood. A diffusely branched form from southern Wyoming has been described as *C. ramulosissima*. In floral and fruiting structures this form is quite indistinguishable from typical *C. Fendleri*. Similar material has been collected in eastern Washington. The range of *C. Fendleri* seems somewhat discontinuous. Its roots are frequently charged with a purple dye. The three extra-Californian species with narrow, smooth and more or less shiny nutlets may be distinguished as follows,—

Calyx broadly conical at base, densely appressed hispid-villous, lacking conspicuous bristles; nutlets 1; style 2/3–3/4 height of nutlets.....*C. gracilis.*

Calyx rounded at base, hispid or hirsute, inconspicuously strigose along margins; nutlets 4; style about equalling nutlets.

Nutlets evidently angled at the margin; groove closed throughout; leaves obtuse or rounded; plant without a straight vertical axis.....*C. Watsoni.*

Nutlets with margins rounded or somewhat obtusish, groove opened at base to form an areola; leaves acute; plant usually with a stiffly erect straight axis.....*C. Fendleri.*

Ser. XIII. LEIOCARPAE. Nutlets 1–4, smooth, ovate or somewhat lanceolate, laterally rounded or obtuse, homomorphous with the abaxial one always developing; style reaching to ¼ height of nutlets or barely surpassing them; calyx-lobes hirsute with straight hairs.

Style reaching to the tips of the nutlets or barely surpassing them.
Nutlets ovate with a subsimple groove; spikes decidedly bracteate.....46. *C. leiocarpa.*
Nutlets ovate-oblong, usually with a forked groove; spikes naked.....47. *C. hispidissima.*
Style reaching to 1/4–3/4 height of nutlets.
Style reaching to 1/4–1/2 height of nutlets.....48. *C. microstachys.*
Style reaching to 2/3–3/4 height of nutlets.
Hairs on upper part of calyx-lobes conspicuously retrorse. 49. *C. nemaclada.*
Hairs on calyx spreading or ascending.
Spikes naked.....50. *C. Clevelandi.*
Spikes bracted.
Corolla less than 1 mm. broad; diffuse prostrate plants.....51. *C. Brandegei.*
Corolla 1.5–2 mm. broad; sparsely branched erect plants.....52. *C. Abramsii.*

46. **C. leiocarpa** (F. & M.) Greene. Laxly branched usually decumbent or prostrate herb; branches usually long and numerous, hispid-strigose or frequently loosely appressed-hispid, becoming 1–4 dm. long; leaves oblance-linear to oblanceolate, strigose-hispid and often sparsely hispid, occasionally pustulate, obtuse or rounded or rarely emarginate, 1–2.5(–4) cm. long, 1–4(–9) mm. broad; spikes solitary or geminate or rarely ternate, becoming 6 cm. long but usually shorter, conspicuously leafy-bracted, not at all sharply differentiated from the mass of the plant; corolla usually inconspicuous, limb 1–2.5(–3.5) mm. broad; fruiting calyces ovate to oblong-ovate, 2–3 mm. long, usually ascending, tardily deciduous, subsessile, usually crowded or becoming loose below, subsymmetrical; mature calyx-lobes lance-linear, loosely connivent above, midrib somewhat thickened and usually decidedly tawny-hirsute, margins strigose; nutlets 4 or very rarely fewer by abortion, oblong-ovate to ovate, 1.6–2 mm. long, smooth, polished or minutely granulate and dull, back convex, margins obtuse, face convexo-obtuse, groove closed and very shortly forked at base if at all; gynobase subulate, ⅔–¾ height of nutlets; style equalling or slightly surpassing the tips of the nutlets.—Pittonia i. 117 (1887). *Echino-*

spermum leiocarpum F. & M. Ind. Sem. Hort. Petrop. ii. 36 (1835). *Krynitzkia leiocarpa* F. & M. l. c. vii. 52 (1841). *Eritrichium leiocarpum* Wats. Bot. King Exped. 244 (1871).

Along the ocean beach from southern (Curry County) Oregon to (Santa Barbara County) Southern California.

Oregon: beach, Gold Beach, *Peck 8691* (G); beach near Harbor, *Peck 8755* (G); Chetco, *Howell 222* (G). California: sand dunes of ocean beach, Humboldt Bay, *Tracy 2457* (G, UC); Bodega Point, *Eastwood 4815* (G); Bodega Bay, *Heller 5615* (G); Point Reyes, 1886, *Curran* (UC); San Francisco, 1895, *Davy* (UC); Golden Gate Park, San Francisco, 1881, *Jones* (UC); Lake Merced, 1901, *Jones* (UC); Presidio, San Francisco, 1894, *Eastwood* (UC); Monterey, 1883, *Parry* (G); Point Pinos, *K. Brandegee* (UC); Morro, *Barber* (UC); Casmaila Station, *K. Brandegee* (UC); Antonio Station, *K. Brandegee* (UC); Surf, 1909, *K. Brandegee* (G); Surf, 1909, *K. Brandegee a, b, c* (UC).

This is a very well marked coastal species, but has been greatly misinterpreted in the past and at various times made to include nearly all the smooth-fruited species of the genus. Study of material in the Gray Herbarium which was raised from authentic seeds received from St. Petersburg, Hamburg and Geneva, shows clearly that the name should be applied to the sea-shore plant of middle and northern California which has bracteate spikes, long styles, and small ovate smooth nutlets with a simple or barely forked groove. Occasionally it grows with *C. hispidissima* and has been confused with that species, although it is readily separable from it by its bracteate spikes, shorter ovate nutlets, simple or barely forked groove, and commonly smaller corollas. The leaves are usually 1–3 mm. broad, but in some peculiar forms from Surf, Santa Barbara County, California, which apparently grew with the common form, the leaves are broadly oblong, retuse and nearly 10 mm. broad.

47. **C. hispidissima** Greene. Erect and ascendingly branched or loosely branched and somewhat decumbent, 1.5–5 dm. high; stems hirsute or somewhat appressed-hispid; leaves oblance-linear to linear-lanceolate, ascending, 1.5–5.5 cm. long, 1.5–4 mm. wide, obtuse or acute, appressed or frequently spreading-hispid, occasionally hirsute-ciliate; spikes ternate or geminate or rarely quadrinate, dense or remotely flowered, bractless or occasionally with 1–2 bracts near base, 1–8(–15) cm. long; corolla more or less conspicuous or occasionally inconspicuous, 1–5 mm. broad; fruiting calyx ovate-oblong, usually spreading, 2–5 mm. long, slightly asymmetrical, base broad, sessile; mature calyx-lobes lance-linear or almost lanceolate, connivent above with the tips somewhat spreading, margins strigose, midrib thickened and decidedly hirsute; nutlets 4, homomorphous, ovate-lanceolate,

1.5–2 mm. long, smooth or very finely granulate, usually shiny, back convex, sides obtusish, groove simple or forked at very base; gynobase elongata, ca. ⅔ height of nutlets; style reaching to nutlet-tips or definitely surpassing them.—Pittonia i. 118 (1887). *C. leiocarpa,* var. *hispidissima* Macbr. Contr. Gray Herb. n. s. xlviii. 43 (1916).

West of and in the Coast Ranges of California, from San Francisco to Point Conception and doubtfully to near Los Angeles.

California: San Francisco, 1888, *Greene* (G); grassy slopes, Lake Merced, 30 m. alt., *Tracy 1809* (G); Siersville, *Mann* (G); in sand, Gigling Station east of Del Monte, *Heller 6711* (G); Del Monte, *Elmer 3561* (G, UC); Cypress Point, Monterey, *Eastwood 86* (G); Seaside, Monterey, *Eastwood 161* (G); Monterey, 1900, *Eastwood* (G); sand hills beyond Castroville, *Heller 8493* (G); Point Pinos, *K. Brandegee* (UC); Pacific Grove, *Davy 7491* (UC); Gigling Station, 1908, *K. Brandegee* (UC); San Lucia Mts., *Summers 898* (UC); San Lucia Mts., *Summers 589* (UC); Hathaway Hill, 1888, Summers, (UC); Salinas River, 1885, *Curran* (G); Lemmon Ranch, Cholame, 1887, *Lemmon 4606* (G); Cholame, 1887, *Lemmon 4613* (G); Lemmon Ranch, 1887, *Lemmon 4559* (G); Casmaila Station, *K. Brandegee* (UC); Surf, 1909, *K. Brandegee d* (UC); Redondo, 1903, *Grant 5500* (UC).

Obviously related to *C. Clevelandi,* var. *florosa* and perhaps not to be kept specifically distinct, although differing in general range and length of style.

48. **C. microstachys** Greene. Erect slender herb 1–5 dm. high; stems commonly with numerous ascending simple or rebranched laterals, hirsute or rarely more or less strigose; leaves linear, obtuse or rounded, 1–6 mm. long, 1.5–5(–8) mm. broad, broadly sessile or the lower ones with a contracted base, hispid or hirsute, rarely somewhat strigose or pustulate; spikes slender, solitary or geminate, naked, 2–8 cm. long, frequently somewhat crowded towards the end of the stem and apparently paniculate; corolla inconspicuous, usually 0.4–1 mm. or rarely even 2.5 mm. broad; fruiting calyces ovate or oblong-ovate, 1.5–3 mm. but commonly 1.5–2 mm. long, sessile, strict or ascending, asymmetrical with the abaxial lobe the longest and most hirsute; mature calyx-lobes linear or linear-lanceolate, connivent above with the tips somewhat spreading, usually united below to form a short siliceous tube, midrib slightly thickened and divaricately short-hirsute, margins ciliate; ovules 4; nutlets 1 or rarely 2, next the abaxial calyx-lobe, acute-ovate to lanceolate, 1.5 mm. long, smooth and shiny, back and sides rounded, groove closed and simple or forked at very base; gynobase very short, ¼ or less height of nutlet; style about as long as gynobase and commonly attaining about ½ height of nutlet or when two nutlets develop reaching to beyond their middle.—Pittonia i. 116 (1887). *Krynitzkia microstachys* Greene in Gray, Proc. Am. Acad. xx. 269 (1885).

Coast Ranges of middle California and the coastal drainage of Southern California.

CALIFORNIA: gravelly slope east of Alder Springs, Glenn Co., *Heller 11444* (G); Colusa County, 1884, *Curran* (G); Wildcat Canyon, *Davy 7046* (UC); Mt. Diablo, 1886, *Greene* (UC); shelving gravelly slope, Mitchell Canyon, Mt. Diablo, *Baker 2810* (G); Salinas road near Del Monte, *Heller 6698* (G); Lewis Creek, 1893, *Eastwood* (UC); Estrella, *Jared* (UC); San Luis Obispo and Monterey counties, 1899, *Jared 2* (G); Santa Barbara, *Elmer 3797* (G); Painted Cave Ranch, *Eastwood 67a* (G, UC); Santa Inez Mts., 1888, *Brandegee* (UC); Fort Tejon, *Xantus 84* (G, TYPE); Tehachapi, 1889, *Brandegee* (G); at roadside, Topango Canyon, *Crawford & Hiatt 995* (G); Topango, 1898, *Barber* (UC); Eagle Rock Canyon, *Grant 241* (UC); Los Angeles, 1884, *Nevin 57b* and *57c* (G); Pasadena, *Grant 239* (UC); San Gabriel Canyon, *Eastwood 8936* (G); Evey Canyon, 900 m. alt., *Johnston 2019* (G); San Antonio Canyon, *Baker 3698* (G); hills near Claremont, *Baker 4779* and *4780* (G); Arrowhead Hot Springs, 480 m. alt., *Spencer 1305* (G); San Bernardino, *Parish 3645* (G, UC); desert slope of San Jacinto Mts., 1020 m. alt., *Jaeger 1873* (G); burn in chaparral, 8 km. northeast of Murietta, 450 m. alt., *Munz & Johnston 5346* (UC); Linda Vista, *Macbride & Payson 797a* (G); Potrero, *Orcutt 1277* (G); San Diego, 1882, *Pringle* (G); Mission Hills, San Diego, *Abrams 3415* (G).

This species is very closely related to *C. Clevelandi* from which it differs in its coarser habit, shorter style, and usually fewer nutlets. The forms most suggestive of that species come from Southern California and have more or less closely appressed pubescence and calyces becoming 2–3 mm. long. These forms are few, however, most specimens being conspicuously bristly and having calyces only 1.5–2 mm. long.

49. **C. nemaclada** Greene. Slender much-branched erect herb 1–3 dm. tall, minutely and sparsely strigose, finely hispid; leaves linear, rather few, 1–3 mm. long, 1–2 mm. broad, obtuse, somewhat appressed, finely hispid, very minutely pustulate; spikes solitary or geminate, slender, naked, becoming loosely flowered, 2–9 cm. long; corolla inconspicuous, less than 1 mm. broad; fruiting calyx oblong-ovate, strictly ascending, 2–4 mm. long, deciduous, obscurely biserial, subsessile by an obliquely conic base; mature calyx-lobes linear, connivent above with the slender tips spreading, midrib thickened and more or less abundantly hirsute but near the tip retrorsely setulose, margins sparsely strigose; ovules 4; nutlets 1–4, lanceolate to ovate-lanceolate, smooth, 1.7–2 mm. long, back convex, sides obtuse, the one next the abaxial calyx-lobe always developing, groove opened or closed but usually open at the broad forking; gynobase slender, about ½ the length of the nutlets; style reaching to about ¾ the height of the nutlets.—Pittonia i. 118 (1887).

Coast Ranges of California from Tehachapi to Colusa County; rare.

CALIFORNIA: Keene Station, Tehachapi, 1905, *K. Brandegee* (UC); Paso Robles, *K. Brandegee* (UC); Alcalde, 1892, *Brandegee* (UC); Colusa County, 1884, *Curran* (UC, part of TYPE).

The plant is obviously related to *C. Clevelandi* and *C. hispidissima*, and further study may justify the reduction of it to one of the species named. Its outstanding feature is the possession of small stout retrorse hairs on the upper part of the calyx-lobes. The type came from Colusa County in the North Coast Range.

50. **C. Clevelandi** Greene. Usually erect freely branched herb 1–5 dm. tall; stems with long branches, strigose or hirsute; leaves linear to linear-lanceolate, usually acutish, 1–4(–6) cm. long, 1–4 mm broad, hirsute or occasionally strigose, spreading; spikes solitary or geminate or ternate, 4–10 cm. long, naked, slender, usually remotely flowered; corolla inconspicuous or conspicuous, 1–5 mm. broad; fruiting calyces ovate-oblong or nearly ovate, 2–5 mm. long, strict, asymmetrical, deciduous, subsessile by an obliquely conical base; mature calyx-lobes linear or lance-linear, usually decidedly connivent with tips somewhat spreading, midrib thickened and decidedly hirsute, margins densely hispid-ciliate; nutlets 1–4, ovate-oblong to broadly lanceolate, 1.5–2(–2.5) mm. long, smooth, usually very finely granulate, back convex, sides obtuse or rounded, axial nutlet always developing; groove closed, broadly forked at base or rarely with a small areola; gynobase elongate, ½–⅔ as high as the nutlets; style reaching to ⅔–⁴/₅ height of nutlets.—Pittonia i. 117 (1887).

Var. **genuina.** Corolla inconspicuous, ca. 1 mm. broad; leaves 1–2(–3) mm. broad; spikes solitary or geminate, not sharply differentiated from leafy mass of plant; nutlets 1–2.—*C. Clevelandi* Greene, l. c.

West of the mountains from the vicinity of Los Angeles southward to northern Lower California.

CALIFORNIA: shaded hillsides, San Jose Hills west of Pomona, 300 m. alt., *Munz & Harwood 3299* (UC); Chollas, 1884, *Orcutt* (UC); San Diego, 1898, *Purpus* (UC); San Diego, 1884, *Brandegee* (UC); San Diego, 1906, *K. Brandegee* (UC); San Diego, 1885, *Greene* (UC, ISOTYPE); Point Loma, 1895, *Brandegee* (UC); Point Loma, 1906, *K. Brandegee* (UC). LOWER CALIFORNIA: Todos Santos Island, 1897, *Brandegee* (UC); All Saints Bay, 1885, *Greene* (UC); Cariso Creek, 1893, *Brandegee* (UC); Vallederos, 1893, *Brandegee* (UC).

Var. **florosa**, var. nov., a varietate genuina differt corolla conspicua 2–5 mm. lata, foliis 1–4 mm. latis, spicis saepe ternatis et supra folia projectis, nuculis 1–4.—*C. Rattani* Greene, Pittonia i. 160 (1887).

In and west of the Coast Ranges of California from San Luis Obispo to San Diego, and infrequent northward to Lake County.

CALIFORNIA: ridges west of Leesville, Lake Co., *Heller 13124* (G); rocky slopes, Knoxville, *Baker 2966* (G); above San Antonio, *without collector* (UC); foot of Jolon Grade, *K. Brandegee* (UC); San Lucia Mts., *Summers* (UC); San Lucia Mts., *Summers 598* and *899* (UC); Reservoir, Hathaway Hill, 1884, *Summers* (UC); San Luis Obispo, 1905, *Roadhouse 54* (UC); San Luis Obispo, 1911, *Condit* (UC); Chorro Station near San Luis Obispo, *K. Brandegee* (UC); steep hills near Lompoc, *Suksdorf 220* and *7757* (G); Gaviota, *K. Brandegee* (UC); near Frazier Borax Mine, Mt. Pinos, *Abrams & McGregor 211* (G); Sisquoc, *Baker 22* (UC); Tehachapi, *K. Brandegee* (UC); Painted Cave Ranch, *Eastwood 31* (UC); San Miguel Island, 1886, *Greene* (UC); Santa Cruz Island, 1908, *Niedenmuller* (UC); Santa Cruz Island, 1888, *Brandegee* (UC); Santa Barbara, *Elmer 3936* (G); Santa Barbara, *Brewer 278* (UC); Santa Inez Mts., 1888, *Brandegee* (UC); Saugus, 1901, *Davy* (UC); South Beach, 1898, *Barber* (UC); Santa Monica Canyon, *Barber 116* (UC); Playa del Rey, *Hall 3780* (G, UC); San Pedro, 1889, *K. Brandegee* (UC); Santa Catalina Island, 1889, *Brandegee* (UC); grassy hillsides, Turnbull Canyon, Puente Hills, *Johnston 1935* (G); shaded hillside, Laguna, *Munz 2214* (G); roadside, Linda Vista, *Macbride & Payson 797* (G, TYPE); San Diego, 1906, *K. Brandegee* (UC).

This species includes almost all the material from South California passing as *C. leiocarpa*. It is related on one hand to *C. hispidissima* and on the other to *C. microstachys*, apparently intergrading with both. In having a very short style, elongate nutlets and bractless spikes, it differs from *C. leiocarpa*. Doubtfully included in the species are several collections from the North Coast Ranges.

51. **C. Brandegei** Johnston. Much branched decumbent or prostrate herb; stems numerous, slender, hispid-strigose, 1–4 dm. long; leaves oblong-lanceolate or lanceolate, spreading, 5–15 mm. long, 2–3(–4) mm. broad, obtuse or acute, hispid-strigose and often sparsely hispid, minutely pustulate; spikes solitary or occasionally geminate, 2–8 cm. long, dense or loose and elongate, slender, more or less evidently leafy-bracted; corolla inconspicuous, less than 1 mm. broad; fruiting calyx ovate-oblong, 2–4 mm. long, strictly ascending, asymmetrical, becoming obscurely biserial, sessile; mature calyx-lobes lance-linear, usually connivent above with the tips spreading, midrib thickened and hirsute, margins strigose; nutlets 1–4, ovate-lanceolate, 1.5–2 mm. long, smooth or very minutely granulate, usually shiny, back convex, sides rounded, face flattened, groove closed with a well developed basal fork; gynobase subulate, about $\frac{1}{2}$–$\frac{2}{3}$ height of nutlets; style reaching to $^{2}/_{3}$–$^{4}/_{5}$ height of nutlets.—Contr. Gray Herb. n. s. lxviii. 53 (1923)

Known only from Santa Rosa off the coast of California.

CALIFORNIA: Santa Rosa Island, 1888, *Brandegee* (G, TYPE; UC, ISOTYPE).

In habit much suggesting *C. leiocarpa* but differing in its more elongate nutlets, widely forked groove, short style and more southern insular range. It is much more closely related to, and perhaps it is

only a phase of, *C. Clevelandi* with which it agrees in nutlets although differing in its longer style and bracteate inflorescence. *Cryptantha Clevelandi*, var. *florosa* occurs on Santa Cruz and San Miguel islands which are adjacent to Santa Rosa Island.

52. **C. Abramsii** Johnston. Erectly and sparsely branched herb 1–3 dm. high; stem slender, finely strigose; leaves linear, rather numerous, 1–3 cm. long, 1–1.5 mm. broad, acutish, hispid-strigose, usually sparsely hirsute-ciliate towards the base; spikes solitary or rarely geminate, 2–10 cm. long, evidently leafy-bracted; corolla evident, 1.5–2.5 mm. broad; fruiting calyx ovate, strict, 2.5–4 mm. long, asymmetrical, becoming distant and obscurely biserial, sessile by an oblique broadly conic base; mature calyx-lobes lance-linear, loosely connivent, midrib somewhat thickened and on abaxial lobe sparsely and very shortly hirsute, margins strigose; nutlets 1–4, lanceolate, acuminate, ca. 2 mm. long, smooth, shiny, back convex, sides obscurely obtuse, groove closed and broadly forked at very base of nutlet; gynobase narrow, about $\frac{2}{3}$ height of nutlets; style reaching to $^3/_4$–$^4/_5$ height of nutlets.—Contr. Gray Herb. n. s. lxviii. 52 (1923).

Southern California, known only from the type locality.

California: San Pedro Hills near Malaga Cove, *Abrams 3139* (G, type; UC, isotype).

Although suggesting *C. leiocarpa* in its bracteate inflorescence, this species differs in its shorter style and elongate nutlets with a broad decidedly basal forking of the groove. It is most related to *C. Clevelandi*, var. *florosa* and possibly is only a bracteate phase of it.

Ser. XIV. FLACCIDAE. Nutlet 1, smooth, somewhat ovate, laterally rounded or obscurely angled, always abaxial; style reaching to $\frac{1}{4}$–$\frac{2}{3}$ height of nutlet; calyx-lobes armed with pallid encrusted arcuate or uncinate hairs.

Style reaching to 1/2–2/3 height of nutlet; nutlet with an open areola; rather coarse plants. . . . . 53. *C. rostellata*.
Style reaching to less than 1/2 height of nutlet; nutlet with a closed groove; more slender plants.
Nutlets nearly terete, rostrate; hairs on calyx usually decidedly encrusted and pale. . . . . 54. *C. flaccida*.
Nutlets evidently compressed, acute; hairs on calyx rather smooth and less pale. . . . . 55. *C. sparsiflora*.

53. **C. rostellata** Greene. Stems stiffish, usually somewhat reddish, 1–2 dm. high, with few ascending branches above, strigose, canescent; leaves few, notably persistent and opposite, thickish, firm, oblanceolate, 10–15 mm. long, 2–3 mm. broad, ascending; spikes

solitary or geminate, stiffish, naked, 2–4 cm. long; corolla inconspicuous, 0.5–1 mm. broad; fruiting calyces 3–4 mm. long, oblong-ovate, spreading or ascending (not strict), coarse, rather few, subpersistent, subsessile by a very asymmetrical base; mature calyx-lobes lanceolate, margin sparsely ciliate or strigose, midrib on all lobes armed with stout encrusted uncinate or arcuate hairs; ovules 4, the one next the abaxial calyx-lobe alone developing; nutlets 1, smooth, compressed, ovate-lanceolate to lanceolate, 2–3 mm. long, back convex, sides rounded, base truncate; groove closed above but dilated below into a definite areola; gynobase very short and stout; style reaching up to ⅓–½ height of nutlet.—Pittonia i. 116 (1887). *Krynitzkia rostellata* Greene, Bull. Calif. Acad. Sci. i. 203 (1885). *K. Suksdorfii* Greenm. Bot. Gaz. xl. 146 (1905). *C. Suksdorfii* Piper, Contr. U. S. Nat. Herb. xi. 484 (1906).

Southern Washington (Klickitat County) southward through eastern Oregon to the Sacramento Valley of California.

WASHINGTON: on dry hills near Rockland, *Suksdorf 1495* (G, TYPE of *K. Suksdorfii;* UC, ISOTYPE). OREGON: on dry hills near Dalles City, *Suksdorf 2346* (G, UC); camp by Grizzly Butte, Crook Co., 1170 m. alt., *Leiberg 282* (G, UC). CALIFORNIA: Hornbrook, 1889, *Howell* (UC); Hornbrook, *Howell 1386* (UC); Leesburg, 1884, *Curran* (UC, "part of type"); near Chico, 1887, *Parry* (UC); Lake County, 1884, *Curran* (G).

Obviously related to *C. flaccida* but readily separated by its usually coarse habit, longer style, compressed nutlets and basally dilated groove. The type is given as having been collected in "Lake County," California. Specimens in the University of California Herbarium, given as from "Leesburg," a town in Colusa County, California, are labeled as "part of type." This material, to judge from general appearance, seems quite the same as the authentic specimen of *C. rostellata* contained in the Gray Herbarium and probably is part of the same collection.

54. **C. flaccida** (Dougl.) Greene. Subsimple or ascendingly branched pallid strigose herb 1.5–4.5 dm. high; stems sparsely close-strigose with short pallid encrusted hairs; leaves oblance-linear or linear or even filiform, 2–6 cm. long, 1–2(–3) mm. wide, closely strigose, strict or ascending, firm, basal portion of lower leaves somewhat persistent; spikes quinate to solitary, naked, usually stiffish, 4–8(–16) cm. long; corolla inconspicuous or medium sized, 1–4 mm. broad; fruiting calyces oblong-ovate, 2–4(–5) mm. long, evidently asymmetrical, usually strict and closely hugging the stem, commonly firm and stiff, sessile or subsessile, base broadly conic; mature calyx-lobes lance-linear, closely connivent above with the tips commonly spread-

ing, margins more or less ciliate or strigose, midrib thickened and armed with pale spreading coarse encrusted arcuate or uncinate bristles, abaxial lobe longest and most hirsute; ovules 4 but only the one next the abaxial calyx-lobe developing; nutlet 1, lance-ovate, rostrate-acuminate, subterete or only slightly compressed, smooth or very finely granulate; groove closed and frequently with the margins overlapping, rarely open particularly towards the base where dilated to form a small areola; gynobase low and stout, scarcely developed, 0.6–0.2 mm. tall; style ⅓–½ as high as nutlet.—Pittonia i. 116 (1887). *Myosotis flaccida* Dougl. in Lehm. Pugil. ii. 22 (1830). *Eritrichium oxycaryum* Gray, Proc. Am. Acad. x. 58 (1874). *Krynitzkia oxycarya* Gray, Proc. Am. Acad. xx. 269 (1885). *C. multicaule* Howell, Fl. N. W. Amer. i. 487 (1901); not Nels. (1900). *C. Howellii* Nels. Bot. Gaz. xxxiv. 30 (1902).

Washington and Idaho to Southern California.

WASHINGTON: Coulee City, *Piper 3887* (G); junction of Crab and Wilson creeks, 450 m. alt., *Sandberg & Leiberg 304* (G, UC); near Sprague, 540 m. alt., *Sandberg & Leiberg* 173 (G, UC); Almota, *Piper 1702* (G); Walla Walla, 1883, *Brandegee* (UC); Waitsburg, *Horner 1170* (G). OREGON: along Des Chutes River at Sherar's Bridge, *Howell 502* (G, ISOTYPE and photograph of TYPE of *C. multicaulis*); Rhea Creek, 390 m. alt., *Leiberg 54* (G, UC); camp at Grizzly Butte, 1170 m. alt., *Leiberg 283* (G, UC); crevices of rocks, Tone, 1903, *Lunell 16* (G); bank of Hood River, 1883, *Henderson* (G); railroad track, Tonquin, *Nelson 3096* (G); dry stubble-field pastured to sheep, 1.6 km. north of Salem, *Nelson 4893* (G); dry bank, 1.6 km. north of Salem, *Nelson 2222* (G); dry slope near Illahe, *Nelson 1377* (G). IDAHO: valley of Clearwater River, *Sandberg, MacDougal & Heller 163* (G); about Lewiston, *Heller 3068* (UC); sandy flats, Falk's Store, 660 m. alt., *Macbride 36* (G); loamy sagebrush flat, Regena, 750 m. alt., *Macbride & Payson 2842* (G); Boise, 1881, *Canby* (G); without locality, 1892, *Mulford* (G). CALIFORNIA: dry land near Yreka, *Butler 734* and *1298* (UC); Yreka, *Smith 211* (G); Ager, 1887, *K. Brandegee* (UC); Edgewood, 1887, *Brandegee* (UC); Hy-Am-Pum, 1888, *Chestnut & Drew* (UC); Iqua, 1882, *Rattan 19* (G); Hupa Indian Reservation, 150 m. alt., *Chandler 1304* (G); dry hillside at little Van Duzen Bridge, 750 m. alt., *Tracy 2758* (UC); dry hillside at Alder Point Bridge on Eel River, 150 m. alt., *Tracy 1880* (UC); along ridge above Hopland, *Baker 3003* (G); Potter Valley, 1898, *Purpus* (UC); sunny hillsides, Potter Valley, *Purpus 1294* (UC); near Madison, *Heller & Brown 5410* (G); Russian River bed at Cloverdale, *Bolander 6541* (G, UC); between Cloverdale and Ukiah, *Bolander 3896* (UC); Leesville, 1889, *Brandegee* (UC); Cloverdale, 1890, *K. Brandegee* (UC); Howell Mt., 360 m. alt., *Tracy 439* (UC); Colusa County, 1884, *Curran* (G); Tiburon, *Eastwood 306* (G); Lower Pleasant Valley, *1891*, *Jepson* (UC); Sacramento Valley, *Hartweg 1872* (G); near mouth of Little Grizzly Creek below Genessee, *Heller & Kennedy 8853* (G); stony bank, 13 km. north of Oroville, *Heller 11325* (G, UC); Little Chico Canyon, 1896, *Austin 624* (UC); Little Chico, 1883, *Austin* (UC); Kelsey, 1889, *Brandegee* (UC); Sweetwater Creek, 1907, *K. Brandegee* (UC); The Buttes, 1891, *Jepson* (UC); Jackson, 390 m. alt., *Hansen 152* (G, UC); Pine Grove, 750 m. alt., *Hansen 430* (G); York Falls, 600 m. alt., *Hansen 431* (G, UC); Knight's Ferry, 1854, *Bigelow* (G); Mokelumne Hill, *Blaisdell* (G); Harmon Peak, *Davy 1420* (UC); Agua

Fria, 1897, *Congdon 44* (G); Beckwell Adobe, 1897, *Congdon 45* (G, UC); Yosemite Valley, *Bolander 6386* (G, UC); Yosemite, 1875, *McLean* (UC); Yosemite Valley, 1200–1350 m. alt., *Abrams 4560* (G); Wawona, *Lemmon* (UC); Borax Lake, *Torrey 329* and *333* (G); Madera, *Buckminster* (UC); Tehipite Valley, 1200 m. alt., *Hall & Chandler 505* (UC); Toll House, Fresno County, 1215 m. alt., *Hall & Chandler 32* (UC); Dunlap, 1893, *Eastwood* (UC); hillsides, North Tule River, *Purpus 5692* (UC); near Old Colony Mill, Giant Forest, 1905, *K. Brandegee* (UC); Portersville, *Donnelly 25* (UC); Camp Badger, 1892, *Holway 6* (UC); sunny gravelly slopes, Bear Creek, *Purpus 1707;* grassy fields, Caliente, *Heller 7625* (G); Caliente, 1892, *Brandegee* (UC); Tehachapi, 1889, *Brandegee* (UC); Keane, 510 m. alt., *Jones* (UC); north of Mt. Diablo, *Brewer 1129* (G); along banks and roadsides, Crystal Springs Lake, *Baker 468* (G, UC); Mt. Hamilton, *Elmer 5038* (UC); between Brick Yard and Licks Observatory, 1110 m. alt., *Pendleton 907* (UC); along Mt. Hamilton road, 22.5 km. from San Jose, *Heller 7437* (G, UC); Coyote, *Chandler 937* (UC); Lewis Creek, 1893, *Eastwood* (UC); Jolon, *Brandegee* (UC); without locality, 1899, *Jarea 1* (G); Lancaster, *K. Brandegee* (UC); Saugus, 1889, *Brandegee* (UC); Los Angeles, 1884, [*Nevin?*] *57g* (G); grassy mesa, Red Hill, 330 m. alt., *Johnston 1941* (G); dry ridges near Cuyamaca Lake, *Abrams 3824* (G); Colorado Desert, 1905, *Brandegee* (UC); without locality, *Blake* (G).

One of the best known species in the genus, readily recognized by its pallid strigose pubescence, stout arcuate bristles on the calyx-lobes, very short style and solitary terete ovate and rostrate nutlet. The type was collected by Douglas probably in eastern Oregon or Washington.

55. **C. sparsiflora** Greene. Very slender, sparingly and ascendingly branched sparsely strigose herb 1–3 dm. tall; cotyledons somewhat persistent, ovate to orbicular, 2.5 mm. broad, contracted to a petiole 2 mm. long; leaves few, narrowly linear, 1–3 cm. long, ca. 1 mm. broad, strigose, herbaceous, noticeably opposite below; spikes geminate or solitary, 2–6 cm. long, slender, not stiff, with 1–2 bracts near very base; corolla inconspicuous, less than 1 mm. broad; fruiting calyces 2–3 mm. long, ovate or oblong-ovate, ascending, few, early deciduous, subsessile by a very asymmetrical broadly conic base; mature calyx-lobes linear-lanceolate, united for ½–¼ length of calyx, loosely connivent, margins sparsely ciliate, midrib slightly thickened, armed with short stout smoothish uncinate hairs; ovules 4, the one next the abaxial calyx-lobe alone developing; nutlet 1, ovate, acute (scarcely if at all acuminate), decidedly compressed, smooth or finely granulate, 2 mm. long, equalled or somewhat surpassed by calyx-lobes, base somewhat truncate, back convex, margins angled, groove closed and broadly forking near the base; gynobase low; style attaining ⅓–½ height of nutlet.—Pittonia i. 116 (1887). *Krynitzkia sparsiflora* Greene, Bull. Calif. Acad. Sci. i. 203 (1885).

Slopes surrounding the Sacramento and San Joaquin valleys of California.

California: Lake County, 1884, *Curran* (G, UC); Coburn Mills, 1892, *Brandegee* (UC); Mormon Bar, Mariposa Co., 1889, *Congdon* (G); Whitlocks, 1897, *Congdon* (G); Havilah, 1891, *Brandegee* (UC).

Although having broad nutlets suggestive of *C. Torreyana*, this species is clearly related to *C. flaccida* as shown by its somewhat encrusted strigose pubescence, single abaxial nutlet, and falcate or uncinate bristles on the calyx-lobe. The plant is characterized by its broad nutlets, very slender habit, and short uncinate bristles on the calyx. The type of the species was collected by Curran somewhere in northern California, probably in Lake or Colusa counties.

Ser. XV. AFFINES. Nutlets 1 or 4, smooth, ovate, laterally rounded, asymmetrical with an excentric groove and an irregular areola, when single always abaxial; style reaching ¼–⅔ height of nutlets.

Nutlets 4; style reaching at least to 2/3 height of nutlets; flowers in biseriate spikes; plant erect.....56. *C. affinis.*
Nutlet solitary; style not reaching to middle of nutlet; flowers axillary; plant spreading.....57. *C. glomeriflora.*

56. **C. affinis** (Gray) Greene. Usually sparsely branched herb 1–2(–4) dm. high; branches commonly few and ascending but plant occasionally much branched from the base, hispid or short-hirsute throughout; leaves narrowly to broadly oblanceolate, 1–4(–5) cm. long, 2.5–6(–8) mm. broad, few, short-hirsute, usually minutely pustulate, obtuse or rounded at tip, lowest pair clearly opposite; spikes geminate or solitary, usually 2–8 but becoming 15 mm. long, slender, remotely flowered, commonly with a very few large leafy bracts below; corolla inconspicuous, 1–2 mm. long, limb ca. 1.5 mm. broad; fruiting calyx 2.5–4 mm. long, usually about as broad as long, laterally compressed, ascending; pedicels 0.5–1 mm. long; mature calyx-lobes lanceolate, somewhat connivent, not greatly surpassing the nutlets, midrib weakly thickened and on the abaxial lobe sparsely hirsute, margins appressed-hispid; nutlets 4, homomorphous, smooth or very finely granulate, shiny, brownish to greenish, frequently mottled, 1.8–2.5 mm. long, ovate, obliquely compressed, back low-convex, margins rounded; groove evidently excentric, closed, simple or shortly and unequally forked at the base; gynobase short, stout, ca. ½ height of nutlets; style evidently surpassed by nutlets or rarely equalling them.—Pittonia i. 119 (1887); Macbr. Contr. Gray Herb. n. s. xlviii. 46 (1916). *Krynitzkia affinis* Gray, Proc. Am. Acad. xx. 270 (1885). *C. geminata* Greene, l. c. *C. confusa* Rydb. Bull. Torr. Bot. Cl. xxxvi. 679 (1909).

Washington and western Montana to Southern California, northern Nevada and southern Wyoming.

WASHINGTON: Falcon Valley, *Suksdorf 455* (G); open pine wood, Falcon Valley, *Suksdorf 179* and *3207* (UC); valley of Swauk River, *Sharples 195* and *197* (G); Kamiach Butte, *Piper 3092* (G); dry rocky hillsides, Blue Mts., 1897, *Horner* (G); dry low ground northwest of Chenowith, *Suksdorf 2768* (UC); east side of Cascades, 1860, *Lyall* (G, TYPE of *K. affinis*). OREGON: dry slopes along Ashland-Klamath Falls road, 19 km. west of Keno, *Peck 9313* (G); without locality, *Howell 371* (G). IDAHO: Beaver Canyon, *Watson 286* (G); Payette Lake, 1899, *Jones* (UC). MONTANA: Priests, 1894, *Brandegee 98* (UC). WYOMING: Upper Madison Canyon, Yellowstone Park, 2200 m. alt., *Rydberg & Bessey 4884* (G, ISOTYPE of *C. confusa*). UTAH: City Creek Canyon near Salt Lake City, *Jones 269* (G) and *107* (UC). NEVADA: log railroad north of Verdi, 1590 m. alt., *Heller 10873* in pt. (G). CALIFORNIA: near Shasta Springs, *Heller 7962* (G); moist open places near Durney's Mill, north base of Mt. Eddy, *Heller 13287* (G, UC); Metcalf's Ranch, northeast base of Mt. Eddy, 1170 m. alt., *Heller 12397* (G); Goose Valley, *Eastwood 737* (G); Susanville, 1891, *Brandegee* (UC); meadows 3 km. south of Red Clover Valley, *Heller & Kennedy 8729* (G); Prattville, 1892, *Brandegee* (UC); Prattville, *Heller & Kennedy 8777* (G); edge of forest about Chico Meadows, 1200 m. alt., *Heller 11489* (G, UC); Sutton House, Butte Co., *Curran* (UC); in gravel on edge of north slope, Little Summit, *Heller 11487* (G, UC); moist soil along lake shore with aspen, Donner Lake, *Hall 6946* (G); near Donner Lake, *Torrey 331* (G); Strong's Canyon near Truckee, 1884, *Curran* (G); Old Camp on Truckee, *Sonne* (UC); Truckee, 1885, *Curran* (UC); lower end of Donner Lake, *Heller 6946* (G); Cobb Mt., Lake Co., *C. F. L.* (UC); near summit of Mt. Sanhedrin, Lake Co., *Heller 5882* (G); near Cape Horn, *K. Brandegee* (UC); Cathedral Trail to Mt. Tallac, 2100 m. alt., *Smiley 219* (G); Sly Park in sierran foothills of El Dorado Co., 1020 m. alt., *Hall 11276* (G, UC); Lake Valley, 1908, *K. Brandegee* (UC); Silver Lake, 1882, *Hansen* (UC); Bear Valley, Calaveras Co., 1800 m. alt., *Hansen 516* (G, UC); Yosemite Valley, *Abrams 4379* (G); Indian Creek, Yosemite Park, 2190 m. alt., *Hall 9172* (G); Vernal Falls, Yosemite Park, *Hall 8925* (UC); summit of Mt. Surprise, 1890, *Congdon 326* (UC); North Fork of San Joaquin, Madera Co., 1895, *Congdon* (G, UC); South Fork of San Joaquin River, Lost Valley, 2280 m. alt., *Hall & Chandler 650a* in pt. (UC); Hockett Meadows, 2550 m. alt., *Hall & Babcock 5632* (UC); Ellis Meadows, 1914, *K. Brandegee* (G); Sequoia National Forest, *Davidson 1820* (G); Sequoia Mills, 1892, *Eastwood* (UC); General Grant Big Tree Grove, 1892, *Brandegee* (UC); Natural Bridge of Volcano Creek, 2250 m. alt., *Hall & Babcock 5439* (G); dryish edge of meadow, Mare Flats, San Bernardino Mts., 2400 m. alt., *Crawford 934* in pt. (G); Middle Peak, Cuyamaca Mts., *Abrams 3856* (G); Southern California, 1888, *Palmer 183* (G).

Especially characteristic of this plant are its obliquely compressed nutlets and the resulting excentric position of the groove. The nutlets appear to be compressed by a force perpendicular to the axial and abaxial faces of the stout gynobase. Greene, l. c., has remarked on this development as exemplified in the type of the synonymous *C. geminata*.

57. **C. glomeriflora** Greene. Small very slender herb 1–8(–10) cm. high; stems simple or with more or less numerous ascending re-

branched basal branches, finely and very appressedly short-hispid or rarely somewhat spreadingly hispid; leaves linear-oblong to oblanceolate or lanceolate, 5–10 mm. long, 0.8–1.3 mm. broad, appressed short-hispid, minutely pustulate; flowers axillary, frequently borne along short branchlets and glomerate, distributed over nearly all parts of the plant; corolla inconspicuous, tubular and just surpassing the calyx, 1.3–1.8 mm. long, ca. 1 mm. broad, lobes broadly orbicular and erect, appendages trapeziform; fruiting calyx obovate, 2–2.5 mm. long, ascending, asymmetrical, united for ⅓–½ its length, base conical and somewhat siliceous, sessile, deciduous, not at all biserial; mature calyx-lobes lanceolate, erect or slightly connivent, midrib thickened and hirsute especially on abaxial lobe, margin short-hispid or hispid-strigose; ovules 4; nutlet 1, ovate, acute, 1.5–2 mm. long, next the abaxial calyx-lobe, asymmetrical, persistent, smooth and shiny, usually greenish, just surpassing or about equalling the axial calyx-lobes, back and sides rounded, face somewhat flattened; groove slightly off-center, closed except just above very base of nutlet where opening abruptly into an irregular roughened areola; gynobase very reduced, ca. 1/10 height of nutlet; style very short, not much surpassing the aborted nutlets, surpassed by the mature nutlet by over 1 mm. —Pittonia i. 116 (1887).

Central Sierra Nevada of California. Rare.

California: borders of ice-ponds below Truckee, 1887, *Sonne* (UC, isotype); dry gravelly pine forest, Tuolumne Meadows, 2600 m. alt., *Ware 2690c* (G); Volcano Creek, Upper Kern River, 2400 m. alt., *Hall & Babcock 5322* (UC).

A very rare and distinct species with a habit recalling *Plagiobothrys* § *Allocarya*. It is very well marked in having asymmetrical solitary nutlets that about equal the calyx-lobes, and in having decidedly axillary glomerate flowers with no suggestion of a biserial arrangement. The nutlets are suprabasal in attachment.

Excluded or Unidentified Species.

Cryptantha Bartolomaei Greene, Pittonia ii. 232 (1892). "Aspect, pubescence and inflorescence of *C. utahensis*, but the minute (½ line long) ovate-lanceolate nutlets (4 and consimilar) perfectly smooth and lucid, and without margin; the ventral groove shortly bifurcate at base, but closed throughout. Bay of San Bartolomé, Lower California, Lieut. Pond, 1889. A connecting link between the *oxygona* and *leiocarpa* groups in the genus."—The identity of this species is wholly obscure.

CRYPTANTHA FALLAX Greene, Pittonia v. 54 (1902). "With much the aspect of a slender *C. muriculata*, less than a foot high, the branches with scattered oblong-linear obtuse foliage and terminating in 3 divergent short and rather dense spikes; stem sparsely villous-hirsute, the foliage as sparingly somewhat strigose, the calyxes with a dense pubescence under the rather few very hispid spreading hairs: calyx-segments lanceolate, short, the tips not attenuate; corolla minute; nutlets ovate-lanceolate from a truncate base, traversed ventrally by a closed scar, this shortly forked at base, the whole surface grayish, smooth and shining, the back but slightly convex and distinctly sharp-edged. A very remarkable species in the almost wing-margined character of the smooth nutlets; for the plant has the aspect of that group of species whose nutlets are obtuse all around, and muricate. The only specimen known was collected by myself in the mountains above Tehachapi, California, 22 June, 1889, and was mixed with my duplicates of *C. muriculata* until now."—Perhaps conspecific with *C. mohavensis*.

Cryptantha heliotropoides Loes. in Fedde, Repert. xii. 243 (1913) = ANTIPHYTUM HELIOTROPIOIDES A. DC. Prodr. x. 122 (1846).

Cryptantha Torreyi Rydb. Mem. N. Y. Bot. Gard. i. 331 (1900).—Although taken up in place of *C. Torreyana* (Gray) Greene, this name is based on *Eritrichium Torreyi* Gray and so falls into the synonymy of PLAGIOBOTHRYS TORREYI Gray, Proc. Am. Acad. xx. 284 (1885).

Krynitzkia californica Gray, Proc. Am. Acad. xx. 266 (1885) = PLAGIOBOTHRYS TRACHYCARPUS (Gray) Johnston, Contr. Gray Herb. n. s. lxviii. 78 (1923).

Krynitzkia californica, var. *subglochidiata* Gray, Proc. Am. Acad. xx. 266 (1885) = PLAGIOBOTHRYS SCOPULORUM (Greene) Johnston, Contr. Gray Herb. n. s. lxviii. 79 (1923).

Krynitzkia Chorisiana Gray, Proc. Am. Acad. xx. 267 (1885) = PLAGIOBOTHRYS CHORISIANUS (Cham.) Johnston, Contr. Gray Herb. n. s. lxviii. 77 (1923).

Krynitzkia Cooperi Gray, Proc. Am. Acad. xx. 267 (1885) = PLAGIOBOTHRYS PARISHII Johnston, Contr. Gray Herb. n. s. lxviii. 78 (1923).

Krynitzkia depressa Jones, Contr. W. Bot. xiii. 5 (1910) = OREOCARYA DEPRESSA (Jones) Macbr. Contr. Gray Herb. n. s. xlviii. 32 (1916).

Krynitzkia echinoides Jones, Proc. Calif. Acad. Sci. ser. 2, v. 709 (1895) = OREOCARYA ECHINOIDES (Jones) Macbr., i. e. plant treated by Macbride, Contr. Gray Herb. n. s. xlviii. 36 (1916), as *O. fulvocanescens*.

Krynitzkia floribunda Gray, Proc. Am. Acad. xx. 265 (1885) = ANTIPHYTUM FLORIBUNDUM (Torr.) Gray, Proc. Am. Acad. x. 55 (1875).

Krynitzkia fulvocanescens Gray, Proc. Am. Acad. xx. 280 (1885) = OREOCARYA FULVOCANESCENS (Gray) Greene, i. e. *O. echinoides* of Macbride, Contr. Gray Herb. n. s. xlviii. 31 (1916)

Krynitzkia fulvocanescens, var. *idahoensis* Jones, Contr. W. Bot. xiii. 6 (1910) = OREOCARYA sp.

Krynitzkia glomerata Gray, Proc. Am. Acad. xx. 279 (1885) = OREOCARYA GLOMERATA (Pursh) Greene, Pittonia i. 58 (1887).

Krynitzkia glomerata, var. *acuta* Jones, Zoe ii. 250 (1891) = OREOCARYA WETHERILLII Eastw. Bull. Torr. Bot. Cl. xxx. 242 (1903).

Krynitzkia glomerata, var. *virginensis* Jones, Contr. W. Bot. xiii. 5 (1910) = OREOCARYA VIRGINENSIS (Jones) Macbr. Proc. Am. Acad. li. 547 (1916).

Krynitzkia heliotropioides Gray, Proc. Am. Acad. xx. 265 (1885) = ANTIPHYTUM HELIOTROPIOIDES A. DC. Prodr. x. 122 (1846).

Krynitzkia Jamesii Gray, Proc. Am. Acad. xx. 278 (1885) = OREOCARYA SUFFRUTICOSA (Torr.) Greene, Pittonia i. 57 (1887).

Krynitzkia Kingii Wats. acc. Hillman, Nevada Agric. Exper. Sta., Bull. xxiv. 71 (1895) = PLAGIOBOTHRYS KINGII (Wats.) Gray, Proc. Am. Acad. xx. 281 (1885).

Krynitzkia leucophaea Gray, Proc. Am. Acad. xx. 280 (1885) = OREOCARYA LEUCOPHAEA (Dougl.) Greene, Pittonia i. 58 (1887).

Krynitzkia leucophaea, var. *alata* Jones, Proc. Calif. Acad. Sci. ser. 2, v. 710 (1895) = OREOCARYA CONFERTIFLORA Greene, Pittonia iii. 112 (1896).

Krynitzkia lithocarya Greene in Gray, Proc. Am. Acad. xx. 265 (1885) = PLAGIOBOTHRYS LITHOCARYUS (Greene) Johnston, Contr. Gray Herb. n. s. lxviii. 76 (1923).

Krynitzkia mensana Jones, Contr. W. Bot. xiii. 4 (1910) = OREOCARYA EULOPHUS Rydb. Bull. Torr. Bot. Cl. xxxi. 637 (1905).

Krynitzkia mollis Gray, Proc. Am. Acad. xx. 267 (1885) = PLAGIOBOTHRYS MOLLIS (Gray) Johnston, Contr. Gray Herb. n. s. lxviii. 74 (1923).

Krynitzkia multicaulis, var. *abortiva* Jones, Contr. W. Bot. xiii. 5 (1910) = OREOCARYA SUFFRUTICOSA, var. ABORTIVA (Jones) Macbr. Proc. Am. Acad. li. 547 (1916).

Krynitzkia multicaulis, var. *setosa* Jones, Contr. W. Bot. xiii. 4 (1910) = OREOCARYA sp.

Krynitzkia oblata Jones, Contr. W. Bot. xiii. 4 (1910) = OREOCARYA OBLATA (Jones) Macbr. Proc. Am. Acad. li. 548 (1916).

Krynitzkia Palmeri Gray, Proc. Am. Acad. xx. 278 (1885) = OREOCARYA PALMERI (Gray) Greene, Pittonia i. 57 (1887).

Krynitzkia Parryi Gray, Proc. Am. Acad. xx. 265 (1885) = ANTIPHYTUM PARRYI Wats. Proc. Am. Acad. xviii. 122 (1883).

Krynitzkia peninsularis Rose, Contr. U. S. Nat. Herb. i. 85 (1890) = ANTIPHYTUM PENINSULARE (Rose) Johnston, Contr. Gray Herb. n. s. lxviii. 51 (1923).

Krynitzkia plebeia Gray, Proc. Am. Acad. xx. 266 (1885) = PLAGIOBOTHRYS PLEBEJUS (Cham.) Johnston, Contr. Gray Herb. n. s. lxviii. 77 (1923).

Krynitzkia pustulata Blankinship, Mont. Agric. Coll. Sci. Studies, Bot. i. 96 (1905) = OREOCARYA AFFINIS Greene, Pittonia iii. 110 (1896).

Krynitzkia Scouleri Gray, Proc. Am. Acad. xx. 267 (1885) = PLAGIOBOTHRYS SCOULERI (H. & A.) Johnston, Contr. Gray Herb. n. s lxviii. 75 (1923).

Krynitzkia sericea Gray, Proc. Am. Acad. xx. 279 (1885) = OREOCARYA SERICEA (Gray) Greene, Pittonia i. 58 (1887).

Krynitzkia sericea, var. *fulvocanescens* Jones, Proc. Calif. Acad. Sci. ser. 2, v. 710 (1895) = OREOCARYA FULVOCANESCENS (Gray) Greene, Pittonia i. 58 (1887).

Krynitzkia setosissima Gray, Proc. Am. Acad. xx. 276 (1885) = OREOCARYA SETOSISSIMA (Gray) Greene, Pittonia i. 58 (1887).

Krynitzkia trachycarpa Gray, Proc. Am. Acad. xx. 266 (1885) = PLAGIOBOTHRYS TRACHYCARPUS (Gray) Johnston, Contr. Gray Herb. n. s. lxviii. 78 (1923).

Krynitzkia virgata Gray, Proc. Am. Acad. xx. 279 (1885) = OREOCARYA VIRGATA (Porter) Greene, Pittonia i. 58 (1887).

PIPTOCALYX MOOREI Oliver in Benth. Fl. Austral. v. 292 (1870).—A shrubby Australian plant belonging to the *Monimiaceae*, cf. Perkins & Gilg, Pflanzenr. iv. Fam. 101, 22–23 (1901).

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Jared, L. 2 microstachys (48).

Johnston, E. L., & Hedgcock, G. G. 509 minima (23).

Johnston, I. M. 27r micrantha v. genuina (7a); 1002 racemosa (2); 1053 barbigera (29); 1542, 1598 muricata v. denticulata (32c); 1620 echinella (41); 1886 muricata v. Jonesii (32b); 1934 intermedia (28); 1935 Clevelandi v. florosa (50b); 1938 intermedia (28); 1941 flaccida (54); 1948 intermedia (28); 1950 muricata v. denticulata (32c); 1957 intermedia (28); 1958 muricata v. Jonesii (32b); 1959, 1960 intermedia (28); 2019 microstachys (48); 2035 simulans (39); 2048a muricata v. Jonesii (32b); 2046, 2047, 2048, 2049 intermedia (28); 2057 simulans and echinella (39 and 41); 2071 echinella (41); 2073 muricata v. denticulata (32c); 3071 Grayi v. cryptochaeta (9c); 3175, 3374, 3505, 3621 racemosa (2); 3947 Grayi v. nesiotica (9b); 4192 racemosa (2); 4221 angelica (3); 4227 angustifolia (8); 6494 pterocarya v. genuina (19a).

Jones, M. E. 26 muricata v. denticulata (32c); 2810 muricata v. Jonesii (32b); 3709 crassisepala (24); 3741 pusilla (5); 3753 pterocarya v. cycloptera (19b); 3824 maritima v. genuina (16a); 3841 costata (6); 3910 utahensis (17); 5106 barbigera (29); 5370 ambigua (40); 5648 Fendleri (45); 6838 Torreyana v. genuina (38a); 7028 muricata v. denticulata (32c).

Jones, W. W. 106 micrantha v. genuina (7a); 342 nevadensis v. rigida (30b).

Kellogg, A., & Harford, W. G. 770 Torreyana v. pumila (38c).

Kennedy, P. B. 952 muricata v. denticulata (32c); 998 pterocarya v. genuina (19a); 1293 ambigua (40); 1345 pterocarya v. genuina (19a); 1428 Torreyana v. genuina (38a); 1446 simulans (39); 1606 echinella (41); 1832 micrantha v. genuina (7a); 1838 decipiens v. genuina (25a); 1917 muricata v. denticulata (32c).

Kennedy, P. B., & Goodding, L. N. 24 pterocarya v. cycloptera (19b); 26 angustifolia (8); 74 dumetorum (14).

Kreager, F. O. 93 Torreyana v. genuina (38a).

Leiberg, J. B. 41 pterocarya v. genuina (19a); 54 flaccida (54); 116 Hendersoni (36); 282 rostellata (53); 283 flaccida (54); 324 circumscissa v. genuina (10a); 1539 Torreyana v. genuina (38a); 2041 pterocarya v. genuina (19a); 2041, 2235, 2271 Watsoni (43); 2362 Hendersoni (36); 2425 recurvata (12); 2465 Hendersoni (36).

Lemmon, J. G. 4559, 4606, 4613 hispidissima (47).

Lunell, J. 16 flaccida (54).

Macbride, J. F. 29 circumscissa v. genuina (10a); 36 flaccida (54); 81 Watsoni (43); 109 Hendersoni (36); 373 Torreyana v. genuina

(38a); 465 ambigua (40); 786 circumscissa v. genuina (10a); 1690 Torreyana v. genuina (38a).

Macbride, J. F., & Payson, E. B. 689 crassisepala (24); 735, 748 intermedia (28); 797 Clevelandi v. florosa (50b); 797a microstachys (48); 947 gracilis (44); 2842 flaccida (54); 2861, 2936, 3044 ambigua (40); 3221 scoparia (31); 3222 Watsoni (43); 3305 ambigua (40).

MacDougal, D. T. 184 gracilis (44).

Macoun, J. 165 Fendleri (45); 672 intermedia (28); 5803 Kelseyana and minima (22 and 23;) 5804 Fendleri (45).

Macoun, J. M. 66580, 78736 Torreyana v. genuina (38a).

Manning, M. H. 160 Torreyana v. genuina (38a).

Mathews, W. 40 crassisepala (24).

Merrill, E. D., & Wilcox, E. N. 873 circumscissa v. genuina (10a); 842 Torreyana v. genuina and ambigua (38a and 40).

Metcalfe, O. B. 52 crassisepala (24); 1573 pterocarya v. cycloptera (19b).

Munz, P. A. 2214 Clevelandi v. florosa (50b); 5784 intermedia (28); 6076 echinella (41).

Munz, P. A., & Harwood, R. D. 3299 Clevelandi v. genuina (50a); 3472 intermedia (28); 3587, 3601a costata (6).

Munz, P. A., & Johnston, I. M. 5176 nevadensis v. genuina (30a); 5317 intermedia (28); 5346 microstachys (48).

Munz, P. A., Johnston, I. M., & Harwood, R. D. 4222 gracilis (44); 4241 utahensis (17); 4281 barbigera (29).

Munz, P. A., & Keck, D. 4755 maritima v. genuina (16a); 4757 barbigera (29); 4763 angustifolia (8).

Nelson, A. 304 minima (23); 412, 672 Kelseyana (22); 672 Watsoni (43); 1335 Kelseyana (22); 1523 Fendleri (45); 1684, 3080 Watsoni (43); 3171 Kelseyana (22); 3510 Fendleri (45); 4683 scoparia (31); 5275 Fendleri (45); 7280 Kelseyana (22); 7611 Fendleri (45); 8731, 8888 ambigua (40); 8897, 9049, 9377a, 9415 Kelseyana (22).

Nelson, A., & Macbride, J. F. 1215 Torreyana v. genuina (38a); 1311 scoparia (31); 1527 Watsoni (43); 1703 scoparia (31); 1739 pterocarya v. genuina (19a); 1773 ambigua (40); 1801 scoparia (31); 2151 Torreyana v. genuina (38a); 2231 scoparia (31).

Nelson, A., & Nelson, E. 5761 Watsoni (43); 5761a ambigua (40); 5887 Pattersoni (20); 6224 Torreyana v. genuina (38a); 6440 ambigua (40); 6546 Torreyana v. genuina (38a); 6886, 7670 Fendleri (45).

Nelson, E. 851 ambigua (40); 859 circumscissa v. genuina (10a).

Nelson, E. W. 6343 albida (11).

Nelson, J. C. 1254, 1369 Hendersoni (36); 1377 flaccida (54); 1414, 2083, 2109, 2166 Hendersoni (36); 2222 flaccida (54); 3093 Hendersoni (36); 3096 flaccida (54); 3253, 4869 Hendersoni (36); 4893 flaccida (54).

Nevin, J. C. 57a flaccida (54); 57b, 57c microstachys (48).

Orcutt, C. R. 15 echinosepala (13); 27, 52, 80 Grayi v. genuina (9a); 1022, 1127 muricata v. Jonesii (32b); 1277 microstachys (48); 1278 intermedia (28); 1279 nevadensis v. genuina (30a); 1281 muricata v. Jonesii (32b); 2257 maritima v. genuina (16a); 2264 barbigera (29).

Osterhout, G. 3425 Fendleri (45); 3464 Kelseyana (22); 3464, 3559b Pattersoni (20); 6188 Kelseyana (22).

Palmer, E. 26 echinosepala (13); 28 pusilla (5); 41 simulans (39); 65 pusilla (5); 67 maritima v. genuina (16a); 68 foliosa (27); 72 gracilis (44); 139 pusilla (5); 150 decipiens v. genuina (25a); 169 angustifolia (8); 183 affinis (56); 188 racemosa (2); 204 scoparia (31); 227 pusilla and albida (5 and 11); 241 angustifolia (8); 242 echinosepala (13); 243 albida (11); 257 intermedia (28); 343

albida (11); 346 pterocarya v. cycloptera (19b); 348 barbigera (29); 350 nevadensis v. genuina (30a); 352 utahensis (17); 371 micrantha v. genuina (7a); 372 circumscissa v. genuina (10a); 376 muricata v. genuina (32a); 397 Grayi v. cryptochaeta (9c); 551 maritima v. pilosa (16c); 606 angustifolia (8); 608 intermedia (28); 691 maritima v. cedrosensis (16b); 695 intermedia (28); 780 barbigera (29); 781 maritima v. genuina (16a); 801 Grayi v. genuina (9a); 842 foliosa (27); 846 racemosa (2); 877 foliosa (27); 879 maritima v. genuina (16a); 896 albida (11); 912 maritima v. genuina (16a); 2046 albida (11); 2142 maritima v. pilosa (16c).

Pammel, L. H., & Blackwood, R. 3895 Torreyana v. genuina (38a).

Parish, S. B. 3337 racemosa (2); 3645 microstachys (48); 3660 intermedia (28); 4850 nevadensis v. genuina (30a); 6940 intermedia (28); 8124 angustifolia (8); 8429 costata (6); 9798 maritima v. pilosa (16c); 9810 dumetorum (14); 9855 holoptera (1); 9859 inaequata (4); 9869 barbigera (29); 10005, 10050 maritima v. pilosa (16c); 10125 racemosa (2); 10138 pterocarya v. genuina (19a); 10238 pterocarya v. genuina (19a); 11117 intermedia (28); 11118 muricata v. Jonesii (32b); 11154 intermedia (28); 11299 intermedia (28).

Parish, S. B., & Parish, W. F. 771 micrantha v. genuina (7a); 771a micrantha v. lepida (7b); 775 racemosa (2); 929 intermedia and muricata v. Jonesii (28 and 32b); 1215 intermedia (28).

Parish, W. F. 167 pterocarya v. cycloptera (19b).

Parry, C. C. 14,164 micrantha v. genuina (7a); 165 circumscissa v. genuina (10a); 171 barbigera (29).

Parry, C. C., & Lemmon, J. G. 279½ simulans (39).

Parry, C. C., & Palmer, E. 623 albida (11).

Patterson, H. N. 111 Kelseyana and minima (22 and 23); 112 Fendleri (45).

Payson, E. B. 296 minima (23) - 395 gracilis (44).

Payson, E. B., & Armstrong, G. M. 3324, 3392 Torreyana v. genuina (38a).

Payson, E. B., & Payson, L. B. 1756 Torreyana v. genuina (38a); 2535 Kelseyana (22); 2546 Pattersoni (20); 2628 Torreyana v. genuina (38a).

Peck, M. E. 1369½, 1416 Torreyana v. genuina (38a); 3587 Watsoni (43); 3607 ambigua (40); 3609 Torreyana v. genuina (38a); 3995 Hendersoni (36); 6108 circumscissa v. genuina (10a); 8473 Hendersoni (36); 8691, 8755 leiocarpa (46); 9264 simulans (39); 9295 Torreyana v. genuina (38a); 9313 affinis (56); 9447 Torreyana v. genuina (38a); 9709 circumscissa v. genuina (10a); 9710 ambigua (40).

Pendleton, R. L. 907 flaccida (54).

Piper, C. V. 295 Fendleri (45); 372 Hendersoni (36); 1702 flaccida (54); 1941, 1944 Hendersoni (36); 1945 Torreyana v. genuina (38a); 2961 pterocarya v. genuina (19a); 2966 circumscissa v. genuina (10a); 3091 Torreyana v. genuina (38a); 3092 affinis (56); 3887 flaccida (54); 4140 Torreyana v. genuina (38a); 5030 scoparia (31); 5044 Torreyana v. genuina (38a); 5018, 5043, 5105, 5106, Hendersoni (36).

Pond, C. F. 21 maritima v. genuina (16a).

Pringle, C. G. 184 pusilla (5); 6648, 8301 albida (11).

Purpus, C. A. 126 albida (11); 1294, 1707 flaccida (54); 2402 albida (11); 5304 circumscissa v. hispida and circumscissa v. genuina (10a, b); 5369 oxygona (18); 5433 utahensis (17); 5692 flaccida (54); 5712 circumscissa v. genuina (10a); 5825 pterocarya v. cycloptera (19b); 5825a oxygona (18); 5841 circumscissa v. genuina (10a); 5856 recurvata (12); 5897 oxygona (18); 5921 gracilis (44); 5986 utahensis and pterocarya v. genuina (17 and 19a); 6024 racemosa (2); 6077 echinella (41); 6488 recurvata (12); 6610 Fendleri (45).

Rattan, V. 6 micromeres (15); 19 flaccida (54); 42 Torreyana v. genuina (38a); 43 intermedia (28).
Ramaley, T., & Robbins, W. W. 3575 Watsoni (43).
Reverchon, J. 2120 minima (23).
Roadhouse, F. E. 54 Clevelandi v. florosa (50b).
Robinson, O. W., & Crocker, H. 998 intermedia (28).
Rothrock, J. F. 88 intermedia (28).
Rydberg, P. A., & Bessey, E. A. 4885, 4886, 4887, 4889 ambigua (40).
Rydberg, P. A., & Garrett, A. O. 9681 Fendleri (45).
Rydberg, P. A., & Vreeland, F. K. 5697 minima (23).
Rusby, H. H. 285 barbigera (29); 745 micrantha v. genuina (7a); 747 gracilis (44); 750 Fendleri (45).

Sandberg, J. H., & Leiberg, J. B. 121 Torreyana v. genuina (38a); 173 flaccida (54); 228 circumscissa v. genuina (10a); 248 Watsoni (43); 260 pterocarya v. genuina (19a); 304 flaccida (54).
Sandberg, J. H., MacDougal, D. T., & Heller, A. A. 163 flaccida (54); 351 Torreyana v. genuina (38a).
Schaffner, J. G. 731 albida (11).
Seaton, H. E. 173 albida (11).
Seler, E., & Seler, C. 5304 albida (11).
Sharples, S. P. 195, 197 affinis (56).
Sheldon, E. P. S10866 Hendersoni (36).
Shockley, W. H. 69 utahensis (17); 81 Watsoni (43); 260 recurvata (12); 282 pterocarya v. genuina (19a); 288 nevadensis v. genuina (30a); 347, 650 utahensis (17).
Smart. 126 barbigera (29); 132 pterocarya v. cycloptera (19b); 141 crassisepala (24).
Smiley, F. J. 219 affinis (56); 820 circumscissa v. genuina (10a).
Smith, L. E. 211 flaccida (54).
Spencer, M. F. 36, 37 intermedia (28); 38 muricata v. Jonesii (32b); 184 nevadensis v. genuina (30a); 187 barbigera (29); 188 nevadensis v. genuina (30a); 189 barbigera (29); 190 pterocarya v. cycloptera (19b); 191 barbigera (29); 194 micrantha v. genuina (7a); 195a, 198 maritima v. genuina (16a); 195, 196, 197 angustifolia (8); 200 pterocarya v. cycloptera (19b); 200a barbigera (29); 201 angustifolia (8); 254 racemosa (2); 290, 294 intermedia (28); 345 muricata v. Jonesii (32b); 387 circumscissa v. genuina (10a); 389, 403, 411 nevadensis v. rigida (30b); 415 oxygona (18); 419 nevadensis v. rigida (30b); 436 micrantha v. genuina (7a); 438 nevadensis v. genuina (30a); 555 nevadensis v. rigida (30b); 838 intermedia (28); 843 angustifolia (8); 844 micrantha v. genuina (7a); 846, 847 pterocarya v. cycloptera (19b); 848 nevadensis v. genuina (30a); 849 angustifolia (8); 850, 851, 852 intermedia (28); 853, 855 angustifolia (8); 856 pterocarya v. cycloptera (19b); 857 micrantha v. genuina (7a); 858 micrantha v. lepida (7b); 859 nevadensis v. genuina (30a); 862 barbigera (29); 863, 920, 921, 922, 923, 929, 938, 1112 intermedia (28); 1178 muricata v. Jonesii (32b); 1179 intermedia (28); 1301 micrantha v. lepida (7b); 1302, 1303 muricata v. Jonesii (32b); 1304 micrantha v. genuina (7a); 1305 microstachys (48); 1306 muricata v. Jonesii (32b); 1347 micrantha v. lepida (7b); 1348, 1349, 1350 intermedia (28); 1512 angustifolia (8); 1513 barbigera (29); 1514 costata (6); 1515 micrantha v. genuina (7a); 1516 barbigera (29); 1517 angustifolia (8); 1518 intermedia (28); 1519 barbigera (29); 1520 maritima v. genuina (16a); 1522 decipiens v. genuina (25a); 1523 maritima v. genuina (16a); 1524 costata (6); 1525 nevadensis v. genuina (30a); 1526 utahensis (17); 1526a angustifolia (8); 1527 costata (6); 1528 maritima v. pilosa (16c); 1781 muricata v. Jonesii (32b); 1782 utahensis (17); 1783 intermedia (28); 1785 angustifolia (8); 1918 micrantha v. genuina (7a); 1950 maritima v. genuina (16a); 2063 intermedia (28); 2065a ptero-

carya v. cycloptera (19b); 2065b intermedia (28); 2066a angustifolia (8); 2066b holoptera (1); 2067, 2068, 2069 maritima v. genuina (16a); 2070 holoptera (1); 2071a maritima v. pilosa (16c); 2071b angustifolia (8); 2072 decipiens v. genuina (25a); 2073, 2074, 2075, 2076 utahensis (17); 2075 intermedia (28); 2078, 2079 racemosa (2); 2079 pterocarya v. cycloptera (19b); 2082 utahensis (17); 2083 intermedia (28); 2084 pterocarya v. genuina (19a); 2087 intermedia (28); 2088 maritima v. genuina (16a); 2089 barbigera (29); 2091 angustifolia (8); 2092 barbigera (29); 2093 utahensis (17); 2117 simulans (39); 2118 angustifolia (8); 2275 intermedia (28).

Stevens, G. W. 245, 282, 598, 616, 664, 3040 minima (23).

Suksdorf, W. N. 46 simulans (39); 179 affinis (56); 180 Hendersoni (36); 181 simulans (39); 220 Clevelandi v. florosa (50b); 404 circumscissa v. genuina (10a); 405 scoparia (31); 406 ambigua (40); 455 affinis (56); 456 Hendersoni (36); 593 Torreyana v. genuina (38a); 594 ambigua (40); 595 simulans (39); 789 Torreyana v. genuina (38a); 889 pterocarya v. genuina (19a); 1494 scoparia (31); 1495, 2346 rostellata (53); 2768, 3207 affinis (56); 3278 Hendersoni (36); 7757 Clevelandi v. florosa (50b).

Summers, R. W. 598 hispidissima (47); 598, 899 Clevelandi v. florosa (50b).

Thornber, J. J. 407, 516 angustifolia (8).

Thurber, G. 61 crassisepala (24); 181 micrantha v. genuina (7); 690 angustifolia (8).

Tidestrom, I. 9026 pterocarya v. genuina (19a).

Torrey, J. 329 flaccida (54); 330 Torreyana v. genuina (38a); 331 affinis (56); 332 circumscissa v. genuina (10a); 333 flaccida (54); 335 ambigua (40); 336 circumscissa v. genuina (10a); 337 Torreyana v. genuina (38a).

Toumey, J. W. 240a crassisepala (24).

Tracy, J. P. 439 flaccida (54); 761 micromeres (15); 793 Torreyana v. pumila (38c); 1653, 1731 Torreyana v. genuina (38a); 1744 Hendersoni (36); 1809 hispidissima (47); 1865 Torreyana v. calistogae (38b); 1879 Torreyana v. genuina (38a); 1880 flaccida (54); 2054, 2060 Torreyana v. pumila (38c); 2074 micromeres (15); 2094 Torreyana v. calistogae (38b); 2457 leiocarpa (46); 2758 flaccida (54); 3071 Torreyana v. genuina (38a); 3335 Hendersoni (36); 3655, 3944, 4301, 4560 Torreyana v. genuina (38a).

Tracy, S. M., & Earle, F. S. 105 pusilla (5); 176 albida (11).

Trask, B. 57 Traskae (37); 56, 57 maritima v. genuina (16a).

Tucker, S. 127 Torreyana v. genuina (38a).

Vasey, G. R. 421 pterocarya v. genuina (19a); 434 Kelseyana (22); 434a Fendleri (45).

Vorhies, C. T. 124 Fendleri (45).

Walker, E. P. 155 minima (23).

Ward, L. F. 1231 gracilis (44).

Ware, R. A. 2690c glomeriflora (57).

Watson, S. 286a ambigua (40); 847, 848 circumscissa v. genuina (10a); 850 nevadensis v. genuina (30a); 856 micrantha v. genuina (7a); 858 Torreyana v. genuina and Watsoni (38a and 43); 859 pterocarya v. genuina (19a).

Wilson, N. C. 170 racemosa (2).

Wright, C. 488 albida and texana (11 and 21); 1565 micrantha v. genuina (7a); 1570 pterocarya v. cycloptera (19b); 1571 pusilla (5); 1572 albida (11).

Wright, W. G. 11 simulans (39); 98 intermedia (28); 1764, 1770 pterocarya v. cycloptera (19b).

Xantus, J. 76 Grayi v. cryptochaeta (9c); 84 microstachys (48); 85 decipiens v. corollata and nevadensis v. rigida (25b and 30b).

Yates, H. S. 402 Hendersoni (36).