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A revision of *Cryptantha* subgenus *Oreocarya*

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**A REVISION OF CRYPTANTHA
SUBGENUS OREOCARYA**

by

Larry C. Higgins



BIOLOGICAL SERIES — VOLUME XIII, NUMBER 4

MARCH 1971

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Frontispiece *Cryptantha flava* Nutt. Drawn from Welsh and Atwood 9833. (2/3 actual size).

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A REVISION OF CRYPTANTHA SUBGENUS OREOCARYA

by

Larry C. Higgins¹

ABSTRACT

This study is a taxonomic revision of *Cryptantha* subgenus *Oreocarya* (Boraginaceae), together with descriptions of species, synonyms, distribution maps, and discussions. The present treatment recognizes fifty-seven species and fourteen varieties, all separated by means of a comprehensive key. A history of the group, along with a discussion of distribution, ecology, and phylogeny is presented. As a basis for the

comparison of taxa much of the research has been concentrated on morphological variation in herbarium specimens. Particular attention has been directed to a study of pubescence types, branching patterns, flowers, calyces, and fruit. The herbarium research has been correlated with extensive field observations and collections made throughout most of western North America.

INTRODUCTION

The genus *Cryptantha* subgenus *Oreocarya* consists of perennial or biennial herbs centered in western North America and belongs to the tribe Eritrichieae of the subfamily Boraginoideae of the family Boraginaceae. The subgenus has long been recognized for its taxonomic difficulty. This is due to the variability of the species and the lack of distinctive vegetative characters. Experience has shown that characters of the fruiting and floral structure provide the only satisfactory basis for precise specific differentiation. The complexity of this subgenus plus the large number of

species described since Payson's monograph (1927), have made a thorough study of the group necessary. It is hoped that the present revision of the North American species of this subgenus will partially meet this need.

The author first became interested in *Oreocarya* while doing fieldwork preliminary to the preparation of a thesis on the flora of the Beaverdam Mountains. Because of the difficulty encountered in classifying the plants of this group and at the suggestion of Dr. Stanley L. Welsh, the present study was undertaken.

Materials and Methods

The materials used in this study are largely dried and pressed specimens from a number of institutional herbaria in the western hemisphere, together with my collections from sites within the western United States. Because of the large number of specimens examined during the course of this investigation, citation of all specimens has been omitted, and only a few representative ones for each taxon are included. Type specimens of most taxa were received on loan and were subsequently photographed and all photographs were deposited in the Brigham Young University Herbarium.

Collections were made during the spring and summer months of 1967 in Utah and northern Arizona. Additional collections were made in Wyoming, Colorado, Montana, Washington, Oregon, Idaho,

Nevada, California, Texas, New Mexico, Mexico, Arizona, and Utah during the spring and summer months of 1968, 1969, and 1970.

The measurements of a 15 cm ruler were used to measure leaves, stems, and inflorescences. Plant height was measured from the base of the stem to the tip of the inflorescence. Stem length was measured from the base of the stem to the first flower. The measurements of calyces, flowers, and nutlets were facilitated by the use of an ocular micrometer fitted to a binocular microscope.

The taxonomic presentation in this revision follows a conventional pattern. The number in Arabic numerals following the description of each species or variety denotes the total number of collections studied in preparation of the text. The figure in small Roman numerals immediately following in parentheses denotes the number of these collections made

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by the

Herbaria from which specimens have been seen, with the standard abbreviations by which they are referred to in the text (Lanjow and Staffleu, 1964) are as follows:

ARIZ	University of Arizona Herbarium, Tucson, Arizona.
ASC	Arizona State College, Flagstaff, Arizona.
BRY	Brigham Young University, Provo, Utah.
CAS	California Academy of Sciences, San Francisco, California.
COLO	University of Colorado, Boulder, Colorado.
CS	Colorado State University, Fort Collins, Colorado.
DIX	Dixie Junior College, St. George, Utah.
GH	Gray Herbarium, Harvard University, Cambridge, Mass.
IDS	Idaho State College Herbarium, Pocatello, Idaho.
LA	University of California, Los Angeles, California.
LL	Lundell Herbarium, Renner, Texas.
MNA	Museum of Northern Arizona, Flagstaff, Arizona.
MONT	Montana State University, Bozeman, Montana.
ND-G	Greene Herbarium, University of Notre Dame, Indiana.
ND	University of Notre Dame, Notre Dame, Indiana.
NY	New York Botanical Garden, New York, New York.
ORI	University of Oregon Herbarium, Eugene, Oregon.
PH	Philadelphia Academy of Natural Sciences, Phila., Penn.
POM	Pomona College Herbarium, Claremont, California.
RM	Rocky Mountain Herbarium, Laramie, Wyoming.
RSA	Rancho Santa Ana Botanic Garden, Claremont, California.
TTC	Texas Tech. University, Lubbock, Texas.
UC	University of California, Berkeley, California.
US	United States National Museum, Washington, D.C.
UT	University of Utah Herbarium, Salt Lake City, Utah.
UTC	Intermountain Herbarium, Logan, Utah.
WU	University of Washington Herbarium, Seattle, Washington.

WTSU West Texas State University, Canyon, Texas.

History of the Subgenus *Oreocarya*

The species belonging to this group to be named first was *Cynoglossum glomeratum* Nutt. in Fras., nom. nud. (*Cryptantha celosioides*), the type of the subgenus. This was collected by Bradbury in "Upper Louisiana" in 1810, and was described by Pursh (1814), at which time he cited the Fraser Brothers Catalogue as the source of his name. The citation should thus read: *C. glomeratum* Nutt. ex Pursh, Fl. Am. Sept. 2:729, 1814. It was transferred to *Myosotis* by Nuttall (1818). Torrey (1828), described a second species, *Myosotis suffruticosa* (*C. jamesii*). A third species was described (*M. leucophaea*), and also assigned to *Myosotis* by Douglas in Lehmann (1830).

With the appearance of the tenth volume of de Candolle's *Prodromus* (1846), *C. glomeratum* and *M. leucophaea* were placed in the genus *Eritrichium* and this treatment stood until 1885.

Asa Gray (1875), published the results of his first study of the eritrichioid borages of western America. Following de Candolle he referred all the species to *Eritrichium* section *Pseudo-myosotis*. Four species and three varieties were recognized in Gray's revision.

Bentham and Hooker (1876), published that part of their *Genera Plantarum* treating the Boraginaceae. These authors accepted the interpretations of de Candolle and Gray and 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 *Plagiobothrys* and *Eritrichium*.

The genus *Eritrichium* became so heterogenous and varied that its breakup was inevitable. This began with Gray's notable paper (1885), *A Revision of some Boragineous Genera*, in which the species of *Cryptantha* were transferred to the section *Pseudokrynitzkia* of *Krynitzkia* with the exception of *K. setosissima* which was placed in the section *Pterygium*. Eight species were recognized by Gray that now are placed in the subgenus *Oreocarya*.

In a series of papers published by Greene (1887), the American representatives of de Candolle's *Eritrichium* were segregated in detail. First, the genus *Allo-carya* was formed to include the species Gray had treated as *Krynitzkia* section *Myosotideae*. Then *Piptocalyx* was reinstated to include the species with circumscissile calyces; also two new genera, *Eremocarya* and *Oreocarya*, were formed. The first, *Eremocarya*, was based upon the plant of southwestern United States described as *E. micranthum* by Torrey (1859), and the second, *Oreocarya*, upon nine species of *Eritrichium* section *Pseudokrynitzkia* and part of *Krynitzkia* section *Pterygium*, described by Gray (1885).

Greene (1896), described eight new species and re-described several old ones. Later Greene (1899), described two new species and still later two more (1901).

In the period from 1896 to 1916 some 35 species were proposed as new, mainly by Marcus Jones (1891, 1895, 1910), Alice Eastwood (1903, 1913), and Per Axel Rydberg (1905, 1906, 1909, 1913).

Macbride (1916), wrote the first comprehensive revision of the subgenus *Oreocarya* which included 45 species. A dichotomous key was provided, specimens were cited, and a short discussion of each species was included.

Ivan M. Johnston (1924), questioned the status of the genus *Oreocarya*, and was of the opinion that both *Oreocarya* and *Cryptantha* should be combined under *Cryptantha*. Payson (1927), transferred all species previously known within *Oreocarya* to *Cryptantha*. His treatment included 45 species and contained keys to the species and a list of synonymy for each species plus descriptions, specimen citations, and discussions.

Brand (1927) proposed the new genus *Hemisphaerocarya*, which included all those species of the subgenus *Oreocarya* in which the fruit is hemispherical. *Cryptantha jamesii* and four of its close relatives formed the basis for this genus.

Since 1927 most of the new species which have appeared in the literature have been proposed by Johnston (1932, 1937, 1939, 1940), and Higgins (1968, 1969).

General Morphology

The plant consists of a taproot, varying in degree of branching, and a simple or branched caudex, the apex of which bears a rosette of leaves and gives rise to the flowering stem. The stem pattern may differ considerably between species, but fundamentally it consists of an axis, usually foliate (or bracteate), with branches bearing several helicoid cymes.

The majority of species live for several years and are classified as perennials. In *C. setosissima* and *C. virgata*, however, the plants are biennial with one prominent rosette giving rise to a central flowering stem.

Stems:

The stems are herbaceous, usually arising from a much branched woody caudex. However, in some species such as *C. virgata* and *C. setosissima* the stems are simple and erect. Most species are very similar with respect to the character of the stem, and so stems can be used only to a limited extent in the differentiation of species.

Leaves:

The leaves are very similar in all species, varying only in length and width. They range from linear in *C. jamesii* var. *laxa* and *C. shackletteana*, to spatulate,

or as is most common, oblanceolate. In all species the margins are entire, and the apices acute, obtuse, or subretuse. The blade is most often gradually narrowed into a long, slender, ciliate-margined petiole.

Inflorescence:

The inflorescence is an open, rounded leafy-bracteate thyrsus or a helicoid cyme. The individual cymules are prevailingly scorpioid, but sometimes glomerate or loosely racemose. In some species the inflorescence is characteristically narrow, while in others as *C. thyrsiflora*, it is very broad and open. In one species, *C. virgata*, the floral bracts are extremely long and greatly exceed the individual glomerate cymules.

Sepals:

The calyx is five-parted to the base, with the lobes all equal and linear, lanceolate, or ovate. In the more primitive species of this subgenus the lobes are only slightly accrescent in fruit, and in the advanced species greatly enlarged. The pedicel of the mature calyx may be nearly sessile or very short, or up to 10 mm long in the case of *C. fulvocanescens* var. *echinoides*.

Trichomes:

The hairs of *Cryptantha* are all simple, unicellular, and more or less silicious. The more silicious hairs are either smooth and somewhat transparent, or more or less roughened by encrustations and then somewhat opaque. The bristles vary notably in attitude (whether appressed, retrorse, or ascending), length, and rigidity. Some species are characteristically setose or hispid and others conspicuously silky-strigose, but most of the different forms are so much alike in pubescence that the differences are unnoticed by one unfamiliar with the group.

Associated with the bristlelike trichomes on the stem and leaves are the pale, blisterlike 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 frequency and size, varying from totally absent to decidedly abundant, and up to a diameter of 4 mm.

The terms used in botanical literature to describe the many diverse types of pubescence are employed by various authors in different contexts. The following list of terms is presented to allow precision in interpretation of pubescence types.

Hirsute:	with long, moderately stiff hairs.
Hispid:	with long, very stiff hairs.
Setose:	with short, rather stiff hairs.
Strigose:	with short, appressed hairs usually in one direction.
Tomentose:	hairs medium to short, curled and interwoven.

Corolla

The corolla limb is nearly always white and rotate-salverform or campanulate, but is distinctly yellow in two species. However, in many of the white-flowered plants the tube is light-yellow. The relative length of the corolla tube to the calyx lobes is an important diagnostic character. The corollas vary from 2-20 mm in length, but are quite constant for any given species. The tube bears at its apex five rounded or emarginate fornicies, 0.5-1.5 mm long, that are conspicuously papillose to nearly glabrous. Near the base of the tube a ring of crests is usually present, but may be lacking, especially in the long-flowered species.

Style:

The length of the style as well as the position of the stamens in the corolla tube is of little specific value in most of the long-flowered species, since most of them are distinctly dimorphic in these characters. However, in *C. oblata*, a long-flowered species, the stamens are always located at the middle of the tube, and the style exceeds the mature fruit by 3 to 5 mm. In the short-flowered species the distance by which the style exceeds the fruit is of some value in distinguishing species.

Fruit and nutlets:

The fruit of *Cryptantha* consists of four or fewer elongate, ventrally grooved nutlets affixed to a usually elongate gynobase. In shape the nutlets vary from broadly ovate or triangular-ovate to narrowly lanceolate. The dorsal surface occasionally is somewhat flattened, but is commonly more or less convex, although in *C. virginensis* it is somewhat obtuse with a medial dorsal ridge. The sides of the nutlets in most species are acute, but can be quite obtusely angled, or as in *C. setosissima* the margin is drawn out into a broad, greatly developed wing. Surface characteristics of the nutlets are also of diagnostic value. The surface of the nutlet may be smooth and shiny as in *C. conjertiflora*, *C. flava*, *C. barnabyi*, *C. semiglabra*, or may be variously roughened. In species such as *C. breviflora*, *C. cana*, and *C. fulvocanescens* the roughenings consist of small, numerous, low, rounded, or sharp projections, a condition here described as muricate. Other species, such as *C. stricta*, *C. flavoculata*, and *C. celosoides* have the surface covered with long or short, irregular or transverse ridges called rugae.

Although four nutlets are commonly produced, one or more of them may fail to develop. This abortion can prevail throughout a plant or be restricted largely to either its younger or older parts. This suggests that abortions might be partially connected to the nutrition of the plant as influenced by seasonal conditions.

The nutlets are all homomorphic in contrast to those in the annual species of the subgenus *Krynitzkia*, which contains many species possessing heteromorphic nutlets. The ventral groove or scar of the nutlet can be open or closed and can be simple or

forked below. The margin surrounding the scar is entirely lacking or is greatly elevated as in *C. flavoculata* and *C. bakeri*.

Distribution and Ecology

Oreocarya, as circumscribed in the present treatment, is principally western North American in distribution. Only one taxon (*C. gnaphalioides*), or possibly two others, namely *C. argentea* and *C. amplexicaulis*, are found in South America (Chile), while all others occur in western North America. Payson (1927) stated,

It would seem reasonable to suppose that the genus originated in the southwestern part of North America and in its perennial primitive form spread to the desert regions of Chile and Argentina. In that region it became differentiated into three main groups. The most primitive of these invaded North America as *Cryptantha* in the limited sense of recent American floras.

With this opinion the present author cannot entirely agree. A more reasonable hypothesis is that the group had its origin in southwestern North America. In its primitive form (probably similar to *C. jamesii* var. *multicaulis*), it spread to the desert regions of Chile and Argentina. In that region it became differentiated into *Geocarya*, an advanced group with highly specialized, cleistogamous flowers. The majority of the group that remained in western North America became specialized and gave rise to the subgenus *Krynitzkia*. The subgenus *Krynitzkia* in turn spread to South America and the specialized subgenus *Cryptantha* developed from it.

The center of distribution in North America is eastern Utah and western Colorado, with the greatest concentration of species extending from southwestern Wyoming and northwestern Colorado to southeastern California.

Members of the subgenus *Oreocarya* occupy for the most part xerophytic habitats at middle elevations. The species of *Oreocarya* grow in widely different ecological situations and in a wide elevational range. Few species are able to tolerate direct competition with other herbs or endure the shade of overhanging trees or shrubs. The prairie species *C. cana* and *C. caespitosa*, appear unable to tolerate the sod-grass climax vegetation, but flourish only on the shaly ridges or gravelly outcrops which here and there break through the prairie sod. Some species are found growing on sandy deserts, e.g. *C. jamesii* var. *disticha*, on alpine talus slopes, e.g. *C. weberi*, *C. crymophila*, *C. thompsonii*, and some on clay knolls or desert playas, e.g. *C. virginensis*, *C. rugulosa*, and *C. semiglabra* which are associated with *Atriplex*. Apparently

no species is able to tolerate a moist, undrained soil. The ability to grow and reproduce in difficult environments has enabled members of the group to colonize a wide variety of raw and newly exposed, often unpromising habitats. It is perhaps this ability, together with the selective action of the environment upon pioneer populations, that has produced the large number of species and at the same time the patterns of narrow endemism which are a feature of the subgenus.

The species are commonly found on almost any barren hillside. Many are restricted to soils that are so strongly impregnated with mineral salts that few other plants are able to compete with them. They are particularly at home on loose hillsides, talus slopes, shale outcrops, and heavy, detrital, clay soils.

Over 50 percent of the species are narrowly restricted in some specific ecological niche or edaphic situation. Some of them are limited to a single hillside, others to a particular mountain range, and still others are restricted to some isolated basin.

The greatest number of endemics are found in the cold desert regions of Utah and Colorado. *C. grahamii* and *C. barnebyi* are restricted to the Green River Shales of the lower Uintah Basin, being the most conspicuous plants on the shales. *C. stricta* is a very narrow endemic, also of the Uintah Basin, but it is limited to heavy clay habitats on the north rim of the basin. Other endemics such as *C. elata*, *C. aperta*, *C. breviflora*, *C. wetherillii*, *C. longiflora*, and *C. rugulosa* grow on highly saline soils. Gypsiferous soils of western Colorado and eastern Utah are the home of *C. paradoxa*, while in this same general region *C. temis* and *C. osterhoutii* are almost always confined to sandy soil.

Endemic species also occur in mesic environments. For example, the Wasatch Formation of western Garfield County, Utah, is the habitat of the narrowly endemic *C. ochroleuca*. The volcanic talus slopes along the Salmon River in central Idaho is the habitat of *C. salmonensis*. Montane and warm desert regions include the habitats of other endemics.

Dispersal mechanisms within the subgenus are almost entirely unknown. One species, *C. setosissima*, has broadly winged nutlets, but the size of the wing in relation to nutlet size is such that it may have little or no value in dispersal. It seems probable that long distance dispersal by means of some animal vector is the most reasonable answer to dispersal of propagules in this group. However, the species of *Cryptantha* are not known to be grazed or eaten by animals, and thus the potential of animals in their dispersal is unknown. It is apparent that much additional information must be obtained to account for the broad distribution of members of this group of plants.

Seasonal differences in the flowering period are highly variable in the subgenus and have probably served in the isolation of species within the group.

For example, *C. jonesiana* is closely related to *C. fulvocanescens* but flowers much earlier. By early May *C. jonesiana* has completed flowering and produced fruit, while *C. fulvocanescens* has only started to flower. Seasonal isolation between other closely related species is known (e.g. *C. virginensis* and *C. hoffmannii*, *C. spiculifera* and *C. interrupta*, and between *C. humilis* and *C. propria*).

Heterostyly, (regularly associated with outbreeding populations), has been developed in several groups in the evolution of the subgenus. Some of the widely distributed species such as *C. flavoculata* and *C. fulvocanescens* are distinctly heterostyled. On the other hand some of the very narrow endemics such as *C. ochroleuca*, *C. compacta*, and *C. jonesiana* are homostyled and possibly self-pollinated. Outbreeding in the subgenus is probably also facilitated by various insects. Butterflies and beetles have been noted visiting several of the species and undoubtedly serve as pollinating agents.

Generic Relations and Phylogeny

The genus *Cryptantha* is a member of the tribe Eritrichieae and is apparently derived from the Lithospermeae through some form similar to the North American species of *Antiphytum*, Johnston (1925).

The primitive fruit was probably similar to that of the Hydrophyllaceae, being two or imperfectly four-loculed, capsular, and terminated by a lobed style. The lobed style consistently occurs in those subfamilies of the Boraginaceae which are considered primitive, i.e. the Heliotropioideae, Ehretioideae, and Cordioideae. Within the subfamily Boraginoideae, the style is lobed or bears geminate stigmas only in the tribe Lithospermeae.

The nutlets have resulted from a pinching in of the pericarp walls to form lobes of the fruit each containing one ovule. The stages of this development may be appreciated by a comparative study of the fruit of *Heliotropium* or better still, of *Coldenia*. *Coldenia canescens* has an unlobed fruit bearing a decidedly terminal style; *Coldenia nuttallii* has the lobing evident and the style attached to the pericarp between and below the apices of the nutlets. In *Coldenia litoralis* the lobing is almost complete and the style is affixed almost upon the receptacle. Evidently the development of nutlets has proceeded by the deepening downward of the lobing from the apex and inward from the sides by the pinching in of the pericarp between the carpels. This finally results in an apparent basal attachment of the nutlets and a gradual lowering of the style base between the nutlets until it is at last directly and firmly affixed upon the receptacle. Johnston (1925).

The nutlets of the annual as well as the perennial species of *Cryptantha* are characterized by the presence of a medial ventral groove, which is caused by

the nonfusion of the pericarp walls. This development appears to have been brought about by the gradual encroachment of the pericarp over the surface of the sharply cut triangular attachment scar such as those 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* the groove may be narrow but not completely closed. In *Amsinckia*, *Plagiobothrys*, etc. the groove is entirely closed and its location is marked by a ridge of fused pericarpel tissue which bears the scar, Johnston (1925).

According to Johnston (1925), it seems quite probable that the subgenus *Oreocarya* has been derived from some form of *Antiphytum*, a genus of Lithospermeae evidently derived from some ancestral plant similar to *Lithospermum*. The subgenus *Oreocarya* is the most primitive in the genus, probably having given rise to the other subgenera of *Krynitzkia*, *Cryptantha*, and *Geocarya*, of which the latter two possess cleistogamous flowers. *Oreocarya* seems also to have given rise to *Plagiobothrys*, a genus which appears then to have evolved *Amsinckia*. The principal derivative of *Oreocarya*, however, appears to be *Hackelia*, for *Oreocarya* appears to be connected with *Cynoglossum* through *Hackelia*.

According to Johnston (1925) and Payson (1927), the subgenus *Krynitzkia* is a specialized offshoot of *Oreocarya*. *Oreocarya* consists of rather coarse perennials or sometimes biennials with usually persistent calyces and homomorphic nutlets. However, in the subgenus *Krynitzkia*, composed mostly of annuals, the calyces are deciduous and the nutlets somewhat heteromorphic. In the present group the question of primitive or of advanced condition is of much interest. In the present work the species have been grouped together mainly on the basis of similar morphological characters. After reviewing the works by Johnston (1924, 1925) and Payson (1927), plus this current research a phylogenetic summary is presented below. These conclusions are not final and may be subject to change after additional research.

Nutlets:

In the hypothetical, primitive plant the nutlets evidently were smooth on both surfaces and ovate in outline. The scar of the nutlet was straight and narrow without an elevated margin. Nutlets also were attached at a very low position on the gynobase. As specialization took place the nutlets were roughened first on the dorsal and then on the ventral surface. The nutlets became more lanceolate, with the scar developing an elevated margin and becoming open and contorted. The nutlet of the supposedly advanced plant also became attached at a higher point on the gynobasic style.

Corolla

The primitive plant had corollas which were short and never exceeded the lobes of the calyx. This prim-

itive corolla had low, rounded fornicies and crests at the base of the tube. As specialization took place the corolla became longer until it greatly exceeded the lobes of the calyx. This long tube apparently developed along several different lines in the evolution of the group. Styles of various lengths (heterostyly), are regularly associated with long tubes. This is also an advanced characteristic, styles of uniform length being primitive.

Calyx segments:

Broadly ovate or lanceolate sepals that were slightly accrescent were primitive, while those which are narrowly lanceolate or linear and conspicuously accrescent in fruit are advanced.

Inflorescence:

The primitive inflorescence was confined to the upper part of the stem and was composed of a few, conspicuously elongated, scorpioid cymules. As development proceeded the cymules became shorter and the inflorescence tended to cover more and more of the stem.

Stem:

The question of the primitive nature of the perennial or annual habit is of much interest. Morphologists, in general, seem to be of the opinion that the perennial habit is more primitive than the annual habit or biennial habit. The author is inclined to agree with this generalization. The primitive species in this group were perennial with slender unbranched stems, while the less enduring ones with very short branched stems are specialized.

Leaves and pubescence:

The linear oblanceolate leaf is more primitive than the broader ovate or spatulate types. An extremely setose indument on the leaf is considered to be a mark of specialization, and in like manner a conspicuously sericeous and uniform covering is a specialization in another direction.

Phylogenetic relationships:

The North American species of the subgenus *Oreocarya* are thought to be monophyletic, but showing several major lines of development. In the present treatment the species groups are not given any taxonomic rank, but are of the rank of sections. As a substitute for the section the term group is employed. The perennial species placed in the subgenus *Oreocarya* are evidently the most primitive in the genus. The most primitive of these is *C. jamesii* var. *multicaulis*. The variety *multicaulis* has so many primitive characteristics that it may be used to visualize the ancestor from which the other subgenera developed. The author tends to agree with Payson (1927) in his postulation that the primitive *Oreocarya* species evolved in four different directions. The species of the main section *Oreocarya* remained perennial and developed a tendency toward larger flowers and shorter cymes. This larger flowered group is probably monophyletic in the sense that a single primitive

ancestor gave rise to several basic types and these in turn produced species as we know them. Development in another direction produced annuals very early in the history of the genus. This group is recognized as the subgenus *Krynitzkia*, with its reduced flowers, heteromorphic nutlets, and elongate cymes. This subgenus is probably polyphyletic, the species in *Krynitzkia* apparently having arisen independently from several perennial ancestors. The other two subgenera, *Geocarya* and *Cryptantha* had primitive perennial ancestors and probably developed along the same lines as *Krynitzkia*, since the species in these subgenera are similar in appearance to *Krynitzkia*. *Geocarya* is probably monophyletic. Evidence for this is indicated in the peculiar morphology of the cleistogamous flowers. The subgenus *Cryptantha*, may have developed along several lines from *Krynitzkia*.

The groups that occur within the subgenus *Oreocarya* are characterized, discussed, and arranged in a phylogenetic scheme (Fig. 1).

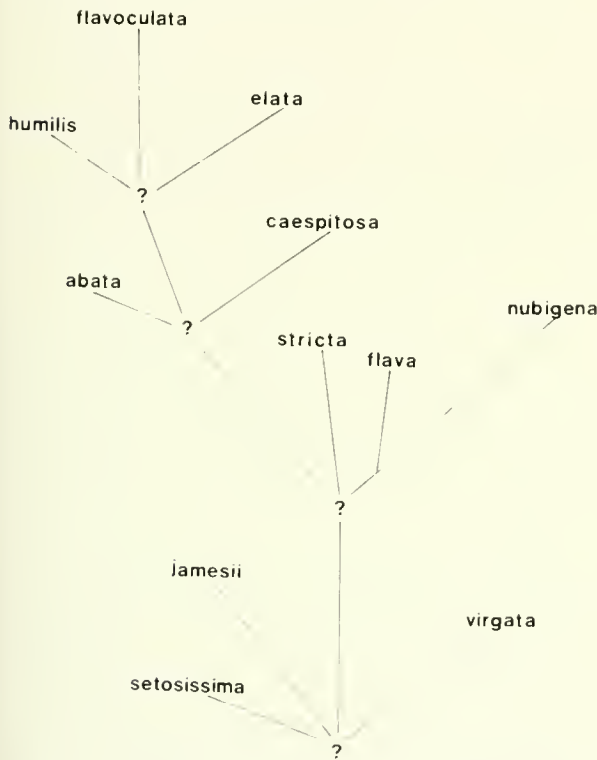


Fig. 1. A proposed phylogenetic arrangement of the groups within the subgenus *Oreocarya*.

The jamesii group: This group is composed of five species and seven varieties mostly confined to the eastern and southeastern section of the range of the subgenus (Fig. 2). It is characterized by the hemispherical fruit, with the nutlets smooth on all surfaces, or rugose and tuberculate, but not at all muricate on the dorsal surface. Ventral surface of the nutlet quite or nearly smooth, with the scar narrow, straight, and closed, and without an elevated margin. The species within the jamesii group form a natural

unit. *Cryptantha jamesii* has more primitive characters (smooth hemispherical nutlets, short corolla tube with crests at the base, low fornicies, oblanceolate leaves, strigose pubescence, and elongate cymes) than any other species in the subgenus and is probably similar to the hypothetical, ancestral form. *C. palmeri*, although very closely related to *C. jamesii*, shows the advanced characteristics of crests lacking at the base of the tube, accrescent sepals, and longer style. *C. crassipes* is to be considered more advanced than *C. palmeri* on the basis of the capitate inflorescence, roughened nutlets, and the longer style, which are all considered as specialized characters.

It seems probable that long corolla tubes are derived from shorter ones and that heterostyled flowers are derived from uniform flowers. On this basis *C. oblata* is more specialized than *C. jamesii*. *C. paysonii* probably very recently has evolved from *C. oblata*, but it is more specialized because of the strongly heterostyled flowers and the more capitate inflorescence.

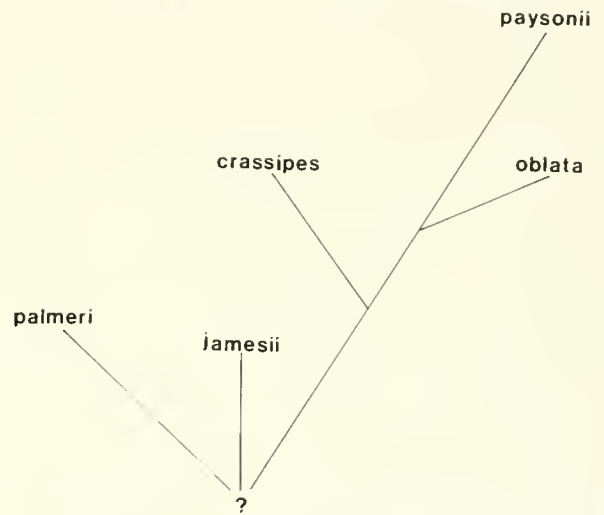


Fig. 2. A proposed phylogenetic arrangement of the species within the jamesii group.

The flava group: The flava group is composed of seven species, most of which are confined to Utah and northern Arizona (Fig. 3). The basic syndrome of characters includes the compressed nutlets which are smooth on both surfaces and the closed scar which lacks an elevated margin. This group is recognized as being closely related to the jamesii group primarily on the basis of the smooth nutlets. The species within this group, however, become more difficult to place because lines of development are more obscure. *C. salmonensis* is probably the most primitive in this group because of its short corolla and uniform style length. All other species within the group possess corollas that exceed the lobes of the calyx. *C. confertiflora* is a widely distributed species of the hot desert regions of Utah, Arizona, Nevada, and California and may have, through selective forces of the environment, given rise to most of the other species.

many of which are narrow endemics, confined to a particular kind of habitat. *C. semiglabra*, *C. capitata*, and *C. johnstonii* are closely related to *C. confertiflora*, but probably because of their ability to inhabit peculiar soil types, have been selected out and isolated from that species. *C. leucophaea*, a species of eastern Washington, which inhabits sand dunes along the Columbia River, was for a time included within the concept of *C. confertiflora* by Parish. It is believed, however, to be more advanced because of the longer inflorescence, conspicuous foliar bracts, and narrowly linear leaves. The author, at one time, was inclined to combine *C. flava* and *C. confertiflora* because of a few intermediates where the ranges of the two species overlap. However, with additional research the number of intermediates were found to be so few that the two taxa are best treated as separate species.

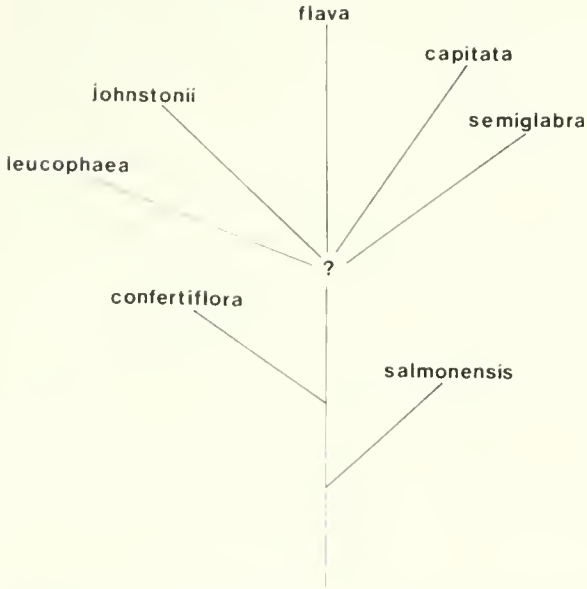


Fig. 3. A proposed phylogenetic arrangement of the species within the flava group.

The stricta group: The stricta group contains two species, *C. stricta* and *C. barnebyi*, both restricted to the Utah Basin of Utah (Fig. 4). The stricta group probably had its origin from the flava group. The very setose or hispid indument, stout stems, and the smooth ventral surface of the nutlets separate this group from that of flava. *C. stricta* is considered more advanced than *C. barnebyi* because of the roughened dorsal surface of the nutlet.

The nubigena group: This group is composed of four species, all of high alpine or montane areas of California, Oregon, and Idaho (Fig. 5). The basic characteristics of the group involve the lanceolate nutlets, which are smooth on the ventral surface and roughened dorsally. This group probably had its origin from the flava group through some form similar to *C. confertiflora*. The three species, *C. nubigena*, *C.*

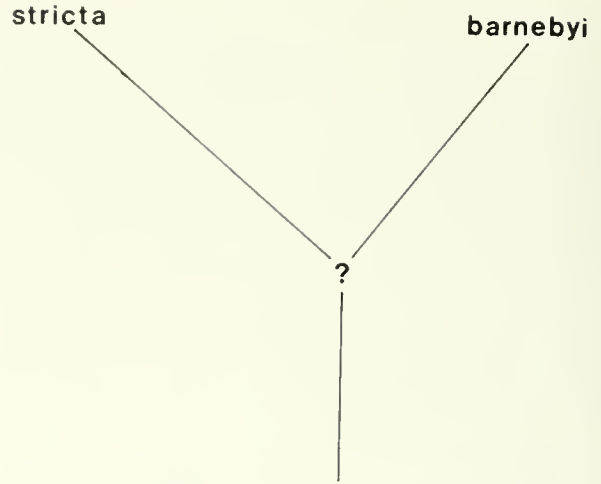


Fig. 4. A proposed phylogenetic arrangement of the species within the stricta group.

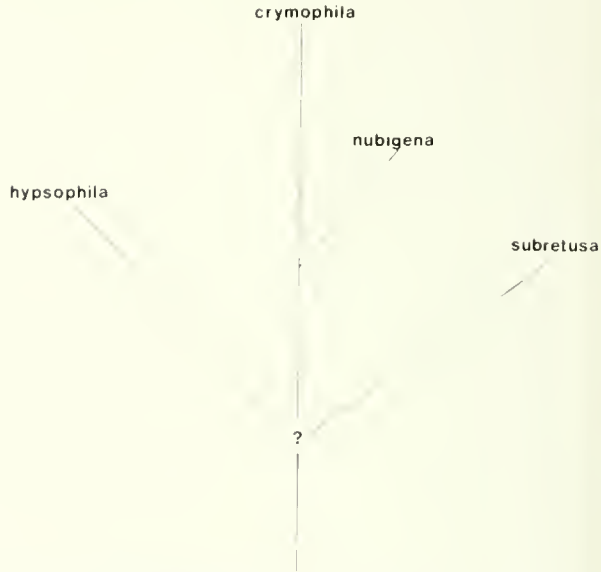


Fig. 5. A proposed phylogenetic arrangement of the species within the nubigena group.

subretusa and *C. hypsophila*, are so closely related that it is difficult to afford them complete specific rank; but because of the wide geographical separation and the slight differences in morphology, they are treated as distinct species. *C. crymophila* is probably more advanced than the other three species because of the larger nutlets, more accrescent sepals, and the longer foliar bracts. It was apparently derived from some form similar to *C. nubigena*.

The abata group: This group is mainly confined to the southwestern part of the range of the subgenus. It contains five species which are characterized by rugose or tuberculate nutlets, with the ventral scar open and triangular and usually surrounded by a slightly elevated margin (Fig. 6). These characters are all much more advanced than those displayed by the jamesii group; so it is probably not closely related to

that group. All the species in this group occur in the Sonoran Desert except for *C. abata*. *C. hoffmannii* is probably a recent derivative from *C. virginensis*. The two species appear to be distinct even though they are quite similar in general appearance. *C. hoffmannii* flowers much later and has nonfragrant flowers. The relationship of the other three species is not so obvious; however, they appear to have been derived from some common ancestor similar to *abata*.

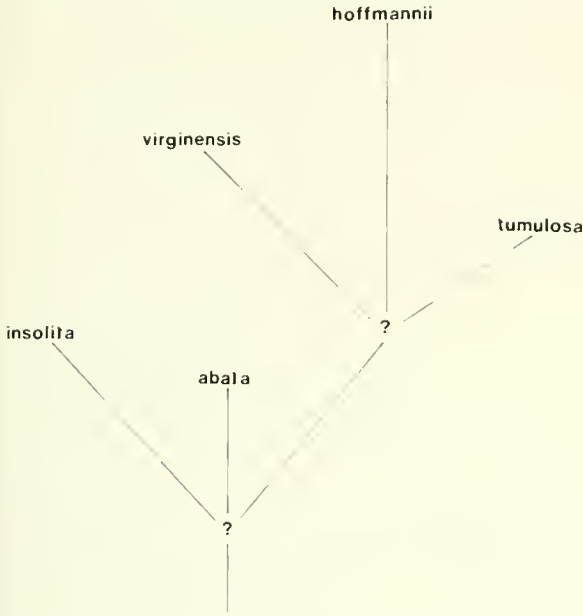


Fig. 6. A proposed phylogenetic arrangement of the species within the abata group.

The caespitosa group: This group contains two species, both of which are apparently derived from the abata or possibly the humilis group. The distribution of this group is bicentric. *C. caespitosa* is a very hummock forming species found throughout southern Wyoming growing on clay hillsides, while *C. ochroleuca* is a narrow endemic growing on gypsiferous soil in western Garfield County, Utah. The two species probably had a common ancestor similar to *C. caespitosa*.

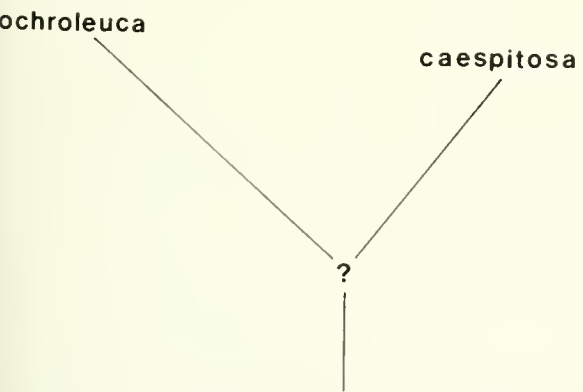


Fig. 7. A proposed phylogenetic arrangement of the species within the caespitosa group.

The humilis group: The humilis group is composed of eight species and five varieties (Fig. 8). The basic syndrome of characters in this group includes the conspicuously muricate nutlets and a scar with a tendency to be open and therefore triangular at the base. Two basic lines of development can be seen within this group; one in which the species possess two kinds of hairs and nutlets which have short rugae between the murications; the other line has leaves which are usually silky-strigose and only murications on the nutlets. *C. cana* and *C. breviflora* are members of this second group. *C. jonesiana* and *C. fulvocanescens* are considered advanced because of the long corolla tubes and more elongated nutlets.



Fig. 8. A proposed phylogenetic arrangement of the species within the humilis group.

The elata group: The elata group is composed of thirteen species, covering a wide geographical and altitudinal range (Fig. 9). The basic syndrome of characters includes nutlets which are always roughened dorsally and distinctly rugose or tuberculate or both, and often muricate also; ventral surface smooth or variously roughened; scar straight, closed or nearly so, margins not elevated; corolla tubes never longer than the calyx lobes, except in *C. rollinsii*. The species in this group are so similar in overall appearance and characteristics that lines of development are obscured. *C. aperta* and *C. thyrsoflora* seem to form a natural unit which possess broad inflorescences and ovate tuberculate nutlets. *C. interrupta*, *C. spiculifera*, *C. shackletteana*, and also *C. rugulosa* seem to form a natural unit and are probably very closely related to each other. The lanceolate nutlets which have similar markings tend to substantiate this hypothesis. *C. celo-sioides*, a widespread and heteromorphic species, apparently gave rise to *C. sobolifera* and *C. thompsonii*. The other species in this group are more obscure in their evolutionary history; probably because they are very narrow endemics which have specialized out on peculiar soil types.



Fig. 9. A proposed phylogenetic arrangement of the species within the elata group.

The flavoculata group: The flavoculata group is composed of eight species, most of which are confined to eastern Utah and western Colorado (Fig. 10). The basic syndrome of characters includes the deeply and conspicuously rugose and tuberculate, sometimes muricate or foveolate nutlets. Scar, except in *C. bakeri*, at least slightly open and then showing a tendency to be constricted above the base; margin usually elevated. The species of this highly developed group form so natural a unit that there is little doubt that they had a common origin. *C. osterhoutii* and *C. tenuis* are two very closely related species, but the longer corolla tube and style of *C. tenuis* evidently make it more advanced. *C. flavoculata* and the closely related species *C. paradoxa*, *C. bakeri*, and *C. mensana* are the most advanced in the subgenus and undoubtedly are very closely related. *C. wetherillii* and *C. longiflora* are somewhat intermediate between this group and the elata group, but seem to be more closely related to the flavoculata group on the basis of the nutlet characteristics.

The virgata group: This monotypic group is so different from the other basic groups that it is separated from them in this treatment. The characteristics which distinguish this distinctive group are the stout, strict, usually simple, fistulose stems and the long



Fig. 10. A proposed phylogenetic arrangement of the species within the flavoculata group.

spicate inflorescence with the greatly elongated foliar bracts.

The setosissima group: This monotypic group is restricted to montane areas throughout southern Utah, Arizona, and southern Nevada. The basic syndrome of characters includes the simple erect stems, broadly winged nutlets, and ovate calyx segments.

Cytology

Very little cytological work has been done on the subgenus *Oreocarya*. Delbert Wiens at the University of Utah began a study of the morphology of the group; but because of the difficulty he had in being able to get seeds to germinate, the study was abandoned. He did, however, make chromosome counts on several of the species in this subgenus. The number in all species for which counts were made was n equals twelve. These species were *C. virgata*, *C. jamesii*, *C. thyrsoiflora*, *C. flava*, *C. bakeri*, and *C. fulvocanescens*. Taylor and Brockman counted the chromosomes in *C. celosioides* (*C. macounii*) and determined the number to be n equals nine. There are some discrepancies in the basic number of this subgenus, which points out the fact that much additional study is needed on the cytology of this group.

TAXONOMY

Cryptantha Lehm. subgenus *Oreocarya* (Greene) Higgins

Perennial or biennial herbs with a conspicuous setose, hirsute, or strigose indument (except in *C.*

jamesii var. *pustulosa* and *C. semiglabra*). Leaves entire, oblanceolate, spatulate or linear. Stems solitary from the root or caespitose, commonly unbranched below the inflorescence, 0.2-1.2 dm tall. Inflorescence a continuous or glomerate cluster of elongating or

reduced, simple or branched, bracteate or nearly ebracteate, two-ranked, unilateral, scorpioid cymes. Calyx segments distinct, usually conspicuously accrescent. Corollas white or yellow, salverform or campanulate; limb 4-17 mm broad; tube equalling or exceeding the calyx. Stamens included in the tube, anthers sessile or nearly so. Style shorter, equalling or much exceeding the mature fruit; stigma entire. Nutlets from nearly circular in outline to narrowly lanceolate, margined or winged, smooth or variously roughened on the different surfaces, attached to the gynobase at a point $1/3$ to $4/5$ of the distance from the base to the apex of the nutlet. Scar of nutlets various, open or closed, and margin elevated or plane. Subgeneric type: *C. celosoides* (Eastw.) Payson.

Key to the Species of *Cryptantha* Subgenus *Oreocarya*

1. Corolla tube elongate, distinctly surpassing the calyx; flowers usually heterostyled (2).
1. Corolla tube short, scarcely if at all surpassing the calyx; flowers not heterostyled (20).
 2. Nutlets smooth and shiny (3).
 2. Nutlets more or less roughened or wrinkled at least on the dorsal surface (9).
3. Corolla yellow (4).
3. Corolla white (5).
 4. Inflorescence an elongate, cylindrical thyrs; nutlets lanceolate, with acute margins, usually only one developing 7 *C. flava*
 4. Inflorescence consisting of a large terminal cluster with one or more remote, at maturity frequently stalked, much smaller lateral clusters; nutlets broadly ovate, with winged margins, all four usually maturing 6. *C. confertiflora*
5. Inflorescence capitate, 0.1-0.4 dm long; corolla limb 6-8 mm broad, the tube little surpassing the calyx; nutlets lanceolate; native to northern Arizona and southern Utah 8. *C. capitata*
5. Inflorescence elongate, 0.4-4 dm long; corolla limb 8-17 mm broad, the tube distinctly surpassing the calyx except in *C. barnebyi*; nutlets ovate (6).
 6. Ventral surface of the leaves glabrous; native to north-central Arizona and southwestern Utah 10. *C. semiglabra*
 6. Ventral surface of the leaves strigose or setose-hispid (7).
7. Corolla limb 13-17 mm broad, crests at base of tube absent; nutlets 3-3.5 mm long; native to San Rafael Swell 9. *C. johnstonii*
7. Corolla limb 8-11 mm broad, crests at base of tube conspicuous; nutlets 3.5-4.5 mm long (8).
 8. Corolla tube 5-7 mm long, the limb campanulate; leaves broadly oblanceolate, setose-hispid; stems stout; endemic to the Uintah Basin, Utah 11. *C. barnebyi*
 8. Corolla tube 8-10 mm long, the limb spreading; leaves linear or narrowly lanceolate, strigose with few or no pustulate hairs; stems slender; native to Washington. 12. *C. leucophaea*
9. Nutlets uniformly muricate or papillose, or sometimes in *C. jonesiana* also with some inconspicuous ridges (10).
9. Nutlets more or less rugose or tuberculate, or sometimes with a few inconspicuous murications (11).
 10. Leaves oblanceolate, strigose with pustulate hairs small or lacking; corolla 7-10 mm long, fornicies elongate; native to southeastern Utah, northwestern New Mexico, western Colorado, and northeastern Arizona 34. *C. fulvocanescens*
 10. Leaves spatulate, hispid with pustulate bristles; corolla 10-15 mm long, fornicies low and broad; native to the San Rafael Swell, Utah 35. *C. jonesiana*
11. Ventral or inner surface of the nutlets smooth or nearly so (12).
11. Ventral surface of the nutlets distinctly roughened (15).
 12. Plants biennial; corolla campanulate, crests at base of tube evident; nutlets lanceolate; native to the Uintah Basin, Utah 49. *C. rollinsii*
 12. Plants perennial; corolla salverform, crests at base of the tube lacking; plants of Texas and New Mexico (13).
13. Inflorescence capitate; nutlets 3.3-3.8 mm long; leaves densely white strigose or subtomentose; native to Brewster county, Texas 5. *C. crassipes*
13. Inflorescence elongate; nutlets 2.5-3.2 mm long; leaves strigose and setose-hispid (14).
 14. Corolla tube 7-10 mm long; calyx lobes 5-7 mm long in anthesis; plants not heterostyled; nutlets conspicuously tuberculate and short rugose; native to Texas 3. *C. oblata*
 14. Corolla tube 12-14 mm long; calyx lobes 7-9 mm long in anthesis; plants strongly heterostyled; nutlets finely tuberculate or rugose; native to New Mexico and western Texas 4. *C. paysonii*
15. Leaves conspicuously pustulate ventrally; corolla tube 12-16 mm long; calyx segments 7-10 mm long in anthesis; native to west-central Colorado and east-central Utah 51. *C. longiflora*
15. Leaves sparsely if at all pustulate ventrally; corolla tube 5.5-12 mm long; calyx segments 3-5.7 mm long in anthesis (16).
 16. Inflorescence 0.1-0.4 dm long; corolla tube 10-12 mm long; margin of nutlets not in contact; plants less than 1.2 dm tall; eastern Utah and western Colorado. 54. *C. paradoxa*
 16. Inflorescence 0.5-3 dm long; corolla tube 5-10 mm long; margin of nutlets in contact or nearly so; plants usually over 1.2 dm tall (17).

17. Scar of nutlets surrounded by an elevated margin but tightly closed; style 1-2 mm long; calyx 3.5-4 mm long in anthesis; native to southern Utah, southwestern Colorado, and northeastern Arizona 55. *C. bakeri*
17. Scar of nutlets conspicuously open; style 3-8 mm long; calyx 4.5-7 mm long in anthesis (18).
18. Scar of nutlets conspicuously open and surrounded by a definite elevated margin; wide-spread 57. *C. flavoculata*
18. Scar of nutlets slightly open and with only an inconspicuous elevated margin if any (19).
19. Leaves linear-spatulate; nutlets sharply and deeply rugose; corolla tube 5.5-7 mm long, for-nices low and broad; native to southeastern Utah 52. *C. tenuis*
19. Leaves obovate or broadly oblanceolate; nutlets with rounded ridges and tubercles; corolla tube 7-10 mm long, fornicies long papillose; native to eastern Utah 50. *C. wetherillii*
20. Nutlets smooth on their dorsal surface, not rugose, muricate or tuberculate (21).
20. Nutlets more or less roughened, muricate, rugose or tuberculate at least on the dorsal surface (26).
21. Fruit depressed globular, nutlets not in contact by their margins (22).
21. Fruit conical, ovoid or lanceolate, nutlets in contact by their margins or nearly so (23).
22. Crests at base of corolla tube conspicuous; calyx not conspicuously accrescent; wide-spread 1. *C. jamesii*
22. Crests at base of corolla tube obsolete; calyx conspicuously accrescent; southwestern New Mexico, western Texas and northern Mexico 2. *C. palmeri*
23. Stout, strictly erect plants with many elongated and conspicuous bracts in the inflorescence; southeastern Wyoming and central Colorado 20. *C. virgata*
23. Smaller, usually caespitose plants with few or inconspicuous bracts in the inflorescence; native to west of the continental divide (24).
24. Corolla tube 5-7 mm long; style 5-6 mm long; calyx 5-7 mm long; endemic to the Uintah Basin, Utah 11. *C. barnesbyi*
24. Corolla tube 2-4 mm long; style 0.5-2 mm long; calyx 2.5-4 mm long (25).
25. Nutlets ovoid; corolla tube 3-4 mm long, limb 7-10 mm wide; plants of central Idaho 13. *C. salmonensis*
25. Nutlets narrowly lanceolate; corolla tube 2-2.5 mm long, limb 3.5-5 mm wide, native to the high sierras in southern California 15. *C. nubigena*
26. Ventral surface of the nutlets smooth or nearly so (27).
26. Ventral surface of the nutlets rugose or variously wrinkled (40).
27. Nutlets bordered by a conspicuous wing; robust plants 5-10 dm tall, with long ebracteate spikes 19. *C. setosissima*
27. Nutlets never conspicuously winged, sometimes with an acute margin simulating a narrow wing; plants usually lower and caespitose; inflorescence bracteate (28).
28. Inflorescence a virgate spikelike thyrus with all but the uppermost floral bracts much longer than the short cymes; nutlets broadly ovate, sparsely rugose or smooth; native to Wyoming and Colorado 20. *C. virgata*
28. Inflorescence various but seldom if ever so spikelike, and at least the upper floral bracts reduced to short bracts which slightly if at all exceed the cymes or racemose branches (29).
29. Corolla tube 7-9 mm long; calyx 6-9 mm long in anthesis (30).
29. Corolla tube 2-6 mm long; calyx 2.5-6 mm long in anthesis (31).
30. Inflorescence capitate, 0.2-0.8 dm long; nutlets ovate; leaves densely white strigose or subtomentose; native to the Big Bend Region of Texas 5. *C. crassipes*
30. Inflorescence elongate, 0.6-2 dm long; nutlets lanceolate; leaves setose-hispid; native to Utah 49. *C. rollinsii*
31. Inflorescence very broad and rounded in outline; native to the eastern slope of the Rocky Mountains 36. *C. thyrsoiflora*
31. Inflorescence narrower; plants west of the continental divide (32).
32. Fruiting calyx 9-14 mm long; nutlets 4-6 mm long (33).
32. Fruiting calyx 4-9 mm long; nutlets 2.5-3.8 mm long (34).
33. Nutlets lanceolate, the scar narrowly subulate but open at the base; native to Alpine and Tuolumne Counties, California 18. *C. crymophila*
33. Nutlets more ovate, the scar broader and cuneate at the base; plants of the high mountains in Kittitas and Chelan Counties, Washington 46. *C. thompsonii*
34. Nutlets 2-2.3 mm long, the scar cuneate or narrowly triangular; plants of Saguache and Hinsdale Counties, Colorado 40. *C. weberi*
34. Nutlets 2.6-3.7 mm long, scar closed or narrowly linear and open only at the forked base (35).
35. Plants conspicuously setose-hispid; nutlets transversely rugose and tuberculate; plants of Colorado, Utah, and Nevada (36).
35. Plants strigose or setose, but not as above; nutlets usually tuberculate or short rugulose; plants of the high mountains in California, Oregon, Idaho, and Montana (37).
36. Nutlets scarcely or not at all muricate between the rugae; strictly erect, conspicuously

- hispid perennials from northwestern Colorado and northeastern Utah . . . 14. *C. stricta*
- 36. Nutlets distinctly muricate or tuberculate between the rugae and near the margins; erect perennials from western Utah and eastern Nevada 41. *C. rugidosa*
- 37. Nutlets with tubercles but no conspicuous transverse ridges, or sometimes nearly smooth; native to California. 15. *C. rubigena*
- 37. Nutlets with evident ridges on the dorsal surface; plants of northern California, Oregon, Idaho, and Montana (38).
- 38. Style 1.8-2.5 mm long; soboliferous perennials from western Montana 47. *C. sobolifera*
- 38. Style 0.5-1.5 mm long; plants of Idaho and Oregon (39).
- 39. Leaves oblanceolate, acute or obtuse, spreading bristly setose; style 1.2-1.5 mm long; central Idaho 17. *C. hypsophila*
- 39. Leaves spatulate, subretuse or obtuse, subtomentose or strigose; style 0.5-1 mm long; Oregon, northern California, and northwestern Nevada 16. *C. subretusa*
- 40. Nutlets conspicuously muricate, or in *C. humilis* also with a few irregular ridges (41).
- 40. Nutlets not exclusively muricate, but rugose or tuberculate, also with a few murications between the ridges (44).
- 41. Leaves distinctly subtomentose or tomentose, also setose in *C. humilis* (42).
- 41. Pubescence of the leaves silky-strigose or strigillose but not subtomentose or tomentose (43).
- 42. Plants 0.3-1 dm tall; leaves 0.5-2.5 cm long; calyx 2-2.5 mm long in anthesis; corolla tube 1.8-2.2 mm long; native to Millard County, Utah 30. *C. compacta*
- 42. Plants 0.4-2.5 dm tall; leaves 2.5 cm or longer; calyx 3-5 mm long in anthesis; corolla tube 3-5 mm long; plants widespread, Colorado to California 28. *C. humilis*
- 43. Plants densely caespitose, caudex multicapital; leaves linear oblanceolate; native to eastern Wyoming and adjacent Nebraska and Colorado 31. *C. cana*
- 43. Plants scarcely or only moderately caespitose; leaves broadly oblanceolate or spatulate; native to the Uintah Basin in northeastern Utah 32. *C. breviflora*
- 44. Scar of nutlets open some distance above the base (45).
- 44. Scar of nutlets closed or nearly so, without a conspicuous triangular opening toward the base (58).
- 45. Scar somewhat constricted some distance below the middle of the open portion (46).
- 45. Scar triangular and not constricted below the middle (47).
- 46. Elevated margin of the scar definitely limited; pustules present on both leaf surfaces; central Utah 56. *C. mensana*
- 46. Elevated margin indefinitely limited; pustules present only on dorsal surface of the leaves; southeastern Utah 53. *C. osterhoutii*
- 47. Some tendency to an elevated margin evident around the scar (48).
- 47. No tendency to an elevated margin around the scar (52).
- 48. Cymules elongating and so the inflorescence broad; biennial or short-lived perennials; nutlets usually with an evident dorsal ridge (49).
- 48. Cymules shorter and the inflorescence narrow; long-lived perennials; nutlets with only a slight dorsal ridge if any. (51).
- 49. Surface of the leaves with inconspicuous appressed bristles; inflorescence open, with only a few elongate cymules, 7-14 cm long terminating the stem; endemic to near Las Vegas, Nevada. 22. *C. insolita*
- 49. Surface of the leaves conspicuously setose-hispid with spreading bristles; inflorescence open, at least at maturity (50).
- 50. Calyx lobes 7-12 mm long in fruit; nutlets 3-4.5 mm long; prominently carinate on the dorsal side; southwestern Utah to southern California 23. *C. virginensis*
- 50. Calyx lobes 5-7 mm long in fruit; nutlets 2.5-3 mm long, with only an indistinct central ridge toward the apex; eastern California and western Nevada 24. *C. hoffmannii*
- 51. Nutlets indefinitely tuberculate and rugose; California and southern Nevada 21. *C. tumulosa*
- 51. Nutlets definitely tuberculate or rugose; native to Utah and eastern Nevada 25. *C. abata*
- 52. Style not exceeding the mature nutlets by more than 0.5 mm; plants usually less than 1.3 dm tall (53).
- 52. Style exceeding the mature nutlets by 1 mm or more; plants usually taller than 1.3 dm (56).
- 53. Corolla tube 3-4 mm long; nutlets 3-3.5 mm long (54).
- 53. Corolla tube 2-2.6 mm long; nutlets 2.3-3 mm long (55).
- 54. Ventral surface of nutlets deeply rugose and tuberculate; native to southern Utah and eastern Nevada 25. *C. abata*
- 54. Ventral surface of nutlets indefinitely muricate; native to southern Wyoming 26. *C. caespitosa*
- 55. Inflorescence less than 2 cm long; calyx segments 3-4 mm long in fruit; plants 0.1-0.3 dm tall; endemic to Inyo County, California 29. *C. roosiorum*
- 55. Inflorescence 2.7 cm long or longer; calyx segments 4-6 mm long in fruit; plants 0.2-1.3 dm

- tall, endemic to Garfield County, Utah 27. *C. ochroleuca*
56. Leaves setose-pustulate and tomentose; nutlets muciculate or with a few short rugae 28. *C. humilis*
56. Leaves finely strigose and appressed setulose; pustulate hairs lacking or inconspicuous on the ventral surface of the leaves; densely caespitose perennials (57).
57. Leaves linear to narrowly oblanceolate; corolla tube 3-3.3 mm long; nutlets inconspicuously tuberculate and rugulose; native to Alaska 44. *C. shackletteana*
57. Leaves oblanceolate to spatulate; corolla tube 3.5-4.5 mm long; nutlets muciculate and irregular rugose; native to Oregon and western Idaho 33. *C. propria*
58. Upper surface of the leaves uniformly appressed strigose and without pustulate hairs (59).
58. Upper surface of the leaves with two distinct kinds of hairs; pustulate at base (63).
59. Nutlets sharply rugose and tuberculate, scar surrounded by an elevated margin 55. *C. bakeri*
59. Nutlets not so sharply rugose or tuberculate; scar not surrounded by an elevated margin (60).
60. Leaves linear or narrowly oblanceolate, 2-13 cm long, 0.1-0.5 cm wide; native to Alaska 44. *C. shackletteana*
60. Leaves shorter and broader; plants from farther south (61).
61. Corolla tube 2-2.5 mm long; style exceeding nutlets by 1 mm or less; endemic to Garfield County, Utah 27. *C. ochroleuca*
61. Corolla tube 3.5 mm long or longer; style exceeding nutlets by more than 1 mm (62).
62. Densely caespitose perennial from a multicapital caudex; native to eastern Oregon and western Idaho 33. *C. propria*
62. Less evident or not at all caespitose; native to Utah, Colorado, and Wyoming 38. *C. sericea*
63. Mature calyx exceeding the nutlets by 2-4 mm; inflorescence broadtopped; western Colorado and eastern Utah 37. *C. clata*
63. Mature calyx exceeding the nutlets by 4-8 mm (64).
64. Nutlets tuberculate, scarcely if at all rugose (65).
64. Nutlets more or less rugose (69).
65. Ventral surface of the nutlets smooth or nearly so; native to high mountains in western Montana 47. *C. sobolifera*
65. Ventral surface of the nutlets distinctly roughened (66).
66. Plant 1-2 dm tall; native to western Colorado and eastern Utah (67).
66. Plants 2 or more dm tall (68).
67. Corolla tube 2.6-3 mm long; calyx segments 2.8-3 mm long in anthesis; nutlets 2-2.6 mm long; endemic to Mesa County, Colorado 39. *C. aperta*
67. Corolla tube 3.5-5 mm long; calyx segments 5-7 mm long in anthesis; nutlets 3-3.8 mm long; native to Uintah County, Utah 48. *C. grahamii*
68. Nutlets broadly lanceolate; mucications lacking or indefinite; inflorescence slightly open to very broad; widespread, from North Dakota to Washington and Oregon 45. *C. celosioides*
68. Nutlets narrowly lanceolate; mucications or tuberculations very definite; Elko County, Nevada 42. *C. interrupta*
69. Scar of the nutlets somewhat open at the base 28. *C. humilis*
69. Scar of the nutlets closed or nearly so (70).
70. Inflorescence very broad and open; plants native on the eastern slope of the Rocky Mountains, from southern Wyoming to northern Texas 36. *C. thyrsoiflora*
70. Inflorescence narrower; plants more northerly in range (71).
71. Leaves narrowly oblanceolate, strongly setose-ciliate on the margins; stems slender; native to eastern Washington and Oregon, and Idaho 43. *C. spiculifera*
71. Leaves usually broader, oblanceolate to spatulate, the margins not strongly setose-ciliate; stems more robust (72).
72. Inner surface of the nutlets conspicuously rugose or tuberculate; widespread 45. *C. celosioides*
72. Inner surface of the nutlets smooth or nearly so (73).
73. Leaves soboliferous, oblanceolate to spatulate, setose; native to high mountains of western Montana 47. *C. sobolifera*
73. Leaves not soboliferous, spatulate, subtretuse, subtomentose; native to northern California and Oregon 16. *C. subtretusa*

1. *Cryptantha jamesii* (Torr.) Payson

Perennials, 1-6 dm tall; stems one-many, 0.4-4 dm long, glabrous to conspicuously hirsute; leaves linear to broadly oblanceolate, obtuse to acute, 2-15 cm long, 0.2-1.5 cm wide, glabrous to hirsute, usually pustulate dorsally, ventral surface lacking pustules or the pustules very inconspicuous; inflorescence open, cymules usually elongating, tomentose to setose-hirsute, floral bracts inconspicuous to very conspicuous; calyx segments ovate-lanceolate, acute, in anthesis 3-4 mm long, in fruit 5-7 mm long, subtomentose to setose-hirsute, (or sometimes nearly glabrous); pedicels 1-3 mm long; corolla white, the tube 2.5-3 mm long, crests at base of tube conspicuous, fornicies

light-yellow, emarginate, 0.5-1 mm long, limb 5-8 mm broad; style exceeding mature fruit 1-3 mm; fruit obovate-ovoid, 1-4 nutlets maturing, ovate-lanceolate, margins acute, 2-2.5 mm long, 1.5-2 mm wide, the margins not in contact, both surfaces smooth and glossy, scar straight, closed, extending from the base to near the apex, elevated margin lacking.

Key to the varieties of *C. jamesii*

- 1. Ventral surface of the leaves glabrous, the petioles not ciliate-margined, nor tufted at the baselg. var. *pustulosa*
- 1. Ventral surface of the leaves strigose or setose, the petioles ciliate-margined; leaves tufted at the base (2).
 - 2. Stems simple, not branched above the base (3).
 - 2. Stems branched from the base as well as above (5).
- 3. Stems 1-4.4 dm long, usually twice as long as the basal tuft of leavesla. var. *multicaulis*
- 3. Stems 0.2-0.9 dm long, usually not exceeding the basal tuft of leaves (4).
 - 4. Floral bracts exceeding the cymules; stems low, decumbent; Nevada and Californiald. var. *abortiva*
 - 4. Floral bracts not exceeding the cymules; stems erect or nearly solc. var. *setosa*
- 5. Stems decumbent; plants of the Great Plainslf. var. *jamesii*
- 5. Stems erect; plants west of the continental divide (6).
 - 6. Leaves linear; cymules 8 cm long or longer, very lax; native to southern New Mexico, Texas, and Mexicolb. var. *laxa*
 - 6. Leaves oblanceolate; cymules usually much shorter than 8 cm long, and more congestedle. var. *disticha*

la. var. *multicaulis* (Torr.) Payson

Cryptantha jamesii (Torr.) Payson var. *multicaulis* (Torr.) Payson, Ann. Mo. Bot. Gard. 14:244. 1927.

Eriichium multicaule Torr. in Marcy, Exploration Red River, 262. 1854.

Oreocarya multicaulis (Torr.) Greene, Pitt. 3:114. 1896.

Oreocarya suffruticosa (Torr.) Payson var. *multicaulis* (Torr.) Payson, Univ. Wyo. Publ. Bot. 1:171. 1926.

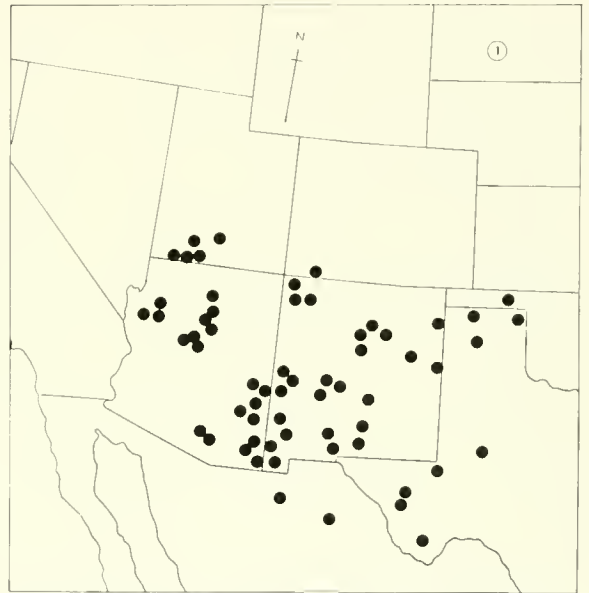
Hemisphaerocarya suffruticosa (Torr.) Brand var. *multicaulis* (Torr.) Brand, Fedde, Rep. Spec. Nov. 24:60. 1927.

Perennial, 2-5.5 dm tall, branched from the base, simple above; stems slender, 1-4.4 dm long, weakly strigose-setose; leaves mostly basal, oblanceolate, 5-15 cm long, 0.4-1 cm wide, dorsal surface strigose and appressed setose, or sometimes setose-hirsute, pustulate, ventral surface uniformly strigose or subtomentose, without pustules, or the pustules small and in-

conspicuous, the petioles conspicuously ciliate on the margins; inflorescence open, 0.5-1.5 dm long, bracts inconspicuous. Collections: 387 (x); representative: Jones 4007 (ARIZ, GH, US, UTC); J. M. Tucker 2771 (GH, ORE); R. C. Rollins 2429 (GH, US, UTC); B. Maguire 11975 (ARIZ, UTC); O. B. Metcalfe 70 (ARIZ, GH, ND-G, US); L. C. Higgins 3136, 3169, 3595 (BRY, WTSU).

Holotype: Fendler 636, collected in New Mexico near Santa Fe, 1847, NY. Isotypes at GH, US.

Distribution: Southern Colorado and eastern New Mexico, south to western Oklahoma and Texas into northern Mexico, north through central Arizona to southern Utah. Growing on a wide variety of soils, 4,500 to 8,000 feet. Map No. 1a. April to September.



Map No. 1a. Parts of southwestern United States. Range of *C. jamesii* (Torr.) Payson var. *multicaulis* (Torr.) Payson.

The original description of *E. multicaule* Torr., was based on a collection from near Santa Fe with setose-hirsute pubescence. This same bristly form also occurs in the White Mountains and southward to the Santa Catalina Mountains of Arizona. A strigose or subtomentose form occurs about Flagstaff, also into southwestern New Mexico, and north into southern Utah. In northern Arizona var. *multicaulis* may be confused with var. *setosa*. It can be separated from var. *setosa* by the longer stems, becoming twice the length of the basal tuft of leaves, and the individual cymes which are longer and more perfectly developed. On its eastern boundary it may be confused with var. *jamesii*, but differs in the simple stem which is never branched above the base, more perfectly developed cymes, and the more dense strigose pubescence.

1b. var. *laxa* (Macbr.) Payson

Cryptantha jamesii (Torr.) Payson var. *laxa* (Macbr.) Payson, Ann. Mo. Bot. Gard. 14:246, 1927.

Oreocarya multicaulis var. *laxa* Macbr. Contr. Gray Herb. 48:35, 1916.

Hemisphaerocarya laxa (Macbr.) Brand. Fedde, Rep. Spec. Nov. 24:60, 1927.

Perennial, 2.5-4.5 dm tall; stems branched from the base and upward, stout, 1-3 dm long, strigose and spreading setose; leaves linear, 4-12 cm long, 0.2-0.5 cm wide, dorsal surface coarsely strigose and pustulate, ventral surface finely strigose, and with a few inconspicuous pustulate hairs, the petioles long ciliate margined; inflorescence very broad and open, lax, 0.7-2.5 dm long, the foliar bracts inconspicuous. Collections: 13 (0); representative: L. C. Hinckley 3480 (GH); V. Harvard s.n. (US); E. L. Reed 3450 (US); E. O. Wootton 401 (NY)

Holotype: Pringle 776, collected in Chihuahua, Mexico, on sand hills near Paso Del Norte, 20 September 1886, GH. Isotypes LL, ND-G.

Distribution: Southern New Mexico, western Texas, and northern Mexico in the state of Chihuahua. Limited to sand dune areas. Map No. 1b. June to November.

This narrow-leaved variety is apparently confined to the sandy, dune areas of Mexico and southern New Mexico. It may be confused with var. *jamesii* in western Texas and southern New Mexico, but usually can be separated from that variety by the stout, erect stems, the narrower leaves, and the longer, more perfectly developed cymes. From variety *multicaulis* it differs in the stems, which are branched above the

base, and the very narrow leaves scattered along the stems.

1c. var. *setosa* (Jones) Johnst. ex Tidestr.

Cryptantha jamesii (Torr.) Payson var. *setosa* (Jones) Johnst. ex Tidestr. Proc. Biol. Soc. Wash. 48:42, 1935.

Oreocarya cinerea Greene, Pitt. 3:113, 1896. (Type: Southern Colorado, on the plains near Pueblo, 1873, Greene s.n.)

Krynitzkia multicaulis var. *setosa* Jones, Contr. West. Bot. 13:4, 1910.

Oreocarya lemmonii Eastw. Bull. Torrey Bot. Club 30:239, 1903. (Type: Arizona, without definite locality, 1884, Lemmon.)

Oreocarya multicaulis var. *cinerea* (Greene) Macbr. Proc. Am. Acad. 51:54, 1916.

Oreocarya suffruticosa var. *cinerea* (Greene) Payson. Univ. Wyo. Publ. Bot. 1:171, 1926.

Hemisphaerocarya suffruticosa var. *setosa* (Jones) Brand. Fedde, Rep. Spec. Nov. 24:60, 1927.

Hemisphaerocarya cinerea (Greene) Brand. Fedde, Rep. Spec. Nov. 24:61, 1927.

Cryptantha jamesii (Torr.) Payson var. *cinerea* (Greene) Payson, Ann. Mo. Bot. Gard. 14:246, 1927.

Perennial, 1-3 dm tall, branched from the base, simple above; stems slender, 0.2-0.9 dm long, strigose and weakly setose; leaves mostly basal, oblanceolate, obtuse, 3.5-13 cm long, 0.4-1.5 cm wide, dorsal surface finely strigose, usually conspicuously pustulate, ventral surface uniformly and densely strigose, the petioles conspicuously ciliate on the margins; inflorescence open, 0.4-2 dm long, bracts evident especially near the base of the inflorescence. Collections: 163 (vii); representative: T. S. Brandegee B31 (NY, US); E. L. Greene s.n. (ND-G); Rydberg and Vieiland 5702 (NY, RM); D. T. MacDougal 204 (ARIZ, US); C.



Map No. 1b. Parts of southwestern United States. Range of *C. jamesii* (Torr.) Payson: (Circles), var. *setosa* (Jones) Johnst. ex Tidestr.: (Triangles), var. *laxa* (Macbr.) Payson.



Map No. 1c. Parts of western United States. Range of *C. jamesii* (Torr.) Payson: (Circles), var. *abortiva* (Greene) Payson: (Triangles), var. *pustulosa* (Rydb.) Harringt.

F. Baker 455 (GH, RM, US); L. C. Higgins 1009, 1443 (BRY).

Holotype: M. E. Jones s.n., collected near Fort Cove, Utah, growing under junipers, 27 June 1901, RSA, Photograph at BRY.

Distribution: South-central Colorado, northern New Mexico, northern Arizona, eastern Nevada, and southern Utah. Usually found on heavy clay soils. Map No. 1b. Late May to early September.

In southern Utah variety *setosa* reaches its best development. It is characterized by the short stems which never exceed the basal tuft of leaves. In the outlying areas on the margins of its range, it freely intergrades with variety *multicaulis* on the south, *abortiva* on the west, and variety *jamesii* on the eastern side. *Oreocarya lemmonii* was separated on the basis of a more setose indument which occurs on a population of this variety about Prescott, Arizona; however, I do not believe that it is worthy of any taxonomic rank. This variety has been recognized in the past as variety *cinerea*, but the older name of *setosa* must be used, at least at the variety level.

1d. var. *abortiva* (Greene) Payson

Cryptantha jamesii (Torr.) Payson var. *abortiva* (Greene) Payson, Ann. Mo. Bot. Gard. 14:250, 1927.

Oreocarya abortiva Greene, Pitt. 3:114, 1896.

Krynitzkia multicaulis var. *abortiva* (Greene) Jones, Contr. West. Bot. 13:5, 1910.

Oreocarya suffruticosa var. *abortiva* (Greene) Macbr. Proc. Am. Acad. 51:547, 1916.

Hemisphaerocarya abortiva (Greene) Brand, Fedde, Rep. Spec. Nov. 24:61, 1927.

Prostrate, caespitose perennials, branched from the base, 0.7-2 dm tall; stems slender, weak, decumbent, 0.3-0.7 dm long, strigose, and with some weak spreading setose hairs; leaves basal, as well as scattered along the stem, linear to narrowly oblanceolate, 1.5-9 cm long, 0.3-0.9 cm wide, dorsal surface finely strigose and setose pustulate, ventral surface finely strigose and without pustules, the petioles ciliate margined; inflorescence open, 0.2-1.3 dm long, floral bracts very evident, usually exceeding the cymules. Collections: 44 (i); representative: Clokey 7280 (BRY, ND, NY, ORE, UTC); Maguire and Holmgren 26119 (NY, UTC); Parish 1480 (US); Purpus 6068 (US).

Lectotype: S. B. Parish 3694, collected in the San Bernardino Mountains, Bear Valley, 6,500 feet, 16-20 June 1895, ND-G. Isolectotypes at GH, UC.

Distribution: Central and southern Nevada, west to the San Bernardino Mountains, north through Inyo and Mono Counties, California. Growing in sandy soils from 6,000 to 10,500 feet. Map No. 1c. Late May to October.

Variety *abortiva* is fairly well defined geographically, and is only to be confused on its eastern boundary with var. *setosa*. It may be separated from that variety by the long foliar bracts which exceed

the individual cymules and the prostrate stems.

I have designated the plant in the Notre Dame Herbarium with Greene's handwritten notation *Oreocarya abortiva* to be the type specimen, as it agrees with the plant and the maturity of the fruit which he discusses in the original description.

1e. var. *disticha* (Eastw.) Payson

Cryptantha jamesii (Torr.) Payson var. *disticha* (Eastw.) Payson, Ann. Mo. Bot. Gard. 14:248, 1927.

Oreocarya disticha Eastw. Bull. Torrey Bot. Club 30:238, 1903.

Erect perennials, branched from the base as well as above; 2.5-4.2 dm tall; stems somewhat woody near the base, 1.2-2.9 dm long, strigose and weakly setose; leaves narrowly oblanceolate, 3-12 cm long, dorsal surface setose-pustulate and strigose, ventral surface strigose to setose or silky-strigose, without pustulate hairs or the pustules inconspicuous, the petioles ciliate-margined; inflorescence open, 0.5-2 dm long, the foliar bracts not conspicuous. Collections: 60 (iv); representative: A. H. Holmgren 3243 (ARIZ, BRY, UC, US, UTC); B. F. Harrison 10370 (BRY, UC); B. Maguire 18298 (UC, UTC); Eastwood and Howell 6674 (UTC); L. C. Higgins 1004 (BRY).

Holotype: A. Eastwood 90, collected in San Juan County, Utah, on Bartons Range, 13 July 1895, CAS. Isotypes at UC, GH, US.

Distribution: Wayne and Emery Counties, Utah, southeast through southwestern Colorado, northwestern New Mexico, northeastern Arizona in Apache, Navajo, and Coconino Counties, north to Garfield County, Utah. Usually found growing on sand dunes or sandy slopes and ridges, 4,000 to 7,500 feet. Map No. 1d. Late April to September.

The variety *disticha* seems to be intermediate between variety *multicaulis* and var. *jamesii*. It can be separated from the former by the more woody stems which are branched above the base, from var. *jamesii* by the erect stems, the leaves which are subglabrescent, and the more perfectly developed cymules. The character of a single nutlet is of no value; as one to four nutlets may be found on the same plant.

1f. var. *jamesii*

Cryptantha jamesii (Torr.) Payson var. *jamesii*.

Myosotis suffruticosa Torr. Ann. Lyc. N.Y. 2:225, 1827, not *Cryptantha suffruticosa* Piper, Proc. Biol. Soc. Wash. 32:42, 1919.

Eritrichium jamesii Torr. in Marcy, Expl. Red River. 262, 1854.

Krynitzkia jamesii (Torr.) Gray, Proc. Am. Acad. 20:278, 1885 in part.

Oreocarya suffruticosa (Torr.) Greene, Pitt. 1:57, 1887. *Hemisphaerocarya suffruticosa* (Torr.) Brand, Fedde, Rep. Spec. Nov. 24:60, 1927.

Hemisphaerocarya suffruticosa var. *typica* Brand, Fedde, Rep. Spec. Nov. 24:60, 1927.

Decumbent perennials, 1.6-4 dm tall, branched from the base as well as above; stems decumbent,

0.6-2 dm long, strigose and weakly setose; leaves linear to oblanceolate, 2.5-8 cm long, 0.3-0.9 cm wide, the dorsal surface coarsely strigose and appressed setose pustulate, ventral surface uniformly strigose and without pustules, the petioles ciliate-margined; inflorescence open, 0.4-1.4 dm long, floral bracts evident but not conspicuous. Collections: 217 (iii), representative: P. A. Rydberg 1514 (GH, ND-G, NY, US); A. Nelson 477 (GH, ND-G, NY, US); C. L. Porter 3951 (BRY, GH, RM); J. H. Christ 954 (CS, GH); I. C. Higgins 1527 (BRY).

Holotype: James s.n., barren deserts high upon the Platte, NY.

Distribution: Wyoming and South Dakota, south through Nebraska, Kansas, and western Oklahoma, west through northern Texas and western New Mexico, and north through Colorado east of the Continental Divide. Growing on sandy to clay soils. Map No. 1d, May to late August.

Variety *jamesii* is confined mainly to the area east of the Continental Divide, but with some overlap in central New Mexico and southern Colorado. In eastern New Mexico it may be confused with var. *multicaulis*, and very often it is quite difficult to separate the two. In south-central and southern Colorado var. *jamesii* may be confused with var. *setosa*, but can usually be separated from it by the shorter leaves which are scattered along the stem, rather than in a basal tuft.

1g. var. *pustulosa* (Rydb.) Harringt.

Cryptantha jamesii (Torr.) Payson var. *pustulosa* (Rydb.) Harringt. *Man. Pl. Colo.* 466, 641. 1954. *Oreocarya pustulosa* Rydb. *Bull. Torrey Bot. Club* 40:480. 1913.

Cryptantha pustulosa (Rydb.) Payson, *Ann. Mo. Bot. Gard.* 14:252. 1927.

Hemisphaerocarya suffruticosa var. *pustulosa* (Rydb.) Brand, Fedde, *Rep. Spec. Nov.* 24:60. 1927.

Erect perennials, 2-5.8 dm tall, branched from the base, simple above; stems slender, 1-3.9 dm long, glabrous or finely strigose; leaves linear to broadly oblanceolate, 2-9 cm long, 0.4-1.5 cm wide, the dorsal surface appressed setose-pustulate, ventral surface glabrous, the petioles not ciliate margined; inflorescence open, 0.4-2 dm long, floral bracts inconspicuous. Collections: 22 (ii); representative: A. H. Holmgren and S. Hansen 3489 (BRY, NY, UTC); P. A. Rydberg and A. O. Garrett 9569 (NY, RM, UT); A. Cronquist and N. Holmgren 9372 (NY, UTC); J. Reveal and G. Davidse 926 (BRY); Welsh, Higgins and Atwood 8933 (BRY).

Holotype: Rydberg and Garrett 9320, collected in San Juan County, Utah, on the Elk Mountains in Hammond Canyon, 31 July 1911, NY.

Distribution: Southeastern Utah in Garfield, Kane, and San Juan Counties, southwestern Colorado, northwestern New Mexico, and northeastern Arizona.

Growing in a wide variety of soils, 4,500 to 8,500 feet. Map No. 1c, Late May to late August.

This variety is quite different in general appearance from any of the other varieties in this species complex. This is due to the slender weak stems, and the lack of any pubescence on the ventral surface of the leaves. The original description characterizes the leaves as being glabrous beneath, sparingly hairy above. However, with the specimens at hand it is the upper and not the lower surface that is glabrous. The var. *disticha* in some cases is nearly glabrous, but always has a few hairs on the ventral surface and is probably a connecting link between var. *setosa* and the present species.

2. *Cryptantha palmeri* (Gray) Payson

Cryptantha palmeri (Gray) Payson, *Ann. Mo. Bot. Gard.* 14:253. 1927.

Krynitzkia palmeri Gray, *Proc. Am. Acad.* 20:278. 1885.

Oreocarya palmeri (Gray) Greene, *Pitt.* 1:57. 1887.

Hemisphaerocarya palmeri (Gray) Brand, Fedde, *Rep. Spec. Nov.* 24:61. 1927.

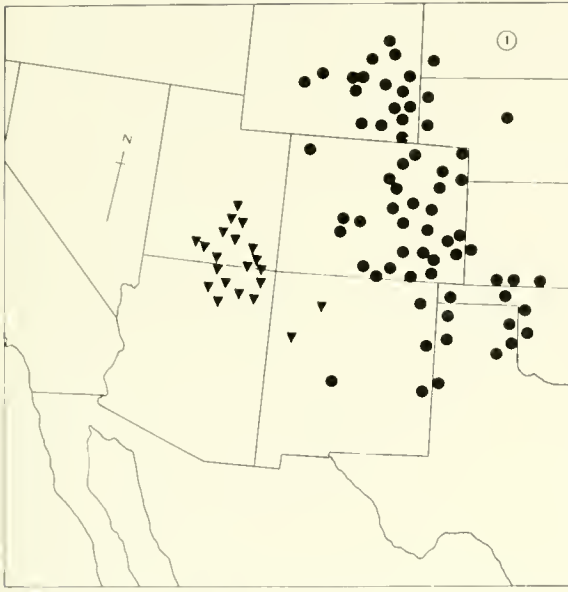
Cryptantha coryi Johnston, *Journ. Arn. Arb.* 20:396. 1939.

Plants biennial or short-lived perennials, 1.7-4 dm tall; stems 1-several, 0.7-3.5 dm long, spreading setose hirsute; leaves linear-lanceolate, acute, 3-16 cm long, 0.4-1 cm wide, strigose and subtomentose, pustulate hairs conspicuous on the dorsal surface, few and not evident on the ventral surface; inflorescence broad-topped due to the elongation of the cymules in age, 0.3-2.7 dm long, setose, the floral bracts inconspicuous; calyx segments lanceolate, in anthesis 4-6 mm long, in fruit becoming 7-10 mm long, setose or weakly hispid; corolla white, the tube 4-6 mm long, crests at base of tube lacking, fornicies yellow, rounded, papillose, 0.5-1 mm long, limb 7-9 mm wide; style exceeding mature fruit by 2-3.5 mm; nutlets ovate, 2.5-2.8 mm long, 2-2.7 mm wide, the margins not in contact, acute, both surfaces of the nutlet smooth and glossy, scar tightly closed and without an elevated margin. Collections: 110 (xii); representative: D. S. Correll and J. M. Johnston 21243 (GH, LL); V. L. Cory 31517 (GH); D. S. Correll 16353 (GH, LL); J. Reverchon 2120 (GH, ND-G); M. E. Jones 18514 (ND); E. J. Palmer 34009 (GH); L. C. Higgins 3097 (BRY).

Holotype: Palmer 895, collected in Coahuila, Mexico, 40 miles south of Saltillo, March 1880, GH.

Distribution: Lower Sonoran life zone in western Texas and adjacent Mexico. Growing on limestone or gravelly to rocky hillsides, 1,000 to 4,000 feet. Map No. 2, April to late July.

The type of *C. palmeri* is very immature, and because of this immaturity some confusion has come about as to which plant should bear the name of *palmeri*. In observing the type specimen on loan from Gray Herbarium and the original description, which characterizes the nutlets as follows: "nuculis opacis



Map No. 1d. Parts of southwestern United States. Range of *C. jamesii* (Torr.) Payson: (Circles), var. *jamesii*; (Triangles), var. *disticha* (Eastw.) Payson.

rugosiusculis," the nutlets are subrugose only because they are immature. For this reason *C. coryi* is placed in synonymy. Immature specimens in all the smooth-fruited species have a tendency for the nutlets to appear subrugose until they are fully matured, which is no exception in the present species.

This species may be separated from its nearest relative *C. jamesii* var. *multicaulis*, by its lack of crests at the base of the corolla tube, the accrescent sepals, and the longer style.

3. *Cryptantha oblata* (Jones) Payson

Cryptantha oblata (Jones) Payson, Ann. Mo. Bot. Gard. 14:254, 1927.

Krynitzkia oblata M. E. Jones, Contr. West. Bot. 13:4, 1910.

Oreocarya hispidissima Wooton and Standley, Contr. U. S. Natl. Herb. 19:545, 1915, not *O. hispidissima* (Torr.) Rydb.

Oreocarya oblata (Jones) Macbr. Proc. Am. Acad. 51:548, 1916.

Hemisphaerocarya oblata (Jones) Brand, Fedde, Rep. Spec. Nov. 24:61, 1927.

Caespitose perennial, 1-3.5 dm tall; stems several, 0.4-1.5 dm long, retrorsely setose and spreading hirsute; leaves oblanceolate, acute, 3-10 cm long, 0.4-1.4 cm wide, coarsely strigose and appressed setose dorsally, pustules conspicuous, ventral surface weakly strigose-setose, and with fewer pustulate hairs, the petioles ciliate margined; inflorescence somewhat open, especially in age, 0.3-2 dm long, setose-hirsute; calyx segments linear-lanceolate, 5-7 mm long in anthesis, becoming 8-10 mm long in fruit, densely setose; corolla white, tube 7-10 mm long, crests at base of tube lacking, fornicies yellow, broad, papillose, limb 8-12 mm wide; style 3-5 mm longer than

mature fruit; nutlets ovoid, usually all four maturing, the margins narrowly separated, acute, 2.5-3 mm long, 2-2.5 mm wide, dorsal surface rugose-tuberculate, ventral surface smooth or slightly uneven, scar closed, straight, and without an elevated margin. Collections: 76 (vi); representative: D. S. Correll and I. M. Johnston 22036 (LL); C. L. and A. Lundell 14309 (GH, LL); G. R. Vasey s.n. (ND-G, US); W. P. Cottam 10228 (BRY, UT); G. C. Nealley 167 (ND-G, US); E. O. Wooton s.n. (ARIZ, RM, US).

Holotype: M. E. Jones 3759, collected at El Paso, Texas, 23 April 1884, POM. Photograph at BRY. Iso-types at RM, US.

Distribution: Southcentral New Mexico, western Texas and northern Mexico. Growing on sandy or gravelly limestone soil, 1,000 to 5,000 feet. Map No. 3. Late March to September.

This species is confined mainly to the western half of transpecos Texas and southern New Mexico. It may be distinguished from its nearest relatives, *C. palmeri* and *C. paysonii* on the basis of the floral and nutlet characters. From the former it may be distinguished by the nutlets which are roughened on the dorsal side and the corolla tube which definitely exceeds the calyx segments. It differs from the latter by the flowers which are not heterostyled, and the stamens which are always attached at the middle of the corolla tube, the fornicies which are nearly glabrous, and the more open loosely thyrsoid inflorescence.

4. *Cryptantha paysonii* (Macbr.) Johnst.

Cryptantha paysonii (Macbr.) Johnst. Wrightia 2:160, 1961.

Oreocarya paysonii Macbr. Contr. Gray Herb. 48:36, 1916.

Hemisphaerocarya paysonii (Macbr.) Brand, Fedde, Rep. Spec. Nov. 24:61, 1927.

Caespitose perennials, 1.6-2.9 dm tall; stems erect, stout, 0.8-1.6 dm long, strigose and more or less spreading setose-hirsute; leaves oblanceolate, obtuse to acute, 3-9 cm long, 0.5-1.5 cm broad, dorsal surface finely strigose or subtomentose, also setose with pustulate hairs, ventral surface similar but with less conspicuous pustulate hairs; inflorescence subcapitate, consisting of four to six compact cymules, 0.5-1.2 dm long, setose; calyx segments linear-lanceolate, in anthesis 7-9 mm long, in fruit becoming 9-10 mm long, setose-hirsute; corolla white, the tube 12-14 mm long, crests at base of tube lacking, fornicies yellow, rounded, densely papillose, 0.5-1 mm long, limb 10-13 mm wide; plants heterostyled; nutlets ovate, 2.7-3 mm long, 2-2.5 mm wide, usually all four nutlets maturing, margins narrowly winged, in contact, both surfaces finely rugulose or finely tuberculate, scar closed, straight, and lacking an elevated margin. Collections: 6 (iii); representative: O. B. Metcalfe 1576 (POM, US); D. S. Correll and I. M.



Map No. 2. Western Texas and northern Mexico. Range of *C. palmeri* (Gray) Payson.

Johnston 22003 (LL); L. C. Higgins 3151 (BRY, WTSU).

Holotype: O. B. Metcalfe 1576, collected in Sierra County, New Mexico, on limestone hills at Berendo Creek, 12 May 1905, GH. Isotypes at POM, US.

Distribution: New Mexico in DeBaca, Otero, and Sierra Counties, south into Culberson County, Texas. Growing on limestone soil, 4,000 to 7,500 feet. Map No. 4, April to June.

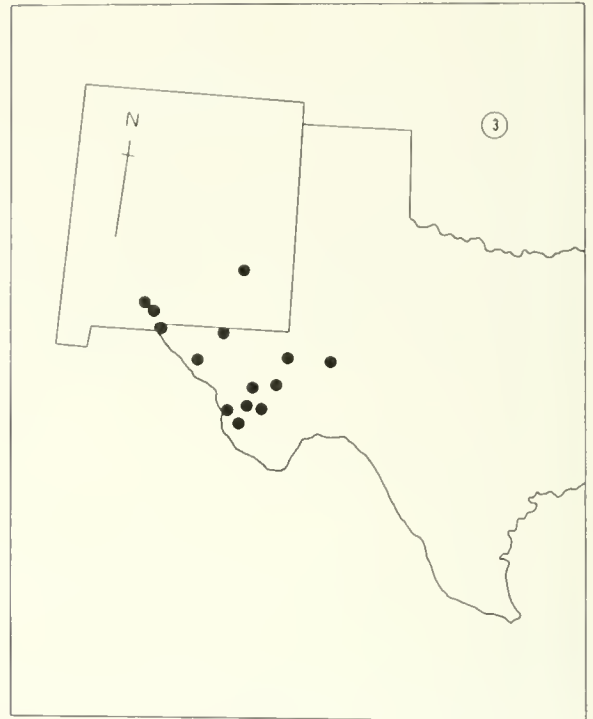
This species has been confused in the past with *C. oblata*, but differs from it in the larger corollas which are strongly heterostyled, the more compact inflorescence, and the nutlets which are only finely rugulose or tuberculate.

More collections of this taxon are badly needed in order to determine its exact geographical range.

5. *Cryptantha crassipes* Johnst.

Cryptantha crassipes Johnst. Journ. Arn. Arb. 20:397, 1939.

Plants perennial, 1.5-2.4 dm tall, stems 1-several, 1.2-1.9 dm long, setose; leaves linear-lanceolate, obtuse to acute, mostly basal, reduced upward, 3-6 cm long, 0.2-0.6 cm wide, densely white strigose, also setose-pustulate on the dorsal surface; inflorescence capitate, 0.2-0.8 dm long, white strigose, floral bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 7-9 mm long, in fruit becoming 9-11 mm long, setose; corolla white, the tube 8-9 mm long, crests at base of tube lacking, fornicees yellow,



Map No. 3. Parts of Texas and New Mexico. Range of *C. oblata* (Jones) Payson.

rounded, about 1 mm long, limb 9-11 mm wide; style exceeding mature fruit 4-7 mm; nutlets ovate or triangular-ovate, 3.3-3.8 mm long, 2.5-3 mm wide, dorsal surface finely rugulose, ventral surface smooth or only slightly uneven, margin acute or narrowly winged, scar closed, and without an elevated margin. Collections: 15 (iii); representative: V. L. Cory 18613 (GH); D. S. Correll and I. M. Johnston 21934 (GH, LL); D. S. Correll and R. C. Rollins 23604 (LI); V. L. Cory 31585 (GH); L. C. Higgins 2767, 2940 (BRY, WTSU).

Holotype: V. L. Cory 18613, collected in Brewster County, Texas, 6.5 miles east of Agua Fria Springs, 13 April 1936, GH. Photograph at BRY.

Distribution: Brewster County, Texas, in the Big Bend region. Growing on white limestone which is shaly or clayey, 1,500 to 4,500 feet. Map No. 5. Late March to early June.

This distinctive plant is closely related to *C. palmeri* and *C. paysonii*. From the former it can be distinguished by the compact capitate inflorescence, the thicker more woody caudex, and the shorter corolla tube. From *C. paysonii*, it differs in the shorter corolla tube, the monomorphic flowers, the nutlets which are more compressed or flattened, and the very woody caudex.

6. *Cryptantha confertiflora* (Greene) Payson

Cryptantha confertiflora (Greene) Payson, Ann. Mo. Bot. Gard. 14:256, 1927.

Krynitzkia leucophaea var. *alata* Jones, Proc. Calif. Acad. Sci. II, 5:710, 1895. (Type: Silver Reef, Utah, on sandstone cliffs, 4,500 feet, 3 May 1894, M. E. Jones 5144.)

Oreocarya confertiflora Greene, Pitt. 3:112, 1896.
Oreocarya lutea Greene, Muhlenbergia 2:240, 1906. Name only. Fedde, Rep. Spec. Nov. 19:72, 1923. Description. (Type: California, Inyo County, White Mountains, 9 May 1906, Heller 8211.)

Oreocarya alata (Jones) A. Nels. Coulter and Nelson, Man. Cent. Rocky Mts. 417, 1909; Rydb. Fl. Rocky Mts. 725, 1917.

Perennial herbs, 1.7-4.3 dm tall; stems 1-7, slender, 1.5-2.5 dm long, tomentose at the base, strigose and setose upward; leaves linear to oblanceolate, 3-12 cm long 0.2-1.6 cm wide, acute, dorsal surface densely strigose and appressed setose with pustulate bases, ventral surface uniformly strigose and with few or no pustules; inflorescence subcapitate, 0.3-2 dm long, strigose and with twisted setose hairs, bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 6-8 mm long, in fruit becoming 10-14 mm long, strigose and spreading setose; corolla yellow, the tube 9-13 mm long, fornicies broad, emarginate, about 1 mm long, crests at base of tube evident or sometimes lacking, limb 8-10 mm wide; plants distinctly heterostyled; nutlets triangular or ovate, 3.5-4 mm long, 2.5-3 mm wide, usually all four maturing, margins narrowly winged, in contact, surfaces smooth and glossy, scar straight, closed, and lacking an elevated margin. Collections: 117 (vi); representative: I. W. Clokey 7659 (ARIZ, LL, ND, ORE, UTC); S. B. and W. F. Parish 1316 (ND-G, US); F. W. Gould 1550 (BRY, UT, UTC); P. Train s.n. (ARIZ, ORE); L. C.

Higgins 1365, 1475, 1771 (BRY).

Holotype: S. B. Parish 1316, collected in San Bernardino County, California, at Cushenberry Springs on the north side of the San Bernardino Mountains, 1882, ND-G. Photograph at BRY. Isotype at US.

Distribution: Southwestern Utah, northern Arizona, southern Nevada, and west to southern and western California. Growing in a wide variety of soils, 2,000 to 8,500 feet. Map No. 6. April to July.

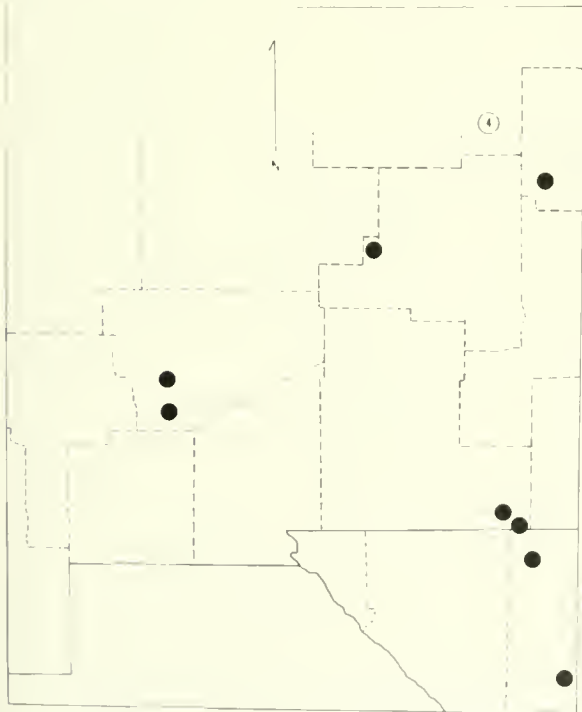
This distinctive, yellow-flowered species is one of the largest of the perennial species of *Cryptantha*, and is not common, but covers a wide distributional range. This species may be distinguished from its closest relative, *C. flava*, by the broader more ovate nutlets and the longer stems with a subcapitate inflorescence.

Brand legally published the nomen nudum *Oreocarya lutea* Greene. He did this on the basis that the stamens were in a different position in the corolla tube. However, this taxonomic criteria is of no value in the present species because the corolla is very dimorphic in regards to this character.

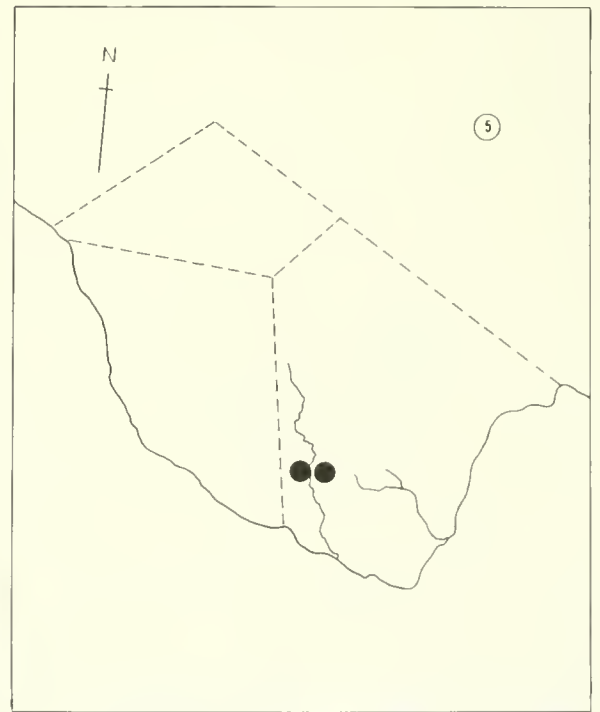
Jones described a narrow-leaved form from southern Utah as a new variety, but it is not worthy of any subspecific rank.

7. *Cryptantha flava* (A. Nels.) Payson

Cryptantha flava (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:259, 1927.



Map No. 4 Northwest Texas and southern New Mexico. Range of *C. paysonii* (Macbride) Johnston.



Map No. 5. Brewster Co., Texas. Range of *C. crassipes* Johnston.

Oreocarya flava A. Nels. Bull. Torrey Bot. Club 25:202. 1898.

Oreocarya lutescens Greene, Pitt. 4:93. 1899. (Type: On hills about Aztec, New Mexico, 25 April 1899, C. F. Baker.)

Cryptantha confertiflora var. *flava* Brand, Pflanzenreich (Heft. 97) 4, fam. 252:90. 1931.

Cryptantha confertiflora var. *lutescens* Brand, Pflanzenreich (Heft. 97) 4, fam. 252:90. 1931.

Perennial, 1.3-4 dm tall; stems many, from a multiple caudex, 0.8-2.6 dm long, densely long white-hairy at the base, becoming setose and strigose upward; leaves narrowly oblanceolate to nearly linear, acute, 2-9 cm long, 0.3-0.8 cm wide, dorsal surface strigose and appressed setose with pustulate hairs, ventral surface almost uniformly strigose, and with the pustules less conspicuous; inflorescence narrow to somewhat open, 0.5-2.5 dm long, conspicuously yellow setose, the floral bracts inconspicuous; calyx segments linear, in anthesis 8-10 mm long, in fruit becoming 9-12 mm long, densely setose, with yellowish hairs, pedicels 3-5 mm long in fruit; corolla yellow, the tube 9-12 mm long, crests at base of tube absent or nearly so, fornicies yellow, truncate, emarginate, 1-1.5 mm long, limb 8-10 mm broad; style exceeding mature fruit 3-7 mm (heterostyled); nutlets lanceolate, 3.4-4 mm long, 1.9-2.2 mm wide, 1-2 usually maturing, margins acute, in contact when more than 1 nutlet matures, both surfaces of nutlet smooth and glossy, scar straight, closed, elevated margin lacking. Collections: 193 (xi); representative:

C. F. Baker 562 (ND-G); A. and R. Nelson 785 (ARIZ. ORE); W. A. Weber 3838 (ARIZ. COLO); W. P. Cottam 2050 (BRY); B. Maguire 18302 (UTC); L. C. Higgins 527, 998, 1057, 1073, 1082, 1105 (BRY).

Holotype: A. Nelson 3074, collected in Sweetwater County, Wyoming at Point of Rocks, 1 June 1897, RM.

Distribution: Southern Wyoming, south through western Colorado and eastern Utah to northern New Mexico and Arizona. Usually found growing in sandy soil, 4,000 to 7,500 feet. Map No. 7. April to August.

This yellow-flowered species is closely related to *C. confertiflora*, but may be separated from that species by the narrowly lanceolate nutlets and the longer thyrsoid inflorescence.

8. *Cryptantha capitata* (Eastw.) Johnst.

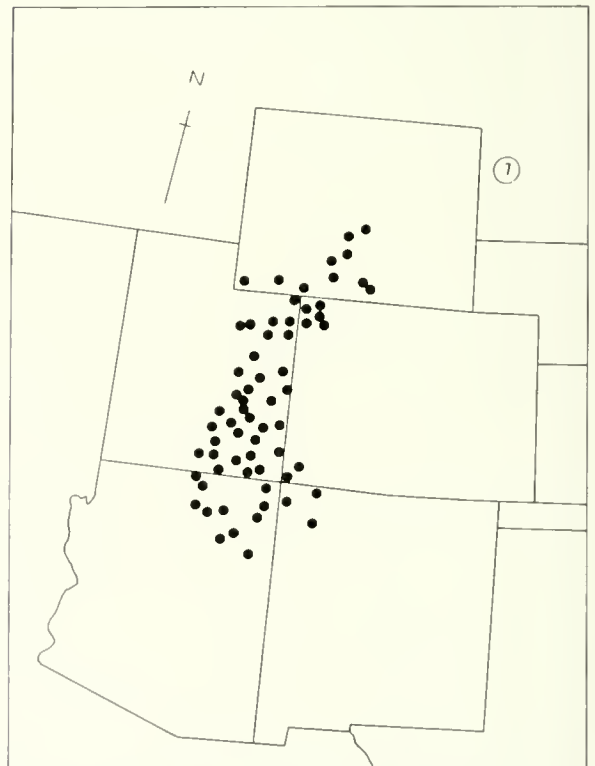
Cryptantha capitata (Eastw.) Johnst. Journ. Arn. Arb. 21:66. 1940.

Oreocarya capitata Eastw. Leaflets West. Bot. 1:9. 1937.

Perennial, 1.5-2.7 dm tall; stems weak, 1-several, 1.2-2.4 dm long, appressed setose; leaves linear, or very narrowly oblanceolate, 3-8 cm long, 0.3-0.5 cm wide, dorsal surface appressed setose-pustulate, ventral surface uniformly strigose and without pustules; inflorescence capitate, or with one or two glomerules below the terminal cluster, 0.1-0.4 dm long, spreading white-setose; calyx segments linear-lanceolate, 7-9



Map No. 6. Parts of western United States. Range of *C. confertiflora* (Greene) Payson



Map No. 7. Parts of western United States. Range of *C. flava* (A. Nels.) Payson.

mm long in anthesis, in fruit becoming 11-16 mm long, conspicuously setose-pustulate; corolla white, the tube 9-12 mm long, crests at base of tube conspicuous, fornices yellow, emarginate, about 1 mm long, papillose, limb 6-8 mm wide; style exceeding mature fruit 4-5 mm; nutlets lanceolate, 4-5 mm long, 2-3 mm wide, two to four usually maturing, the margins in contact, knifelike, both surfaces glossy-smooth, scar closed, straight, and without an elevated margin. Collections: 11 (0); representative: A. Eastwood and J. T. Howell 1005 (CAS, GH); A. Eastwood 5832, 5969 (CAS, GH); L. White s.n. (MNA); R. E. Collom kt26 (ASC); F. W. Pennell 21575 (ARIZ).

Lectotype: A. Eastwood 5969, collected in Cocino County, Arizona, from Hermit Trail on the south rim of the Grand Canyon, 9 April 1917, CAS. Photograph at BRY. Isolectotype at GH.

Distribution: Southcentral Utah, and northcentral Arizona in the Colorado River drainage basin. Growing in sandy soil, 6,500 to 8,500 feet. Map No. 8. April to July.

C. capitata is probably most closely related to *C. confertiflora*, but differs from that species in the more capitate inflorescence, the narrower leaves, white flowers, with crests at the base of the tube, and usually smaller size.

Two collections by Cronquist and N. Holmgren 9299 and 9365, appear to be the same species, but the leaves are broader. These two collections came from the Henry Mountains and Aquarius Plateau in Utah.

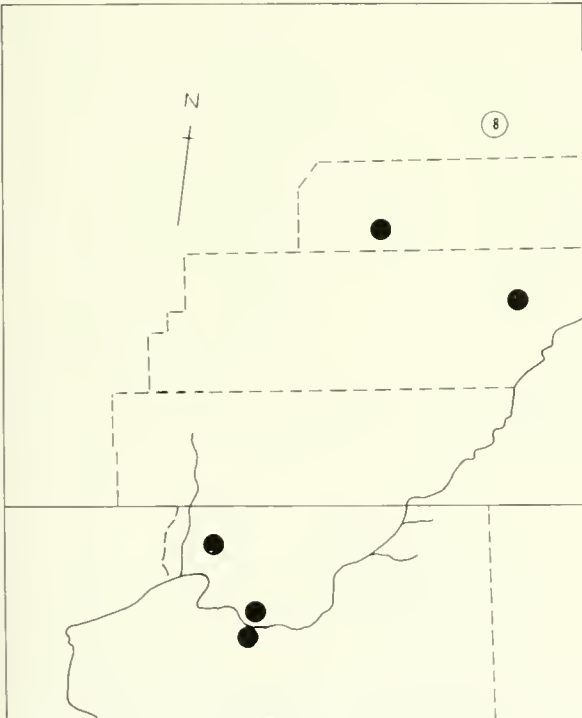
9. *Cryptantha johnstonii* Higgins

Cryptantha johnstonii Higgins, Great Basin Naturalist 28:195, 1968.

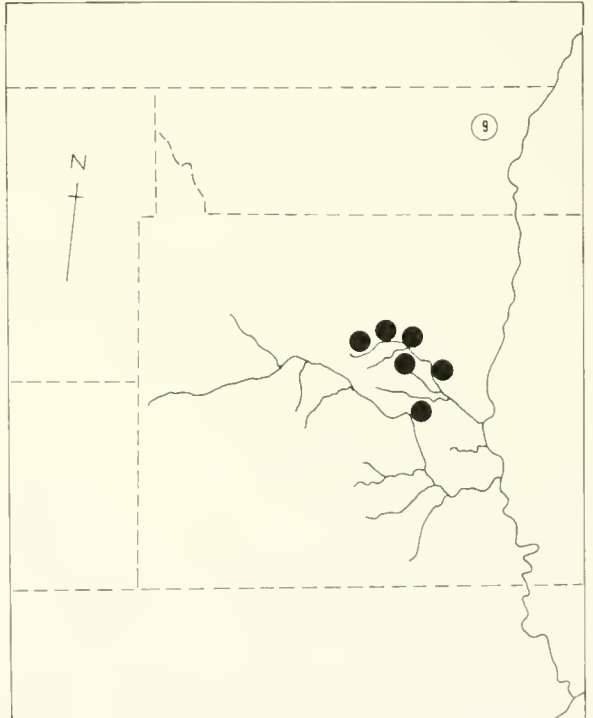
Caespitose perennial 1-2.5 dm tall; stems several, arising from the branched caudex, 0.6-1.3 dm long, very weakly strigose; leaves oblanceolate, the apices obtuse to acute, 2-6.5 cm long, 0.4-1 cm wide, dorsal surface strigose with conspicuous pustulate hairs; inflorescence somewhat open, 0.5-2 dm long; foliar bracts evident but not conspicuous, 1-2 cm long; calyx segments linear-lanceolate, in anthesis 5-6 mm long, in fruit becoming 8-10 mm long, strigose and spreading white setose; pedicels 0.5-1 mm long; corolla white, the tube 12-15 mm long, flaring in the throat, crests at base of tube lacking, fornices yellow, 1-1.5 mm long, emarginate, papillose, limb 13-17 mm broad; style exceeding mature fruit 3-8 mm (heterostyled); nutlets ovate, 3-3.5 mm long, 2.3-2.7 mm wide, usually all four maturing, the margins acute or knifelike, in contact, both surfaces smooth and glossy, scar straight, closed, elevated margin lacking. Collections: 5 (iii); representative: L. C. Higgins 1310 (BRY); B. F. Harrison 5628 (BRY).

Holotype: L. C. Higgins 1310, collected in Emery County, Utah, on low rolling hills about 15 miles west of hwy. 50-6 along the road from Woodside to Castle Dale, 25 May 1968, BRY. Isotypes at CAS, GH, NY, POM, RM, US, UTC.

Distribution: Known only from the type locality 15 miles west of hwy. 50-6 on the San Rafael Swell,



Map No. 8. Southern Utah and northern Arizona. Range of *C. capitata* (Lastw.) Johnston.



Map No. 9. Emery County, Utah. Range of *C. johnstonii* Higgins.

Emery County, Utah. Growing on clayey to sandy soils, 5,000 to 5,500 feet. Map No. 9. May and June.

Cryptantha johnstonii is most closely related to *C. confertiflora* known from western Utah, northern Arizona, Nevada, and southwestern California. It can be distinguished from that species by its smaller size, longer and more open inflorescence, white flower color, larger corolla with longer fornicies and no basal crest.

10. *Cryptantha semiglabra* Barneby

Cryptantha semiglabra Barneby, Leaflets West. Bot. 3:197, 1943.

Erect perennials, 2-3 dm tall; stems 1-several, 0.9-1.8 dm long, retrorsely strigose and weakly spreading setose; leaves oblanceolate, acute, 3-7 cm long, 0.3-0.6 cm wide, dorsal surface appressed setose-pustulate, ventral surface glabrous, the old leaf bases long white-hairy; inflorescence narrow, or somewhat open, 0.4-1.3 dm long, foliar bracts slightly surpassing the cymes, 1.5-2 cm long; calyx segments lanceolate, in anthesis 5-8 mm long, in fruit becoming 10-13 mm long, setose; pedicels 1-2 mm long; corolla white, the tube 10-12 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, 1-1.2 mm long, obscurely papillose, limb 8-10 mm wide; style surpassing the mature fruit 5-7 mm; nutlets ovate, 3.5-4 mm long, 2-2.5 mm wide, usually all four maturing, margins acute, in contact, both surfaces smooth and glossy, scar closed, elevated margin lacking. Collections: 5 (ii); representative: J. W. Harrison s.n. (DIX); H. D. Ripley and R. C. Barneby 8519 (UTC); D. Atwood 1525 (BRY); L. C. Higgins 1357, 1364 (BRY).

Lectotype: Ripley and Barneby 8429, collected in Coconino County, Arizona, on detrital clay hills about 2 miles east of Fredonia, 4,900 feet, 5 June 1942, CAS.

Distribution: Apparently confined to near the type locality and north just across the state line into Washington and perhaps Kane County, Utah. Growing in clay soils, 4,500 to 5,000 feet. Map No. 10. Early May to July.

Cryptantha semiglabra is closely related to *C. capitata* and *C. confertiflora*. From the former it differs in several important aspects, the most immediate difference being the distribution of pubescence. The upper part of the caudex branches are densely clothed with long white hairs, the lower surface of the leaves are beset with stout appressed setose hairs with pustular bases, while the upper surface is glabrous. The inflorescence of a long narrow thyrsus also distinguishes it from *C. capitata*. From the latter it may be distinguished by the white flowers, the glabrous ventral surface of the leaves, crests at the base of the corolla tube, and the longer foliar bracts.

11. *Cryptantha barnebyi* Johnst.

Cryptantha barnebyi Johnst. Journ. Arn. Arb. 29:240, 1948.

Perennial, 1.5-3.5 dm tall; stems stout, erect, several, 0.8-1.2 dm long, conspicuously yellowish hispid; leaves oblanceolate, thick, acute, 5-9 cm long, 0.5-1.4 cm wide, coarsely appressed hispid pustulate on both surfaces, and with some finer hairs beneath, the petioles conspicuously ciliate; inflorescence narrow, 1-1.5 dm long, densely yellowish hispid, foliar bracts evident to conspicuous; calyx segments lanceolate, in anthesis 5-7 mm long, in fruit becoming 8-13 mm long, yellowish hirsute; corolla white or light yellow, the tube 5-7 mm long, crests at base of tube very conspicuous, fornicies yellow, emarginate, distinctly papillose, 0.5 mm long, limb 8-11 mm wide; style exceeding mature fruit 5-6 mm; nutlets ovate, 3.5-4 mm long, 2.5-3 mm wide, all four maturing, margins of nutlets in contact, acute, smooth and glossy on both surfaces, scar closed, straight, and without an elevated margin. Collections: 10 (viii); representative: Ripley and Barneby 8748 (GH); D. Atwood 1562 (BRY); L. C. Higgins 1584, 1587, 1599, 1601 (BRY).

Holotype: Ripley and Barneby 8748, collected in Uintah County, Utah, 30 miles south of Ouray on white shale knolls, 5,500 feet, 17 June 1947, GH. Photograph at BRY.

Distribution: Confined to the lower part of the Uintah Basin, Uintah County, Utah. Growing on white barren shale knolls, 5,000 to 6,000 feet. Map No. 11. May to June.

This endemic species is confined to white shaley knolls, and is the only conspicuous plant on them. In the western part of its range it is found growing with *C. grahamii*, but still limited to white shale.

In the original description of this species the corolla was described as being long tubed and protruding beyond the sepals. In observing this plant in the field the corollas do not exceed the calyx, or if they do, it is by less than 1 mm.

C. barnebyi is a very distinctive species, and is probably most closely related to *C. confertiflora* or *C. johnstonii*, but may be distinguished from both of them by the thick stout stems, campanulate corolla, harsher hispid pubescence, and the more woody caudex.

12. *Cryptantha leucophaea* (Dougl.) Payson

Cryptantha leucophaea (Dougl.) Payson, Ann. Mo. Bot. Gard. 14:262, 1927.

Myosotis leucophaea Dougl. in Lehmann, Pug. 2:22, 1830.

Fritrichium leucophaeum (Dougl.) A. DC. Prod. 10:129, 1846.

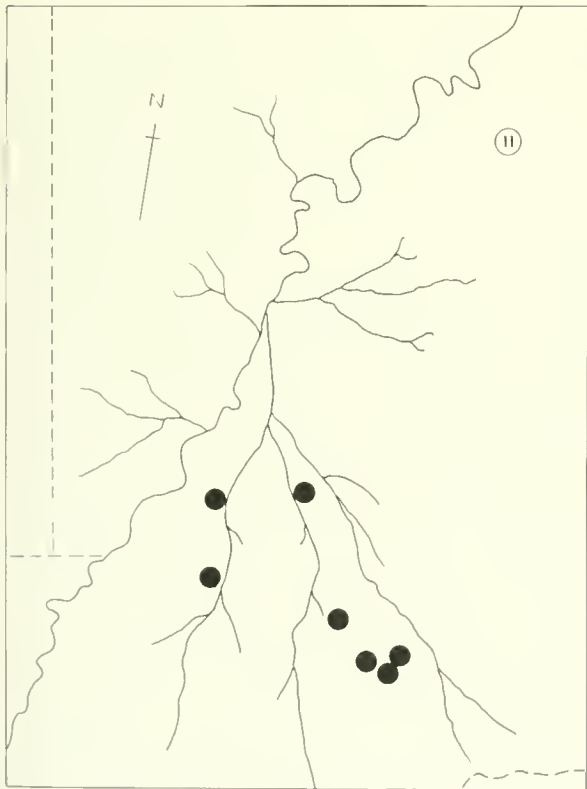
Krynitzkia leucophaea (Dougl.) Gray, Proc. Am. Acad. 20:280, 1885.

Oreocarya leucophaea (Dougl.) Greene, Pitt. 1:58, 1887.

Long-lived perennials, 1.5-3.7 dm tall; stems



Map No. 10. Southern Utah and northern Arizona. Range of *C. semiglabra* Barneby.



Map No. 11. Uintah County, Utah. Range of *C. barnebyi* Johnston.

slender, 1-several from a multiple caudex, 1.2-2.3 dm long, strigose, and appressed setose, leaves linear to narrowly oblanceolate, acute, 3-9 cm long, 0.4-0.7 cm wide, dorsal surface densely strigose, and with appressed setose hairs, pustulate, ventral surface uniformly strigose and with few or no pustulate hairs, petioles white-ciliate; inflorescence narrow, 0.8-1.7 dm long, conspicuously white setose, foliar bracts evident but not conspicuous; calyx segments linear, in anthesis 6-8 mm long, in fruit becoming 10-15 mm long, setose; corolla white, the tube 8-10 mm long, crests at base of tube evident, fornices yellow, emarginate, 0.5-1 mm long, limb 8-10 mm wide; style exceeding mature fruit 2-8 mm (heterostyled); nutlets ovate, 3.5-4.5 mm long, 2.5-3 mm wide, usually less than four maturing, margins acute, in contact, both surfaces smooth and glossy, scar straight, closed, elevated margin lacking. Collections: 16 (0); representative: J. H. Sandberg and J. B. Leiber 373 (RM, US); J. W. Thompson 11453 (US, WTU); T. S. Brandegee 997 (US); L. Hitchcock 20952 (RM); A. Elmer 1056 (US); J. S. Cotton 1027 (US).

Type: Douglas s.n., collected in Washington State, on arid barrens of the Columbia River. Not seen.

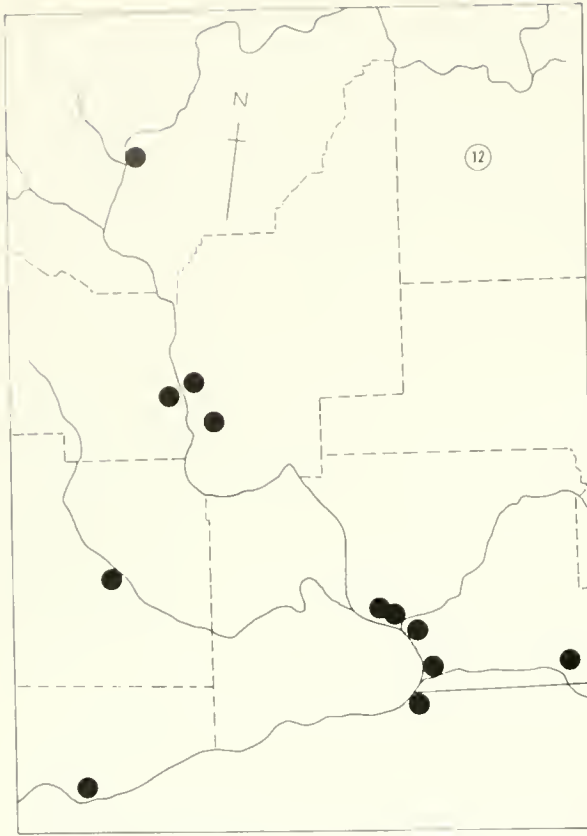
Distribution: Upper Sonoran Zone in south-central Washington along the Columbia River and its northern and southern tributaries. Growing in sandy soil. Map No. 12. Late April to early July.

This species of south-central Washington is most closely related to *C. confertiflora*, but differs from this species by the white corolla, the open and more elongated inflorescence, and the evident crests at the base of the corolla tube.

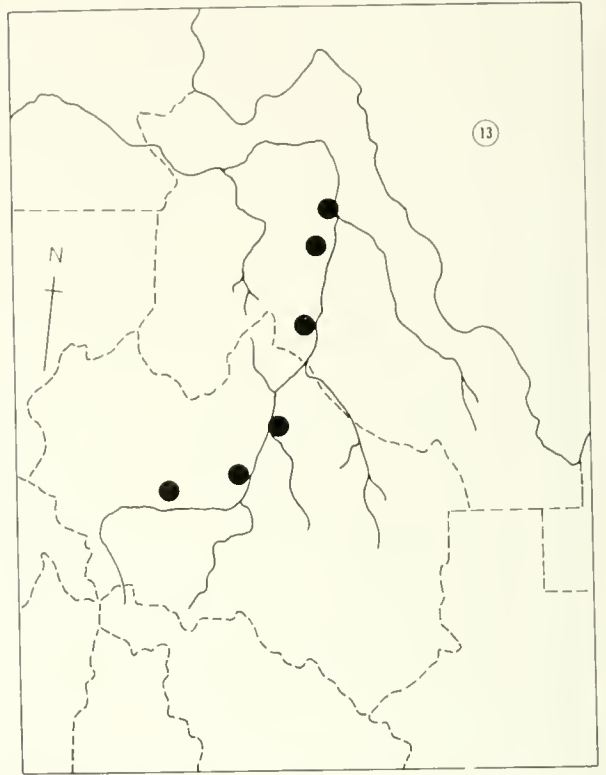
13. *Cryptantha salmonensis* (Nels. & Macbr.) Payson

Cryptantha salmonensis (Nels. & Macbr.) Payson, Ann. Mo. Bot. Gard. 14:263, 1927.
Orcocarya salmonensis Nels. & Macbr. Bot. Gaz. 61:43, 1916.

Moderately caespitose perennials, 1.5-3.5 dm tall; stems erect, 0.7-1.5 dm long, strigose, and with some white spreading setose hairs; leaves oblanceolate to spatulate, 2-9 cm long, 0.5-1.5 cm wide, strigose and spreading setose, also somewhat tomentose, pustulate on both of the surfaces; inflorescence narrow, 1-1.8 dm long, foliar bracts evident but not conspicuous; calyx segments lanceolate, 3-4 mm long in anthesis, in fruit becoming 6-8 mm long, setose; corolla white, the tube 3-4 mm long, fornices yellow, rounded, papillose, crests at base of tube well developed, limb 7-10 mm wide; nutlets lanceolate, 3-4 mm long, 1.5-2 mm wide, all four usually maturing, acute or narrowly winged-margined, the margins in contact, smooth and glossy on both surfaces, scar straight, closed, and without an elevated margin. Collections: 10 (v); representative: Macbride and Payson 3348 (RM); Hitchcock and Muhlick 8950 (UTC); A. Cronquist 3812 (UTC); F. B. Payson 1880 (RM); L.



Map No. 12. Central and southern Washington. Range of *C. leucophaea* (Dougl.) Payson.



Map No. 13. Central Idaho. Range of *C. salmonensis* (Nels. & Macbr.) Payson.

C. Higgins 1710, 1711, 1713, 1714, 1715 (BRY).

Holotype: Kirtley s.n., collected in Lemhi County, Idaho, at Salmon, June 1896, RM. Photograph at BRY.

Distribution: Along the Salmon River in Lemhi and Custer Counties, Idaho. Growing on loose talus slopes of volcanic origin, 4,500 to 7,500 feet. Map No. 13. June to August.

Cryptantha salmonensis is apparently confined to the Salmon River drainage of south-central Idaho. It is perhaps most closely related to *C. leucophaea*, but differs from that taxon by the short corollas, more lanceolate nutlets, shorter style, and shorter inflorescence.

14. *Cryptantha stricta* (Osterl.) Payson

Cryptantha stricta (Osterl.) Payson, Ann. Mo. Bot. Gard. 14:264, 1927.

Oreocarya stricta Osterl. Bull. Torrey Bot. Club 50:217, 1923.

Strict perennial, 1-3.7 dm tall; stems 1-several, 0.4-2 dm long, strigose and conspicuously setose-hirsute; leaves mostly basal, oblanceolate to spatulate, acute, 2-7 cm long, 0.4-0.9 cm wide, retrorsely strigose and spreading setose-hirsute, pustulate; inflorescence narrow, interrupted below the terminal

cluster, 0.5-2 dm long, setose-hirsute, floral bracts inconspicuous; calyx segments lanceolate, 4-6 mm long in anthesis, in fruit becoming 7-9 mm long, setose-hirsute; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, papillose, limb 7-10 mm wide; style exceeding mature fruit 1-1.5 mm; nutlets lanceolate to elliptic, 3-3.5 mm long, 1.5-2 mm wide, usually all four maturing, margins in contact, knifelike, dorsal surface with definite transverse ridges, also somewhat tuberculate, ventral surface smooth or nearly so, scar open, very narrowly linear, elevated margin lacking. Collections: 17 (iii); representative: E. H. Graham 8163 (GH); L. Williams 489 (GH); R. C. Barneby 9145 (GH); Welsh and Moore 6714 (BRY); W. J. MacLeod 10a (COLO. CS); G. E. Osterhout 6391 (RM); L. C. Higgins 1869, 1874 (BRY, TTC, WTSU).

Holotype: G. E. Osterhout 6195, collected in Moffat County, Colorado, some distance south of the Yampa or Bear River along the Victory hwy., 21 June 1922, GH. Photograph at BRY. Isotype at RM.

Distribution: Southwestern Wyoming in Carbon County, south into Moffat County, Colorado, and west to Utah in Uintah, Daggett, and Summit Counties. Growing on clay soils, 5,000 to 8,500 feet. Map No. 14. June to September.

Cryptantha stricta is an endemic species, confined to the three corners area of Colorado, Wyoming, and

Utah. In general appearance it somewhat resembles *C. celosiooides*, but is probably not very closely related to that plant. It may be distinguished from other species in the Uintah Basin by the strict stems with harsh setose hairs, the nutlets which are smooth on the ventral surface, and the conspicuous transverse ridges on the dorsal surface.

15. *Cryptantha nubigena* (Greene) Payson

Cryptantha nubigena (Greene) Payson, Ann. Mo. Bot. Gard. 14:265. 1927.

Oreocarya nubigena Greene, Pitt. 3:112. 1896.

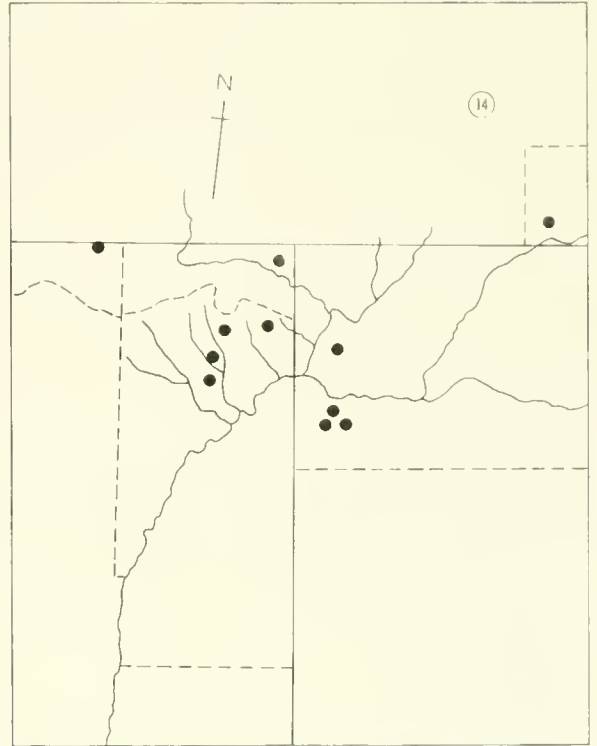
Cryptantha clemensae Payson, Ann. Mo. Bot. Gard. 14:267. 1927. (Type: Glenn's Pass, California, Mrs. Joseph Clemens, 22 July 1910, RM.)

Short-lived perennials, 0.8-2.5 dm tall; stems several from a slender taproot, 0.4-1 dm long, setose; leaves narrowly oblanceolate, flaccid, obtuse to acute, 2.5 cm long, 0.3-0.7 cm wide, strigose and spreading setose, dorsal surface pustulate, ventral surface with few or no pustules; inflorescence narrow, cylindrical or nearly capitate, 0.4-2 dm long, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 2.5-3 mm long, in fruit becoming 4-6 mm long, setose; corolla white, the tube 2-2.5 mm long, crests at base of tube evident, fornicies light-yellow to nearly white, rounded, about 0.5 mm long, slightly papillose, limb 3.5-5 mm wide; style exceeding mature fruit 0.5-1 mm; nutlets narrowly lanceolate, papery, 2.8-3.2 mm long, 1.3-1.5 mm wide, margin narrowly winged, in contact, dorsal surface weakly tuberculate to nearly smooth, ventral surface smooth, scar open, narrowly linear, margin of scar not elevated. Collections: 32 (0); representative: Chestnut and Drew s.n. (ND-G); G. T. Robbins 3399 (RM, WTU); P. A. Munz 12547 (POM, WTU); J. T. Howell 25933 (POM, UTC); F. W. Pierson 14030 (POM); Alexander and Kellogg 4552 (UTC).

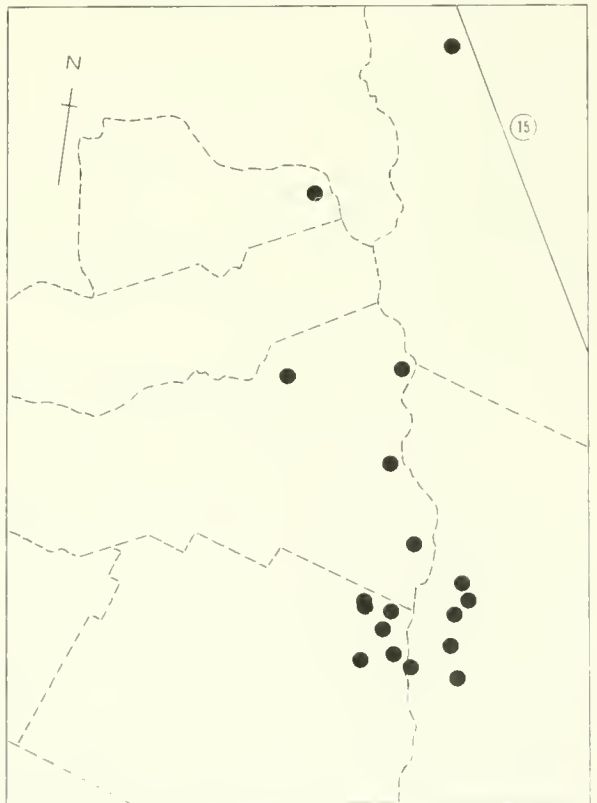
Lectotype: Chestnut & Drew s.n., collected in Mariposa County, California, on Clouds Rest, Yosemite Natl. Park, 10 July 1889, ND-G. Photograph at BRY. Isolectotype at CALIF.

Distribution: East-central California in Inyo, Tulare, Fresno, Mono, and Mariposa Counties. Growing in gravelly soil or talus slopes of volcanic origin, 9,000 to 13,000 feet. Map No. 15. July to September.

This species is endemic to the high Sierras, chiefly between 9,000 and 12,500 feet. The specimens of this species available to past monographers has been very poor and scanty. Payson saw a poor isotype of the species and mistakenly identified it with some plants of Oregon and Idaho. The reasonably good specimens of this plant from the southern Sierras Payson described as a new species *C. clemensae*. This latter name however falls in synonymy of *C. nubigena* and the plants of Oregon and Idaho mistakenly called *nubigena* were described as new (Johnston 1939)



Map No. 14. Northeastern Utah and adjoining Colorado and Wyoming. Range of *C. stricta* (Osterhout) Payson.



Map No. 15. Parts of east-central California. Range of *C. nubigena* (Greene) Payson.

The Oregon plant is now known as *C. subretusa*, and the Idaho plant as *C. hypsophila*. *C. nubigena* may be separated from the latter two by being a weaker, more slender, more bristly plant with less firm, green, basal leaves, much smaller, smoother nutlets, and a more interrupted inflorescence with a capitate terminal cluster, and scattered smaller lateral ones below.

16. *Cryptantha subretusa* Johnst.

Cryptantha subretusa Johnst. Journ. Arn. Arb. 20:393, 1939.

Cryptantha andina Johnst. ex M. L. Peck, Man. Pl. Ore. 601, 1941. (Without latin diagnosis or type.)

Oreocarya subretusa (Johnst.) Abrams, Ill. Fl. Pac. St. 3:599, 1951.

Caespitose perennial, 1-2 dm tall; stems several, 0.5-1.5 dm long, setose; leaves spatulate, subretuse or obtuse at apex, congested at the base, reduced upward, 1-4 cm long, 0.4-1 cm wide, tomentose and weakly setose, pustules conspicuous on the dorsal surface, fewer and less evident on the ventral surface; inflorescence compact, cylindric, 0.2-1 dm long, spreading setose, floral bracts inconspicuous; calyx segments lanceolate, 3-4 mm long in anthesis, in fruit becoming 6-9 mm long, setose and subtomentose; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, papillose, about 0.5 mm long, limb 4-6 mm wide; style exceeding mature fruit 0.5-1 mm; nutlets lanceolate, 3-4 mm long, 2-2.5 mm wide, 2-4 maturing, the margins in contact, knifelike or narrowly winged, dorsal surface inconspicuously tuberculate, and with low short ridges, ventral surface similar, but the markings much less evident, or smooth, scar open, subulate or narrowly linear, and without an elevated margin. Collections: 25 (0); representative: J. W. Thompson 12206 (GH, POM, WTU); R. L. Rogers 87 (ORF); W. H. Baker 6282 (WTU); W. C. Cusick 2028 (ND-G), (RM); C. G. Hansen 534 (GH, ORF); G. Mason 7502 (ORF); M. L. Peck 19480 (GH).

Holotype: J. W. Thompson 12206, collected in Klamath County, Oregon, on pumice rim of Crater Lake, 7,000 feet, 20 July 1935, GH. Photograph at BRY. Isotypes at POM, WTU.

Distribution: Northeastern Oregon in Wallowa County, south to Harney County and to Humboldt County, Nevada, West to northern California and north into Klamath County, Oregon. Growing on pumice or talus slopes of volcanic origin, 6,500 to 10,000 feet. Map, No. 16, June to August.

Generally *C. subretusa* may be distinguished from the other plants of Oregon by its elongate nutlets, tomentulose, thickish, obtuse, truncate or subretuse basal leaves, and the small corollas.

The account of *C. nubigena* in Payson's monograph applies almost entirely to this species. His description, as well as the nutlets belong to *C. subretusa*.

17. *Cryptantha hypsophila* Johnst.

Cryptantha hypsophila Johnst. Journ. Arn. Arb. 20:395, 1939.

Caespitose perennials, 1-2 dm tall; stems several, 0.5-1.4 dm long, setose-hispid; leaves oblanceolate-spatulate, obtuse, 2-6 cm long, 0.3-0.7 cm wide, strigose and spreading setose, dorsal surface evidently pustulate, ventral surface with fewer pustulae; inflorescence narrow, 0.2-0.7 dm long, foliar bracts inconspicuous; calyx segments lanceolate, 3-4 mm long in anthesis, in fruit becoming 5-7 mm long, setose-hirsute, corolla white, the tube 3-4 mm long, crests at base of tube well developed, fornicies yellow, rounded, limb 4-5 mm wide; style exceeding mature fruit 1.2-1.5 mm; nutlets oblong-lanceolate, 3-3.7 mm long, 1.5-1.8 mm wide, margins acute, in contact, dorsal surface tuberculate or some of these connected to form short low ridges, ventral surface smooth or nearly so, scar narrowly linear, the margin not elevated. Collections: 11 (0); representative: J. W. Thompson 14129 (GH, WTU); A. Cronquist 2894 (GH, IDS); C. L. Hitchcock and C. V. Muhllick 10676 (WTU); Macbride and Payson 3771 (POM).

Holotype: J. W. Thompson 14129, collected in Blaine County, Idaho, on crest of high barren ridge at head of Boulder Creek, Sawtooth Mountains, 11,000 feet, 6 August 1937, GH. Photograph at BRY. Isotype at WTU.

Distribution: Endemic to central Idaho in Blaine and Custer Counties. Growing on talus slopes and soils of volcanic origin, 8,000 to 11,500 feet. Map No. 17, July and August.

Payson identified this plant as part of *C. nubigena*. Its affinities, however, are not with that plant but with *C. subretusa* of Oregon. The Idaho plant can be distinguished by its spreading bristly hairs, narrower nutlets, and narrower less firm leaves that are obtuse or acute at the apex.

This species may also be confused with *C. spiculifera*, but differs in being a smaller and more caespitose plant, with more elongate nutlets, and shorter basal leaves. It is also separated from this plant in elevation and flowering time.

18. *Cryptantha crymophila* Johnst.

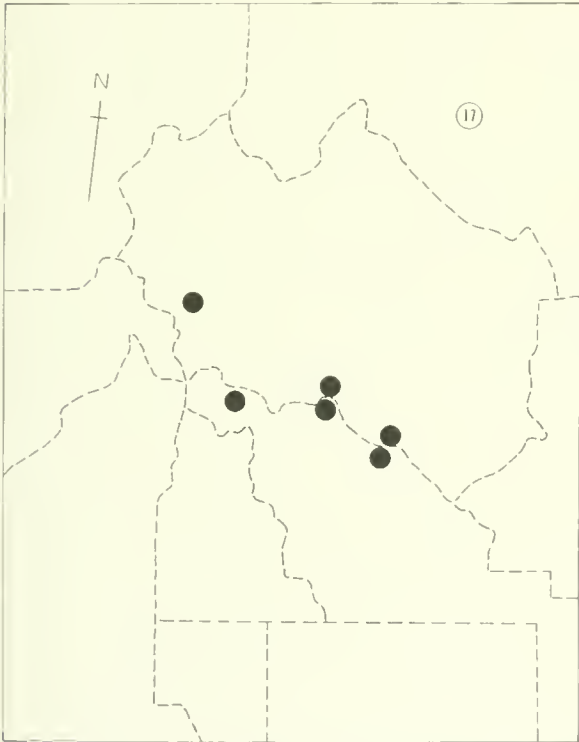
Cryptantha crymophila Johnst. Journ. Arn. Arb. 21:65, 1940.

Oreocarya crymophila (Johnst.) Jeps. & Hoover, in Jepson Fl. Calif. 3:328, 1943.

Perennial, 1.5-3 dm tall; stems 1-several, 0.9-1.3 dm long, erect, hirsute; leaves oblanceolate, 4-10 cm long, 0.5-1.3 cm wide, finely setose and appressed hirsute, the dorsal setae pustulate at base, the ventral with fewer pustules; inflorescence narrow, 1.9-2.3 dm long, setose; calyx segments lanceolate, 4-5 mm long in anthesis, in fruit becoming 10-14 mm long, hirsute; corolla white, the tube 3-5 mm long, crests at base of



Map No. 16. Western United States. Range of *C. subretusa* Johnston.



Map No. 17. Central Idaho, Blaine and Custer Counties. Range of *C. hypsophila* Johnston.

tube evident, fornicies yellow, rounded, papillose, 0.5 mm long, limb 4.7 mm wide; style exceeding mature fruit 1-2 mm; nutlets ovoid, usually four maturing, 5-6 mm long, 3-3.5 mm wide, the margins in contact, winged, dorsal surface with low ridges, also inconspicuously muricate, to nearly smooth, ventral surface smooth, scar open, linear, and without an elevated margin. Collections: 4(ii); representative: R. F. Hoover 4193 (GH); C. B. Hardham 6510 (POM); L. C. Higgins 1766, 1767 (BRY).

Holotype: R. F. Hoover 4193, collected in Alpine County, California, on Red Peak, 28 July 1939. GH. Photograph at BRY.

Distribution: Alpine ridges between the Clark Fork and the Middle Fork of the Stanislaus River in Alpine and Tuolumne Counties, California. Growing in loose rocks of volcanic origin, 9,000 to 10,000 feet. Map No. 18. Late June to September.

C. crymophila is probably closely related to *C. nubigena* of the southern Sierras. However, it differs from *C. nubigena* by being much taller and more robust, with longer leaves, much larger fruiting calyces, and the larger more rugose nutlets which are definitely winged-margined.

19. *Cryptantha setosissima* (Gray) Payson

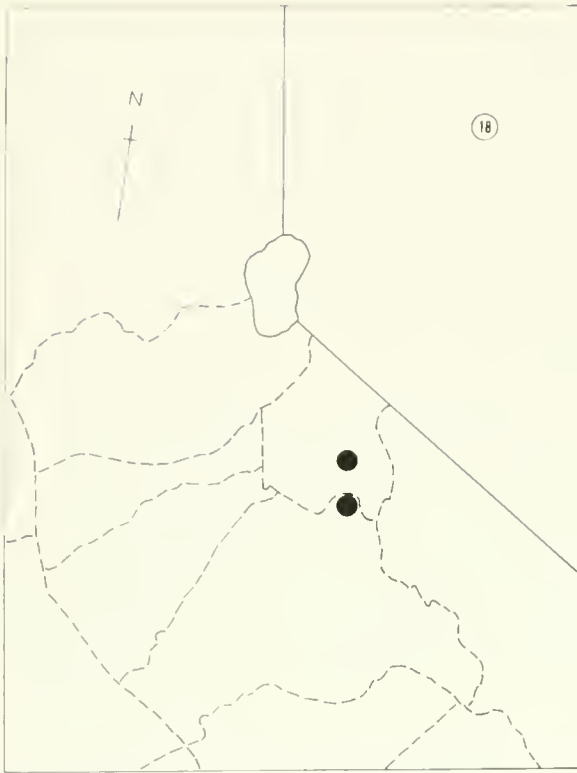
Cryptantha setosissima (Gray) Payson, Ann. Mo. Bot. Gard. 14:268. 1927.

Eritrichium setosissima Gray, Proc. Am. Acad. 12:80. 1877.

Krynitzkia setosissima (Gray) Gray, Proc. Am. Acad. 20:276. 1885.

Oreocarya setosissima (Gray) Greene, Pitt. 1:58. 1887.

Biennial or short-lived perennials, 3-10 dm tall, stems usually 1-3 erect, 1.5-5 dm long, hirsute; leaves clustered at the base, reduced upward, oblanceolate, the apices obtuse to acute, 3-13 cm long, 0.5-1.5 cm wide, setose, with some finer twisted pubescence beneath, pustulate hairs numerous on both surfaces; inflorescence broad-topped due to the elongation of the scorpioid racemes, 1-5 dm long; calyx segments broadly lanceolate, 4-6 mm long in anthesis, in fruit becoming 9-11 mm long, setose, and strigose; corolla white, the tube 3-5 mm long, constricted above the ovary by the conspicuous ring of crests, fornicies yellow, emarginate, 0.5 mm long, limb 7-9 mm wide; style exceeding mature fruit 1-2 mm; nutlets ovate, 5-6 mm long, 3.5-4.5 mm wide, papery, with a broad-winged margin, dorsal surface muricate, and inconspicuously rugose or tuberculate, ventral surface smooth or nearly so, scar straight, narrow, slightly open, elevated margin lacking. Collections: 58 (viii); representative: Maguire and Holmgren 25583 (BRY, ORE, RM, UTC); L. F. Ward 646 (UC); R. H. Peebles 12566 (ARIZ); D. T. MacDougal 165 (ARIZ, RM); C. F. Deaver 6306 (ASC); W. D. Stanton 516 (UT); E. Palmer 591 (US); L. C. Higgins 1125, 1117, 1440, 1775, 1795 (BRY).



Map No. 18. Fast central California, Alpine and Tuolumne Counties, and adjoining Nevada. Range of *C. crymophila* Johnston

Holotype: L. F. Ward 646, collected in Sevier County, Utah, at Fish Lake, 25 August 1875, GH. Photograph at BRY. Isotypes at UC, MO, PH, US.

Distribution: Central Utah, south through most of Arizona in the mountainous areas, west to Nye County, Nevada. Growing in gravelly to sandy soils, 7,000 to 10,000 ft. Map No. 19. June to September.

This is one of the most distinctive species in the entire genus. It may be separated from all other species by the stout, strict, solitary stems, and the broadly winged ovate nutlets.

20. *Cryptantha virgata* (Porter) Payson

Cryptantha virgata (Porter) Payson, Ann. Mo. Bot. Gard. 14: 270. 1927.

Fritrichium virgatum Porter, Hayden Rept. 479. 1870.

Fritrichium glomeratum var. *virgatum* Porter, in Porter & Coulter, Syn. 11 Colo. 102. 1874.

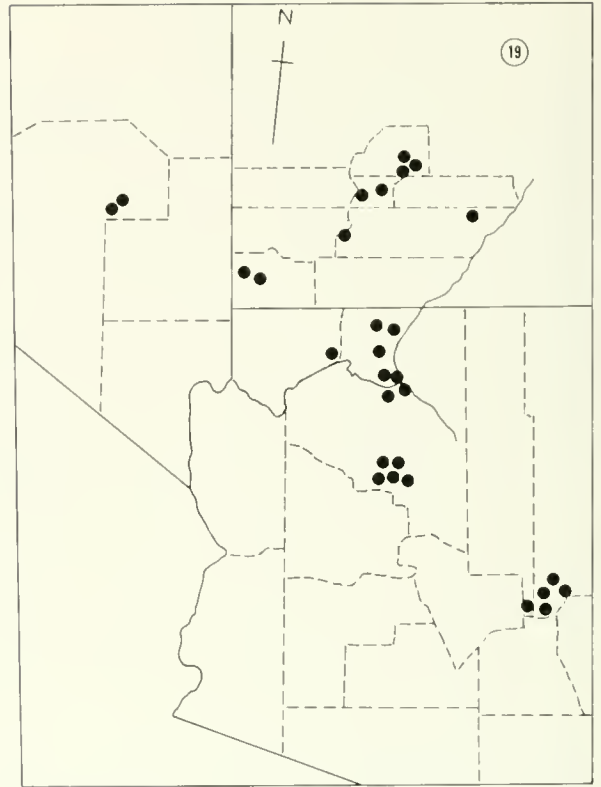
Krynitzkia virgata (Porter) Gray, Proc. Am. Acad. 20: 279. 1885.

Oreocarya virgata (Porter) Greene, Pitt. 1: 58. 1887.

Oreocarya spicata Rydb. Bull. Torrey Bot. Club 36: 678. 1909. (Type: Artists Glen, Pikes Peak, Colorado, 1 August 1901, Clements 102 f.)

Oreocarya virgata forma *spicata* (Rydb.) Macbr. Proc. Am. Acad. 51: 546. 1916.

Strict biennial, arising from a stout taproot, 2.5-8 (10) dm tall, stems usually solitary, but sometimes several from the base, stout, 0.5-2 dm long, setose or



Map No. 19. Utah, Arizona, and southeastern Nevada. Range of *C. setosissima* (Gray) Payson.

hirsute-hispid; leaves narrowly oblanceolate, obtuse, 3-20 cm long, 0.4-1.5 cm wide, setose-hirsute, with pustulate hairs on both surfaces; inflorescence cylindrical, 1.5-7 (9) dm long, with conspicuous, linear-oblanceolate foliar bracts that much exceed the cymules; calyx segments lanceolate, in anthesis 3.5-4 mm long, in fruit becoming 10-12 mm long, hirsute; corolla white, the tube 3.5-4 mm long, crests at base of tube very conspicuous, fornicies yellow, emarginate, papillose, about 0.5 mm long, limb 8-11 mm wide; style surpassing the mature fruit 1.6-2 mm; nutlets ovate, 2.7-3.5 mm long, 2.4-3 mm wide, usually all four maturing, the margins in contact, acute, dorsal surface usually with conspicuous low ridges, and a few tubercles, or sometimes nearly smooth, ventral surface smooth or with a few indistinct tubercles, scar narrowly open, linear, and without an elevated margin. Collections: 62 (vi); representative: B. Maguire 16292 (UTC); A. Nelson 1937 (ND-G, RM); G. T. Robbins 3358 (ARIZ); E. B. Payson 4253 (RM); J. Ewan 14947 (COLO); A. Nelson 1267 (UC, RM); L. C. Higgins 1491, 1501, 1543 (BRY).

Type: B. H. Smith s.n., collected near Denver, Colorado, Colorado Territory, 1869. Not seen.

Distribution: Southeastern Wyoming, south through central Colorado, on foothills on the eastern side of the Rocky Mountains. Growing on gravelly soils, 5,000 to 9,500 feet. Map No. 20. Early May to

September.

C. virgata is one of the most conspicuous herbaceous plants on the eastern foothills of the Rocky Mountains. The stems of this plant are usually solitary, with long leafy foliar bracts that greatly exceed the individual cymules. For a few years this plant was treated as a variety of *C. celosoides*, but there is no reason to believe that it is even remotely related to that species.

Rydberg described *Oreocarya spicata* as a new species on the basis of the smooth nutlets. Later it was transferred as a form of *O. virgata*. Macbride contended that *O. spicata* was not deserving, even of varietal rank. In observing specimens from the type locality about Pikes Peak, it is even more evident that *spicata* is only a form of *virgata*.

21. *Cryptantha tumulosa* (Payson) Payson

Cryptantha tumulosa (Payson) Payson, Ann. Mo. Bot. Gard. 14:276. 1927.

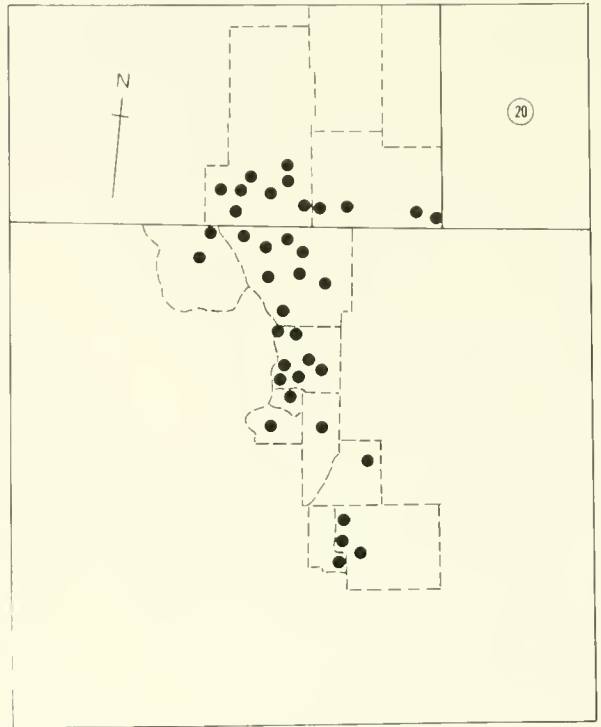
Oreocarya tumulosa Payson, Univ. Wyo. Publ. Bot. 1:164. 1926.

Long-lived perennials, 0.8-2.9 dm tall; stems 1-several from a woody taproot, 0.4-1.4 dm long, spreading setose; leaves oblanceolate, obtuse, 3-6 cm long, 0.4-0.9 cm wide, strigose, setose and tomentose, pustulate on both surfaces, but more conspicuous on the dorsal side; inflorescence narrow, cylindric, uninterrupted, 0.4-2 dm long, floral bracts not evident; calyx segments linear-lanceolate, 4-5 mm long in anthesis, in fruit becoming 7-10 mm long, yellowish setose; corolla white, the tube 3.5-4.5 mm long, crests at base of tube evident, fornicies yellow, acute, papillose, 0.5-1 mm long, limb 6-8 mm wide; style exceeding mature fruit 0.5-1 mm; nutlets ovate, 3-4 mm long, 2.5-3 mm wide, one to three usually maturing, the margins in contact when more than one matures, acute, dorsal surface with a low inconspicuous crest, tuberculate, and with some low ridges, ventral surface similar, sear open, triangular, margin of sear slightly elevated. Collections: 40 (0); representative: I. W. Clokey 7667 (ARIZ, UC, LL, ORE, RM, UTC); T. S. Brandegee s.n. (UC); P. A. Munz 14787 (BRY, GH); R. S. Ferris 11265 (RM); E. K. Ball 19346 (POM); Alexander and Kellogg 1463 (UC).

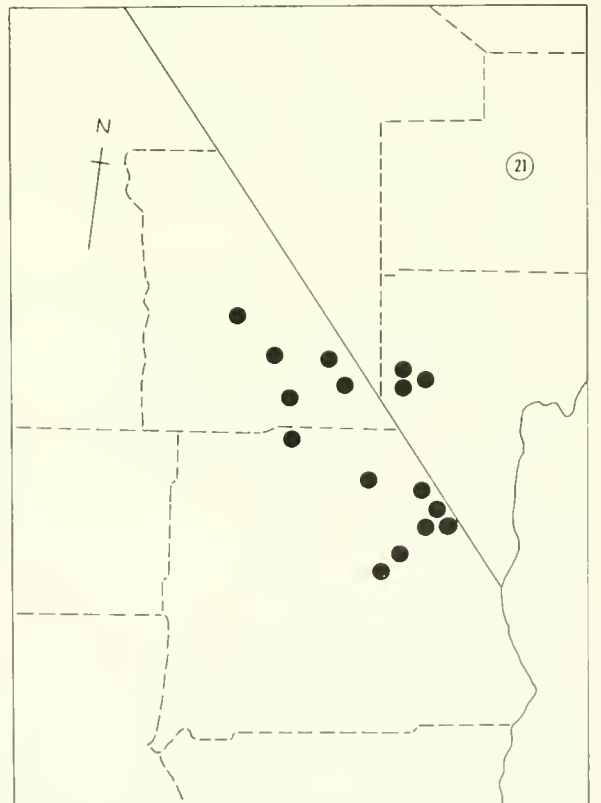
Holotype: T. S. Brandegee s.n., collected in San Bernardino County, California, on the Providence Mountains, May 1902, UC. Photograph at BRY.

Distribution: Clark County, Nevada, in the Charleston Mountains, southwest to the Providence Mountains, California, north to Inyo County. Growing on gravelly to clayey soils, 5,000 to 10,200 feet. Map No. 21. March to July.

This species has been confused in the past with *C. humilis* and *C. nubigena*. The nutlets are quite different from either of those species. Its nearest relatives are probably *C. virginensis*, *C. insolita* and *C.*



Map No. 20. Southeastern Wyoming and central Colorado. Range of *C. virgata* (Porter) Payson.



Map No. 21. Southern Nevada and adjoining California. Range of *C. tumulosa* (Payson) Payson.

abata From *C. abata* it differs in the lack of a conspicuous elevated margin around the scar and by the indefinite roughenings on the dorsal surface. It differs from *C. virginensis* and *C. insolita* in its definite perennial habit, narrow congested inflorescence, more tomentose indument, and the smoother nutlets with only a slightly elevated margin around the scar.

22. *Cryptantha insolita* (Macbr.) Payson

Cryptantha insolita (Macbr.) Payson, Ann. Mo. Bot. Gard. 14:273, 1927.

Oreocarya insolita Macbr. Contr. Gray Herb. 48:28, 1916.

Biennial or short-lived perennial from a slender taproot, 3-4 dm tall; stems 1-several, 1-3 dm long, strigose and conspicuously setose; leaves spatulate, mostly basal, obtuse, 3-5 cm long, 0.5-1.4 cm wide, dorsal surface subtomentose and sparsely appressed setose pustulate, ventral surface similar but the setae smaller and fewer, pustules few and small, petioles long-hairy at the base; inflorescence open, cymes few, much elongating, 0.7-1.4 dm long, weakly setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 3.5-4.5 mm long, in fruit becoming 7-9 mm long, densely hirsute; corolla white, the tube 3-4 mm long, crests at base of tube well developed, fornicies yellow, slightly emarginate, papillose, 0.5-1 mm long, limb 6-8 mm wide; style exceeding mature fruit 1-1.5 mm; nutlets ovate to lanceolate, 3.7-4 mm long, one to four maturing, the margins acute, in contact or nearly so, dorsal surface carinate, tuberculate, granulo-muricate and sometimes slightly rugulose, ventral surface tuberculate and somewhat rugulose, scar narrow but open, the margin showing some tendency to become elevated. Collections: 2 (0); representative: L. N. Goodding 2286 (GH, RM).

Holotype: L. N. Goodding 2286, collected in Clark County, Nevada, at Las Vegas, 4 May 1905, GH. Photograph at BRY. Isotype at RM.

Distribution: Known only from the region about Las Vegas. Growing in white alkaline soil, 1,900 to 2,500 feet. Map No. 22. April to June.

This species somewhat resembles *C. elata* of eastern Utah and western Colorado, but it is doubtful if the two are even remotely related. However, this plant is probably closely related to *C. virginensis*, but differs in the length of the floral bracts, number of cymes, and the shape of the nutlets.

23. *Cryptantha virginensis* (Jones) Payson

Cryptantha virginensis (Jones) Payson, Ann. Mo. Bot. Gard. 14:274, 1927.

Kuntzia glomerata var. *virginensis* Jones, Contr. West Bot. 13:5, 1910.

Oreocarya virginensis (Jones) Macbr. Proc. Am. Acad. Sci. 54:7, 1916.

Biennial, 1.5-3.5 (4) dm tall, stems 1-several, arising

from a stout taproot, 0.3-0.6 dm long, setose-hirsute; leaves oblanceolate to spatulate, obtuse, 3-10 (12) cm long, 0.5-1.5 cm wide, dorsal surface sparsely setose, pustulate, also with some fine tangled hair beneath, ventral surface subtomentose and weakly appressed setose, with only a few pustulate hairs; inflorescence a broad thyrus with the individual cymes much elongating, 0.5-3 dm long, foliar bracts conspicuous; calyx segments linear-lanceolate, in anthesis 3-4 mm long, in fruit becoming 7-11 mm long, hirsute; corolla white, the tube 3-4 mm long, crests at the base of tube conspicuous, fornicies yellow, emarginate, papillose, about 1 mm long, limb 7-9 mm broad; style exceeding mature fruit 1-1.5 mm; nutlets ovate, 3.3-4.5 mm long, 2.4-2.6 mm wide, usually only one to two nutlets maturing, margins in contact, acute, dorsal surface with a distinct ridge, the surface tuberculate and usually rugulose, ventral surface very uneven with indeterminate rugae and tubercles, scar open, and triangular, with an elevated margin. Collections: 64 (ii); representative: I. W. Clokey 5820 (ARIZ, BRY, ORF, RM, UTC); B. Maguire 4470 (RM, UTC); F. W. Gould 1580 (ARIZ, BRY, DIX, RM); Maguire and Holmgren 25404 (ARIZ, BRY, UTC); Alexander and Kellogg 3019 (RM, UTC); J. Beatley 4275 (BRY, LA); L. C. Higgins 1243 (BRY).

Holotype: M. E. Jones 5195a, collected in Washington County, Utah, at Laverkin, 8 May 1894, POM. Isotypes at UC, RM, MO, US.

Distribution: Southwestern Utah, southern Nevada, northwestern Arizona, and southeastern California. Growing on gravelly to clay soils, 2,000 to 8,000 feet. Map No. 23. March to July.

Cryptantha virginensis has its closest relatives with *C. tumulosa* and *C. hoffmannii*. From the former it differs in the biennial habit, more open inflorescence, more setose indument, and the nutlets which are more conspicuously roughened.

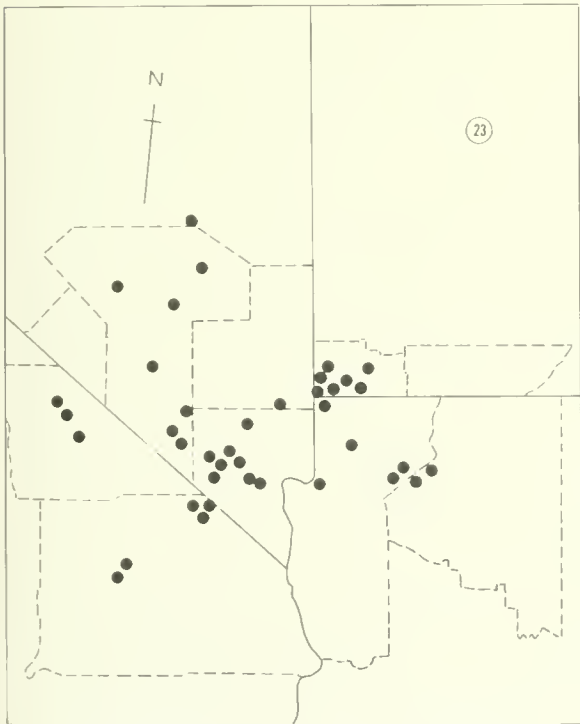
There can be no doubt that *C. virginensis* and *C. hoffmannii* are very closely related; and, because of the variation encountered in each, it is difficult to find characters of a high order which are consistently differential. Variation as now known in *C. virginensis* is rather great, especially marked in size of nutlets, length of the calyx, and the markings on the nutlets. However, where they approach each other in range, they occupy different life zones, and *C. virginensis* comes into flower a month or more earlier. The former also has fragrant flowers while *C. hoffmannii* does not. Additional collections of this complex are badly needed from western Nevada and eastern California.

24. *Cryptantha hoffmannii* Johnston

Cryptantha hoffmannii Johnston, Contr. Arn. Arb. 3:90, 1932.



Map No. 22. Southern Nevada. Range of *C. insolita* (Macbr.) Payson.



Map No. 23. Southern Nevada and parts of adjoining states. Range of *C. virginensis* (M. F. Jones) Payson.

Oreocarya hoffmanni (Johnst.) Abrams, Abrams, III, Fl. Pac. St. 3:600, 1951.

Plants biennial, 1.7-3.4 dm tall; stems 1-several, 0.2-1.6 dm long, conspicuously hirsute; leaves spatulate, crowded at the base, reduced upward, 2-5 cm long, 0.5-1.2 cm wide, spreading setose-hirsute, pustulate on both leaf surfaces, but more conspicuous dorsally; inflorescence broad-topped, interrupted, 1-2.8 dm long, floral bracts evident but not conspicuous; calyx segments lanceolate, in anthesis 3-5 mm long, in fruit becoming 5-8 mm long, hirsute-hispid; corolla white, the tube 3-4 mm long, crests at base of tube evident, fornices yellow, rounded, 0.5 mm long, papillose, limb 5-7 mm wide; style exceeding mature fruit 0.2-0.8 mm; nutlets ovate, 3-3.5 mm long, 2-2.5 mm wide, two to four nutlets maturing, the margins in contact, acute, both surfaces irregularly low rugose and minutely tuberculate, the dorsal with a low inconspicuous crest, scar open, triangular, without an elevated margin. Collections: 10 (i); representative: R. Hoffmann 78 (GH); Alexander and Kellogg 2503 (ARIZ, POM, RM); F. W. Pierson 7544 (GH, POM); P. Train 3977 (UTC); J. Roos 5849 (POM).

Holotype: R. Hoffmann 78, collected in Inyo County, California, on rocky open slopes of Westgard Pass, 7,300 feet, 11 July 1930, GH. Photograph at BRY.

Distribution: Western Nevada and southeastern California. Growing on gravelly soil in the pinyon-juniper community, 7,000 to 9,000 feet. Map No. 24. June and July.

Johnston, in the original description, said that this species was most closely related to *C. insolita*, however; I believe that its closest relative is *C. virginensis*, as discussed under that taxon.

25. *Cryptantha abata* Johnst.

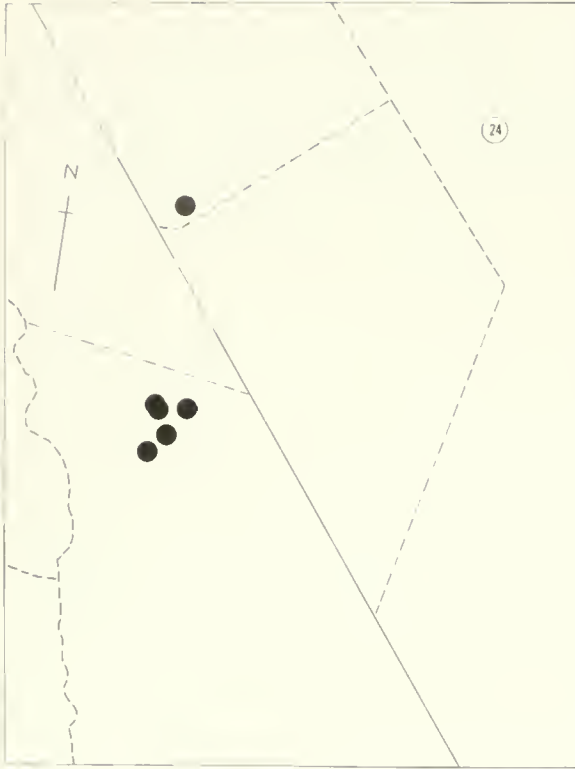
Cryptantha abata Johnst. Journ. Arn. Arb. 24:240, 1948.

Krynitzkia depressa Jones, Contr. West. Bot. 13:5, 1910, not *C. depressa* A. Nels. Bot. Gaz. 34:29, 1902.

Oreocarya depressa (Jones) Macbr. Contr. Gray Herb. 48:32, 1916.

Cryptantha modesta Payson, Ann. Mo. Bot. Gard. 14:278, 1927, not *C. modesta* Brand, Fedde, Rep. Spec. Nov. 24:48, 1924.

Plants perennial, arising from a strong woody taproot, 0.5-1.8 dm tall; stems many, 0.2-1.5 dm long, strigose and weakly setose, leaves oblanceolate to spatulate, obtuse, strigose, setose, and subtomentose, the petioles ciliate margined; inflorescence narrow, 0.2-0.8 dm long; calyx segments lanceolate to ovate, 2.5-4 mm long in anthesis, in fruit becoming 5-8 mm long, setose; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornices yellow, rounded, papillose, about 0.5 mm long, limb 7-8 mm wide; style exceeding mature fruit 0.5-1 mm; nutlets ovate, 3-3.5 mm long, 2-2.5 mm wide, usually all four maturing, margins in contact, obtuse to acute, dorsal surface carinate, tuberculate, muricate, and



Map No. 24. Inyo County, California, and adjoining Nevada. Range of *C. hoffmannii* Johnston.

sometimes with low inconspicuous ridges, ventral surface deeply and irregularly rugose, scar open, triangular, surrounded by a slightly elevated margin. Collections: 28 (v); representative: M. E. Jones 6692 (POM, UTC); B. F. Harrison 9009 (BRY); W. S. Boyle 1117 (BRY, UTC); L. N. Goodding 996 (POM, RM); Eastwood and Howell 651 (CAS); L. C. Higgins 1015, 1016 (BRY).

Lectotype: M. E. Jones 6692, collected at Aurum, Nevada, 7,300 feet, 20 June 1893, POM. Photograph at BRY. Isotype at US.

Distribution: South-central Utah, northwestern Arizona, and eastern Nevada. Growing on sandy or gravelly soil, 4,000 to 9,000 feet. Map No. 25. April to early July.

The name Payson applied to this species of southern Utah and eastern Nevada was invalid because of an earlier homonym. Johnston, noting this, named the plant *C. abata*.

Cryptantha abata is a modest, densely tufted *Cryptantha*, that is not greatly different in general appearance from some of the varieties of *C. humilis* or of *C. tumulosa*. It differs from these species by the short inflorescence, the deeply rugose nutlets on the ventral surface, and the spatulate leaves.

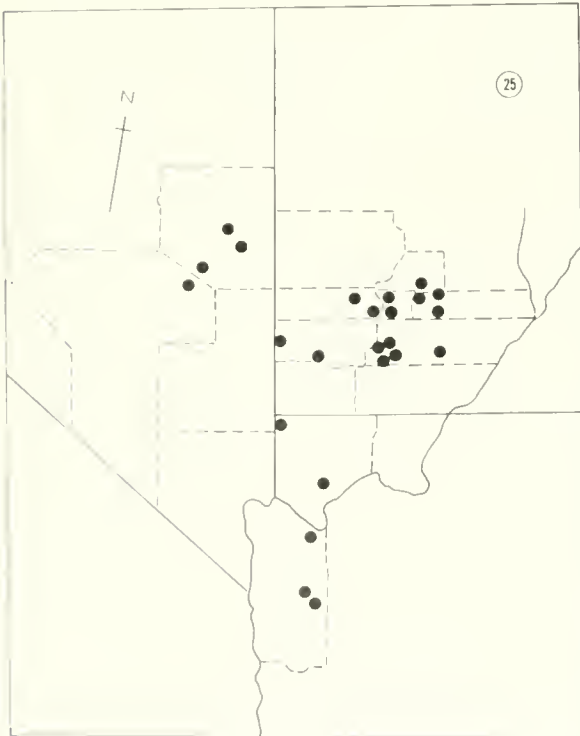
This plant is not often collected because of the early flowering time.

26. *Cryptantha caespitosa* (A. Nels.) Payson

Cryptantha caespitosa (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:281, 1927.

Oreocarya caespitosa A. Nels. Frythea 7.65, 1899.

Densely caespitose perennials, 0.5-1.5 dm tall; stems 1-many, arising from a much-branched woody caudex, 0.2-0.9 dm long, weakly setose, and appressed strigose; leaves oblanceolate to spatulate, 1-3 cm long, 0.3-0.7 cm wide, pubescence of two kinds, strigose and appressed setose, becoming tomentulose toward the petiole; inflorescence narrow, 0.3-1 dm long, foliar bracts inconspicuous; calyx segments lanceolate, in anthesis 3-4 mm long, in fruit becoming 5-8 mm long, strigose and weakly setose, also somewhat tomentulose; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, about 0.5 mm long, limb 4-7 mm wide; style equally long or 0.5 mm longer than mature fruit; nutlets lanceolate, 3-3.5 mm long, 2-2.5 mm wide, the margins acute, in contact, dorsal surface with low rounded rugae, also tuberculate, and with numerous murications between the ridges, ventral surface muricate, scar open, narrowly triangular, margin of scar not elevated. Collections: 40 (vi); representative: A. Nelson 4671 (CS, RM); E. Nelson 4497 (RM); G. E. Osterhout 6248 (RM); E. B. Payson 4249 (RM); R. C. Rollins 1685 (RM, UTC); D. Atwood 1568 (BRY); L. C. Higgins 1557, 1562, 1563, 1566, 1586, 1570 (BRY).



Map No. 25. Southwestern Utah and adjoining states. Range of *C. abata* Johnston.

Leectotype: A. Nelson 4749, collected in Sweet-water County, Wyoming, at Point of Rocks, 15 June 1898, RM. Photograph at BRY. Isotype at US.

Distribution: Southern Wyoming, but to be expected in northern Colorado and Utah, and perhaps eastern Idaho. Growing on heavy clay soils, 5,000 to 7,500 feet. Map No. 26. Early May to late July.

From the original description it is evident that Nelson also included in this species the plants that he later described as *C. cana*. In *C. cana* the leaves are silky-strigose, the inflorescence more capitate, and the nutlets are sharply muricate.

27. *Cryptantha ochroleuca* Higgins

Cryptantha ochroleuca Higgins, Great Basin Naturalist 28:197, 1968.

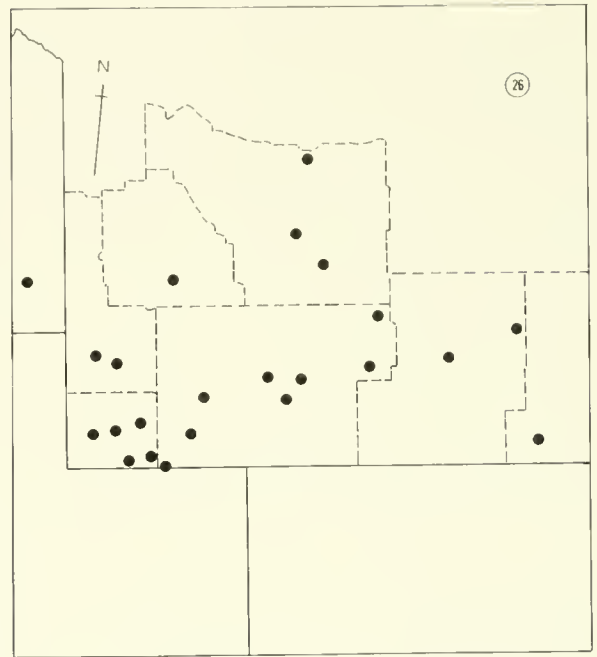
Low caespitose perennial, 0.2-1.3 dm tall; stems several, 0.1-0.4 dm long, strigose and weakly setose; leaves linear-oblongate to oblongate, the apices acute or sometimes obtuse, 1-2.5 cm long, 0.1-0.3 cm wide, basal leaves uniformly and densely strigose, sparsely setose, the petiole white-hairy, cauline leaves strigose and with some setose-pustulate bristles; inflorescence narrow, 0.2-0.7 dm long, weakly setose; calyx segments linear-lanceolate, 2-2.5 (3) mm long in anthesis, in fruit 4-6 mm long, setose; corolla pale-yellow, the tube 2-2.5 mm long, crests at base of tube conspicuous, fornices yellow, rounded, about 0.3 mm long, limb 4-5 mm wide; style scarcely surpassing mature fruit; nutlets lanceolate, 2.5-3 mm long, 1.4-1.6 mm wide, usually only one maturing, margin acute, dorsal surface irregularly rugose with low, rounded ridges; ventral surface only slightly uneven, scar open, narrowly triangular, extending $\frac{3}{4}$ the length of nutlet, no elevated margin. Collections: 5 (i); representative: L. C. Higgins 1788 (BRY); Reveal and Reveal 1031 (BRY); D. Atwood 1891 (BRY, WTSU).

Holotype: L. C. Higgins 1788, collected in Garfield County, Utah, on outcrop 100 meters south of Red Canyon Campground along hwy. 12, 6,500 feet, 21 July 1968, BRY. Isotypes at GH, NY, US.

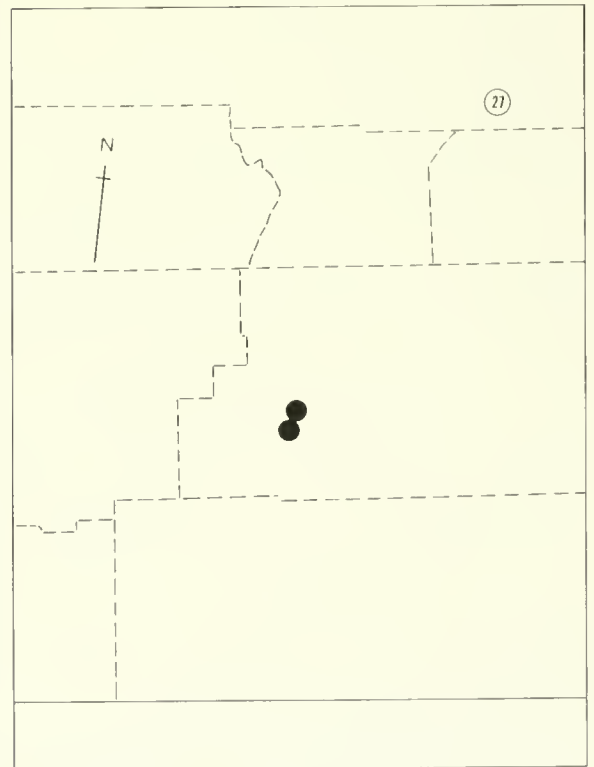
Distribution: Limited to the red Wasatch Formation near Red Canyon Campground in southwestern Garfield County, Utah, 6,500 to 7,000 feet. Map No. 27. May to August.

Cryptantha ochroleuca is apparently most closely related to *C. caespitosa* of southwestern Wyoming, but also has some affinities with *C. humilis*. It differs from *C. caespitosa* by its less caespitose habit, the slender, less woody taproot, shorter calyx, shorter, pale yellow instead of white corolla, and the smaller nutlets which are more rugose. From *C. humilis*, *C. ochroleuca* differs in the shorter calyx, pale yellow corolla, and the rugose nutlets.

This local species is apparently confined to the red Wasatch Formation in southwestern Garfield County, Utah.



Map No. 26. Southern Wyoming. Range of *C. caespitosa* (A. Nels.) Payson.



Map No. 27. Garfield County, Utah. Range of *C. ochroleuca* Higgins.

28. *Cryptantha humilis* (A. Gray) Payson

Perennials, more or less densely caespitose, 0.5-3 dm tall, stems many, arising from the ends of the branched caudex, 0.2-1.5 dm long, strigose to spreading setose; leaves oblanceolate to spatulate, 1-6 cm long, 0.2-1.2 cm wide, strigose, setose or subtomentose, pustulate on both surfaces; inflorescence narrowly cylindrical to open and lax, 0.2-1.8 dm long, tomentose to conspicuously setose; calyx segments linear-lanceolate, in anthesis 2.5-4.5 mm long, in fruit becoming 6-13 mm long, setose or tomentose; corolla white, the tube 2.5-4.5 mm long, crests at base of tube conspicuous to nearly obsolete, fornicies yellow, more or less papillose, rounded, about 0.5 mm long, limb 7-10 mm wide; the style shorter than to exceeding the mature fruit by 2.5 mm; nutlets lanceolate to ovate-lanceolate, 3-4.5 mm long, 1.8-3.2 mm wide, one to four of them maturing, margins in contact, acute to obtuse, dorsal surface muricate, tuberculate, or somewhat rugulose, ventral surface indistinctly muricate or tuberculate, scar open, triangular, margin not elevated.

Key to the varieties of *C. humilis*

1. Leaves strigose and setose but not conspicuously tomentose; calyx conspicuously setose (2).
1. Leaves densely strigose as well as tomentose; calyx setose and subtomentose (4).
 2. Nutlets rugulose as well as muricate; style 1.5-2.5 mm longer than mature fruit 28a. var. *humilis*
 2. Nutlets mucate or tuberculate; style not exceeding the fruit by more than 1.5 mm (3).
 3. Style exceeding the mature nutlets 1-1.5 mm; the inflorescence open and broad; plants loosely tufted 28b. var. *commixta*
 3. Style not or only slightly surpassing the nutlets; inflorescence congested, even in fruit; plants densely caespitose. 28e. var. *nana*
 4. Style scarcely exceeding the mature nutlets; inflorescence somewhat open at maturity; north-central Utah and southeastern Idaho 28c. var. *shantzii*
 4. Style exceeding the mature nutlets 0.5-1.5 mm; inflorescence cylindrical and congested in fruit; southwestern Utah to southeastern California 28d. var. *ovina*

28a. var. *humilis*

Cryptantha humilis (A. Gray) Payson var. *humilis*
Lewishym glomeratum var. *humile* A. Gray, Proc. Am. Acad. 10:61. 1875.

Orocarya humilis Greene, Phil. 3:112. 1896.

Orocarya hispida Nels. & Kennedy, Proc. Biol. Soc. Wash. 19:156. 1906. (Type: Ormsby County, Nevada, in Carson Valley, 24 April 1904, G. H. True 865.)

Orocarya echinoides Macbride, Contr. Gray Herb. 48:31. 1916, not *Krynitzkia echinoides* M. E. Jones

Orocarya macbridii Brand, Fedde, Rep. Spec. Nov. 19:73. 1923. (Type: Mt. Jarbidge, Nevada, 6 July 1912, Nelson and Macbride 1960.)

Cryptantha humilis (Greene) Payson, Ann. Mo. Bot. Gard. 14:278. 1927.

Caespitose perennial, 0.5-3 dm tall; stems 1-many, 0.4-1.5 dm long, erect, strigose and sparsely setose; leaves spatulate to oblanceolate, 1.5-7 cm long, 0.2-1 cm wide, weakly setose, strigose, and subtomentose, the petioles ciliate-margined, both surfaces pustulate; inflorescence narrow to somewhat open, 0.8-1.7 dm long, the floral bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 4-5 mm long, in fruit becoming 7-13 mm long, setose; corolla white, the tube 3.4-5 mm long, crests at base of tube evident to nearly obsolete, fornicies yellow, rounded, papillose, about 0.5 mm long, limb 8-10 mm wide; style exceeding mature fruit 1.5-2.5 mm; nutlets ovate-lanceolate, 3-4.5 mm long, 1.8-2 mm wide, dorsal surface muricate, tuberculate, and usually rugulose, scar open at the base or nearly closed. Collections: 62 (vii); representative: Alexander and Kellogg 4443 (UC, US, UTC); Maguire and Holmgren 25938 (ARIZ, UC, ORE, UTC); A. Cronquist 8312 (ORL, UTC, WTU); P. A. Munz 21036 (CAS); M. E. Jones 5163 (US); Eastwood and Howell 8451 (POM); L. C. Higgins 1745, 1747, 1757, 1761 (BRY).

Lectotype: Bolander s.n., collected at Summit Station (Donner Pass), Nevada County, California, 1871. Not seen.

Distribution: Southeastern Oregon and southwestern Idaho, south throughout Nevada and into eastern California, mainly in mountainous regions. Usually growing on gravelly slopes and ridges, 4,500 to 12,000 feet. Map No. 28a. April to August.

In eastern Nevada and western Utah there is a mixing of two populations formerly referred to as *C. humilis* and *C. nana* var. *commixta* (Macbr.) Payson. The specific limits between *C. humilis* of A. Gray and that of *C. nana* are uncertain, and too many intermediates are present to hold them apart. For this reason the two species have been combined under *humilis*. The varieties within this complex are also very difficult to separate and can be done only tentatively in certain areas. For example, in central Utah the varieties *shantzii*, *commixta*, and *ovina* are extremely difficult to separate.

Brand's *O. macbridii*, from Jarbidge, Nevada, was described as new on the basis of the nutlets which tend to have rugae between the murications. The present author has found this same nutlet ornamentation in all the varieties of *C. humilis* which is just another reason for combining *C. humilis* and *C. nana*.

28b. var. *commixta* (Macbr.) Higgins stat. nov.

Cryptantha humilis (A. Gray) Payson var. *commixta* (Macbr.) Higgins

Orocarya commixta Macbr. Contr. Gray Herb. 48:33. 1916

Cryptantha nana (Eastw.) Payson var. *commixta* (Macbr.) Payson, Ann. Mo. Bot. Gard. 14:312. 1927.

Caespitose perennials, 1-2.7 dm tall; stems 1-several, arising from the ends of the branched caudex, 0.3-1 dm long, weakly strigose and spreading setose; leaves spatulate to broadly oblanceolate, 2.5-6 cm long, 0.5-1.2 cm wide, strigose and spreading setose; inflorescence open, 0.8-1.8 dm long, foliar bracts evident on lower part of the inflorescence; calyx segments linear-lanceolate, in anthesis 3.5-4.5 mm long, in fruit becoming 7-10 mm long, setose; style exceeding mature fruit 0.7-1.6 mm; nutlets lance-ovate, 3.5-4 mm long, muricate, tuberculate, or sometimes with the murications joined to form short irregular ridges, scar subulate or nearly closed. Collections: 18 (iv); representative: L. N. Goodding 1074 (GH, RM); M. E. Jones 5388L (US); B. F. Harrison 10148 (BRY); R. C. Holmgren 266 (BRY); L. C. Higgins 1468, 1617 (BRY).

Holotype: L. N. Goodding 1074, collected in Juab County, Utah, on sandy slides at Juab, 9 June 1902, G.H. Photograph at BRY. Isotype at RM.

Distribution: Central Utah to eastern Nevada. Growing on gravelly soil or talus slopes, 4,500 to 7,500 feet. Map No. 28b. May to July.

This variety may be distinguished by its open inflorescence, setose or coarsely strigose leaves, and the length of the style.

The variation within *commixta* is also noticeable, and a population along the Sevier River in Sevier and Piute Counties may prove to be another variety or species. The nutlets of this population along the Sevier River are more tuberculate than muricate, the scar is closed or nearly so, and the leaves are greener than in typical *commixta*.

28c. var. *shantzii* (Tidestr.) Higgins stat. nov.

Cryptantha humilis (A. Gray) Payson var. *shantzii* (Tidestr.) Higgins.

Oreocarya shantzii Tidestr. Proc. Biol. Soc. Wash. 26:122. 1913.

Oreocarya dolosa Macbr. Contr. Gray Herb. 48:32. 1916. (Type: College Bench, Logan, Utah, 4 June 1909, Smith 1605.)

Cryptantha nana (Eastw.) Payson var. *shantzii* (Tidestr.) Payson, Ann. Mo. Bot. Gard. 14:313. 1927.

Caespitose perennial, 1-2 dm tall; stems 1-many from the ends of the much branched caudex, 0.3-1 dm long, weakly setose and strigose; leaves spatulate to oblanceolate, obtuse, 2-5 cm long, 0.3-0.7 cm wide, tomentose and appressed setose, with slender more or less appressed bristles; inflorescence usually narrow, but the cymes slightly elongating, lower foliar bracts rather conspicuous in the young inflorescence; calyx segments densely setose and subtomentose; style scarcely exceeding the mature nutlets; nutlets muricate. Collections: 40 (v); representative: B. Maguire 12952 (RM); C. P. Smith 1573 (RM); C. P. Smith 1605 (RM); Kearney and Shantz 3098 (US);

R. Gourley 8068 (UT); R. J. Davis 988 (IDS); A. A. Beetle 5792 (ND); E. Palmer 42 (RM); L. C. Higgins 1087 (BRY).

Holotype: Kearney and Shantz 3098, collected in dry saline soil at Grants Station south of the Great Salt Lake, Utah, 6 August 1912, G.H.

Distribution: Southwestern Montana, eastern Idaho, and northern Utah. Growing on a wide variety of soils, 4,500 to 8,000 feet. Map No. 28b. April to July.

This variety may be distinguished by the short style, evident foliar bracts, and the basal leaves, which are silvery strigose and setose.

Payson designated the specimen collected by C. P. Smith 1605, as the type of var. *shantzii*. However, the plant collected by Kearney and Shantz 3098, should have been used since it was designated as the type in the original description.

28d. var. *ovina* (Payson) Higgins stat. nov.

Cryptantha humilis (A. Gray) Payson var. *ovina* (Payson) Higgins.

Cryptantha nana (Eastw.) Payson var. *ovina* Payson, Ann. Mo. Bot. Gard. 14:314. 1927.

Densely caespitose long-lived perennials, 0.5-1.5 dm tall; stems several, 0.2-0.7 dm long; leaves spatulate to oblanceolate, obtuse, 2-4 cm long, tomentose and appressed setose with rather weak bristles; inflorescence narrow, cylindrical, lower foliar bracts inconspicuous; calyx segments linear-lanceolate, densely setose and tomentose; style exceeding the mature fruit 0.5-1 mm; nutlets muricate or tuberculate. Collections: 21 (v); representative: P. A. Munz 21036 (UT); Eastwood and Howell 9377 (CAS); Ripley and Barneby 3485 (CAS); G. H. Bentley s.n. (RM); J. L. Reveal 1414 (BRY, LA); S. L. Welsh 5226 (BRY); L. C. Higgins 1234, 1409, 1449, 1455 (BRY).

Holotype: Georgia H. Bentley s.n., collected in Nye County, Nevada, in the vicinity of Currant, June 1916, RM.

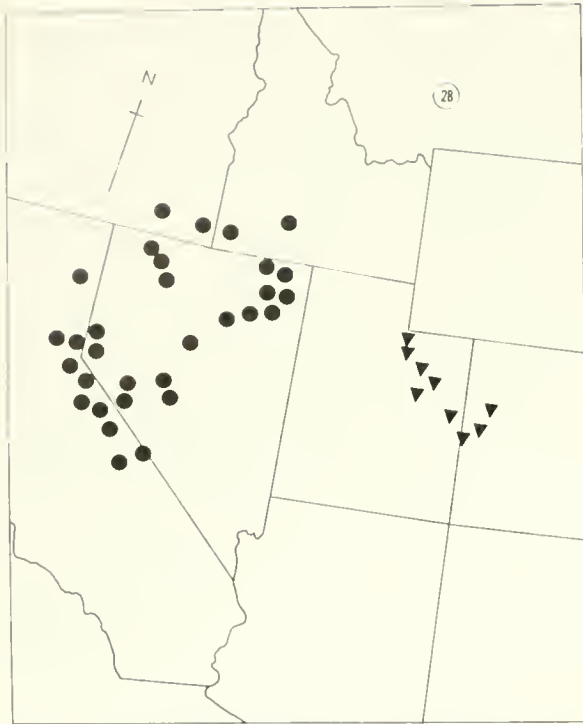
Distribution: Southwestern Utah, southern Nevada, and southeastern California. Growing on gravelly loam or clayey soils, mainly in the pinyon-juniper belt, 3,500 to 7,000 feet. Map No. 28b. April to July.

Variety *ovina* has its closest relative in var. *shantzii*. It may be separated from that variety only tentatively by the more tomentose leaves and calyces and the longer style. The foliar bracts are also less evident in this variety.

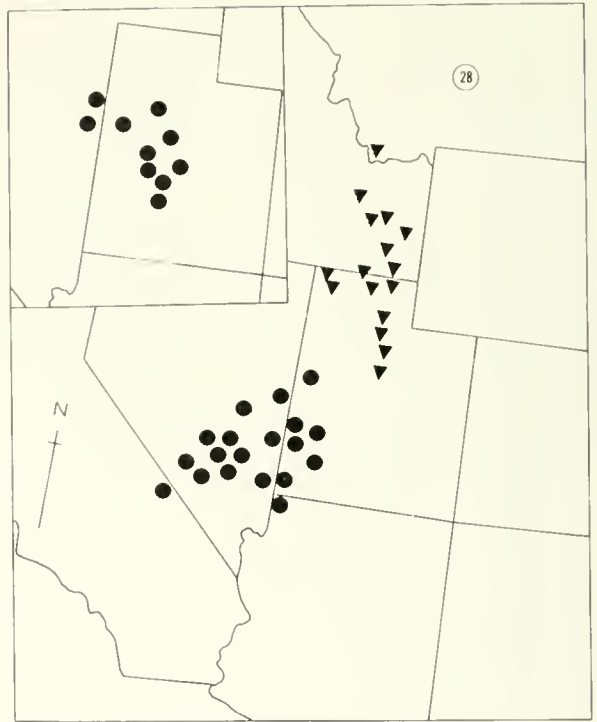
28e. var. *nana* (Eastw.) Higgins stat. nov.

Cryptantha humilis (A. Gray) Payson var. *nana* (Eastw.) Higgins.

Oreocarya nana Eastw. Bull. Torrey Bot. Club 30:243. 1903.



Map No. 28a. Parts of western United States. Range of *C. humilis* (Gray) Payson: (Circles), var. *humilis*: (Triangles) var. *nana* (Eastw.) Higgins.



Map No. 28b. Parts of western United States. Range of *C. humilis* (Gray) Payson: (circles), var. *orina* (Payson) Higgins: (triangles) var. *shantzii* (Tidestr.) Higgins; inset, (circles), var. *commixta* (Macbr.) Higgins.

Cryptantha nana (Eastw.) Payson var. *typica*, Ann. Mo. Bot. Gard. 14:315. 1927.

Caespitose perennial, 0.5-1.5 dm tall; stems several, 0.2-0.7 dm long, setose; leaves oblanceolate to spatulate, 0.5-4 cm long, 0.2-0.6 cm wide, strigose to subtomentose, spreading setose; inflorescence narrow, cylindrical, 0.2-1 dm long, setose; calyx segments linear-lanceolate, in anthesis 2.5-3.5 mm long, in fruit becoming 6-8 mm long, setose; corolla white, the tube 2.5-3.5 mm long, crests at base of tube evident; style shorter to slightly longer than mature fruit; nutlets muricate or sometimes tuberculate or rugulose. Collections: 18 (v); representative: Ripley and Barneby 4675 (CAS); W. A. Weber 11258 (COLO); A. Eastwood s.n. (CAS); G. E. Osterhout 4484 (RM); D. Wiens 3066 (COLO); L. C. Higgins 1066, 1598 (BRY).

Holotype: A. Eastwood s.n., collected in Mesa County, Colorado, near Grand Junction on the mesa above the Gunnison River, 17 May 1892, CAS. Photograph at BRY. Isotypes at RM, UC, GH.

Distribution: Western Colorado and eastern Utah. Growing on sandy or clay soils, 4,500 to 7,000 feet. Map No. 28a. April to July.

Variety *nana* can usually be separated from the other varieties of this complex by the setose leaves which are only rarely tomentose, the very short style which usually does not exceed the fruit, and the compact inflorescence.

The *C. humilis* complex is distinguished mainly by the short corollas and the uniformly muricate nutlets. These are also characteristics shared by *C. cana* and *C. breviflora*; however, these species have an indument which is silky-strigose and with few or no pustulate hairs especially on the ventral surface.

29. *Cryptantha roosiorum* Munz

Cryptantha roosiorum Munz, El Aliso 3:124. 1955.

Densely caespitose, long-lived perennial, 0.1-0.3 dm tall; stems many from the end of the branched caudex, rather slender, 0.1-0.2 dm long; leaves spatulate to oblanceolate, acute, 0.5-1.2 cm long, densely strigose and appressed setose, appearing almost tomentose, scarcely pustulate; inflorescence compact, about 1 cm long, foliar bracts inconspicuous; calyx segments linear, in anthesis 2.8-3.1 mm long, in fruit becoming 3.8-4.3 mm long, strigose, and more or less setose; corolla white, the tube 2.5-3 mm long, crests at base of tube well developed, fornicies low, rounded, yellow, about 0.5 mm long, limb 4.5-5.5 mm wide; style slightly surpassing the nutlets; nutlets 2.3-2.5 mm long, lance-ovate, acutish, dorsal surface rugulose, with low, rounded, irregular ridges, also somewhat muricate, ventral surface similar but the markings less evident, scar narrowly triangular, and lacking an elevated margin. Collections: 1 (O); representative: J. C. and A. R. Roos 6015 (RSA).

Holotype: J. C. and A. R. Roos 6015, collected in Inyo County, California, along crest of Inyo Mountains three miles east of Badger Flat, at 10,600 feet, 13 August 1953, RSA. Photograph at BRY. Isotypes at CAS, GH.

Distribution: Apparently endemic to the type locality, Inyo County, California. Growing on open rocky slopes, 10,600 feet. Map No. 29. July and August.

Cryptantha roosiorum is not very well known, and many more collections of this species are badly needed. It is perhaps most closely related to *C. humilis*, but differs in the more caespitose habit, smaller leaves, calyx, and corolla. The inflorescence is also more compact, and the whole plant is much smaller.

30. *Cryptantha compacta* Higgins

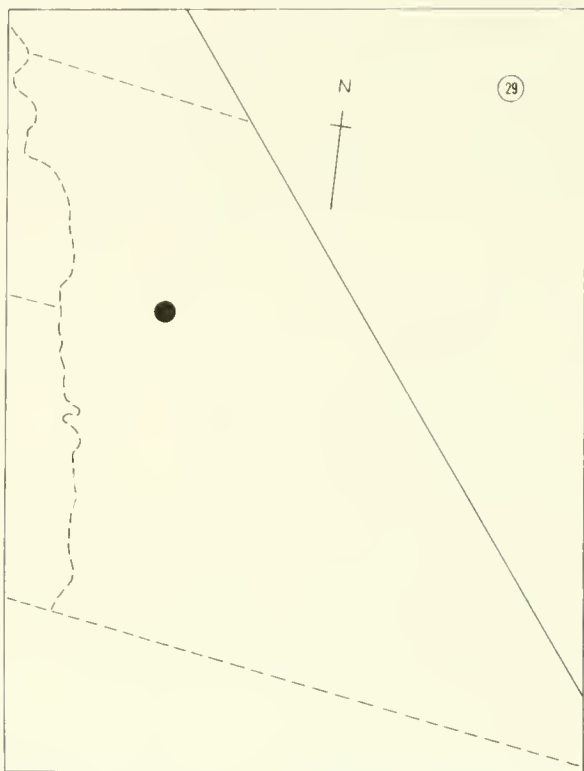
Cryptantha compacta Higgins, Great Basin Naturalist 28:196, 1968.

Densely caespitose perennial, 0.3-1 dm tall; stems numerous, arising from a woody root, 0.1-0.4 dm long, tomentose below, weakly strigose above; leaves oblanceolate to spatulate, obtuse, 0.5-1.5 (2) cm long, 0.2-0.4 cm wide, dorsal surface with appressed setose-pustulate bristles, also densely strigose or subtomentose, ventral surface similar but with fewer pustulate hairs, the petioles tomentose; inflorescence narrow, nearly capitate, 1-5 cm long; foliar bracts evident but not conspicuous; calyx segments lanceolate, 2-2.5 mm long in anthesis, in fruit becoming 3.5-4.5 (5) mm long, densely white setose and tomentose; corolla white, the tube 1.8-2.2 mm long, crests at base of tube evident, fornicies yellow, rounded, papillose, about 0.5 mm long, limb 4.5-5.5 mm wide; style equalling or shorter than mature fruit; nutlets lance-ovate, acute, 2.5-3 mm long, 1.5-1.8 mm wide, only one to two maturing, dorsal surface muricate or weakly tuberculate-rugulose, ventral surface muricate, scar open, subulate to narrowly triangular, elevated margin lacking. Collections: 6 (ii); representative: R. C. Holmgren 521 (BRY); B. F. Harrison 6371 (BRY); L. C. Higgins 1462 (BRY).

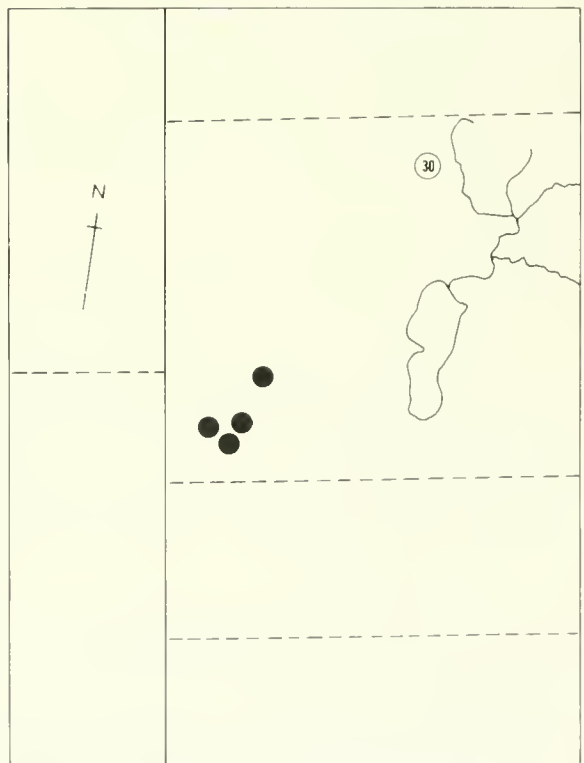
Holotype: L. C. Higgins 1613, collected in Millard County, Utah, about 8 miles west of Desert Range Experiment Station Headquarters along Hwy. 21, 100 m west of pass at the north end of Needle Range, 18 June 1968, BRY. Isotypes at CAS, GH, NY, POM, US, UTC.

Distribution: Known only from southwestern Millard County, Utah, but to be expected from northern Beaver County, Utah, and perhaps in eastern Nevada. Growing on gravelly loam soil, 4,500 to 6,000 feet. Map No. 30. May to July.

Cryptantha compacta is most closely related to *C. humilis* but differs in its more compact and caespitose habit, smaller leaves, shorter calyx segments, and



Map No. 29. Inyo County, California. Range of *C. roosiorum* Munz.



Map No. 30. Western Utah and adjoining Nevada. Range of *C. compacta* Higgins.

smaller corolla. This plant has been known for over 30 years, but has been placed with *C. humilis*, probably due to the immaturity of the specimens. In observing this species in the field it becomes even more apparent of its right to specific distinction, due to its dense caespitose habit that more resembles *C. caespitosa* than *C. humilis*. At the type locality it is the most common plant, growing on shallow stony loam.

31. *Cryptantha cana* (A. Nels.) Payson

Cryptantha cana (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:316, 1927.

Oreocarya cana A. Nels. Bot. Gaz. 34:30, 1902.

Caespitose perennials, 0.5-2 dm tall; stems many, arising from a multiple caudex, 0.2-0.5 dm long, weakly setose; leaves narrowly oblanceolate, acute, very dense at the ends of the caudices, 2-6 cm long, 0.3-1 cm wide, uniformly silky-strigose, also with small inconspicuous pustulate hairs on both leaf surfaces; inflorescence narrow, setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, 3-4 mm long in anthesis, in fruit becoming 6-7 mm long, weakly setose; corolla white, the tube 3-4 mm long, crests at base of tube evident, fornicies yellow, rounded, papillose, about 0.5 mm long, limb 6-9 mm wide; nutlets lance-ovoid, 2.5-3 mm long, 1.4-1.8 mm wide, usually only one maturing, margins acute, dorsal surface muricate with elongated papillae, or sometimes tuberculate, ventral surface similar but less roughened, scar narrowly triangular, and without an elevated margin; style shorter than the mature fruit. Collections: 31 (iv); representative: E. J. Palmer 37423 (GH); C. L. Porter 5723 (GH, RM); Ripley and Barneby 10547 (GH); A. Nelson 2876 (ND-G); J. Ewan 12770 (GH); L. C. Higgins 1534, 1542, 1537 (BRY).

Holotype: A. Nelson 8309, collected in Goshen County, Wyoming, at Fort Laramie, on gravelly hill-top, 29 June 1901, RM. Photograph at BRY. Isotype at GH.

Distribution: Western Nebraska, northeastern Colorado, and southeastern Wyoming. Growing on gravelly loam soils, 4,000 to 6,000 feet. Map No. 31. May to early September.

Cryptantha cana is similar to *C. caespitosa* in habit, but can be distinguished from *C. caespitosa* by the silky-strigose pubescence, sharply muricate nutlets, and the different range.

32. *Cryptantha breviflora* (Osterh.) Payson

Cryptantha breviflora (Osterh.) Payson, Ann. Mo. Bot. Gard. 14:318, 1927.

Oreocarya breviflora Osterh. Univ. Wyo. Publ. Bot. 1:169, 1926.

Long-lived perennials, 1.6-3 dm tall; stems several, slender, 0.7-1.7 dm long, densely white setose at the

base, strigose above; leaves oblanceolate to spatulate, 2.5-9 cm long, 0.4-1.4 cm wide, clustered at the ends of the branched caudices, the apices obtuse, dorsal surface densely and uniformly silky-strigose, with many small pustulae, ventral surface similar but with fewer pustules; inflorescence narrow in flower, but becoming broad and open at maturity, 0.6-2.7 dm long, setose; calyx segments linear-lanceolate, 4.5-6 mm long in anthesis, in fruit becoming 7-9 mm long, setose; corolla white, 3.5-4.5 mm long, crests at base of tube evident, fornicies yellow, rounded, about 0.5 mm long, limb 8-12 mm wide; style exceeding mature fruit by 2 mm or less; nutlets lanceolate, 3.4-4 mm long, 2-2.5 mm wide, less than four nutlets maturing, margins in contact, knifelike, dorsal surface uniformly muricate or tuberculate, ventral surface similar, scar open, narrowly triangular, margin not elevated. Collections: 25 (vii); representative: R. C. Rollins 1736 (UTC); S. L. Welsh 466 (COLO); J. Brotherson 806 (BRY); W. A. Weber 5310 (COLO); Higgins and Welsh 1018 (BRY) L. C. Higgins 1084 (BRY).

Holotype: G. E. Osterhout 6414, collected in Uintah County, Utah, 6½ miles north of Jensen, 19 June 1925, RM. Photograph at BRY.

Distribution: Northeastern Utah in Duchesne and Uintah counties. Growing on heavy clay soils, 4,500 to 7,000 feet. Map No. 32. May to July.

Cryptantha breviflora is apparently endemic to the Uintah Basin. It differs from its closest relative, *C. fulvocanescens*, by the short corolla, low fornicies, different pubescence, and shorter style. The range of the two is also consistently different, *C. fulvocanescens* being more southerly and never in the Uintah Basin.

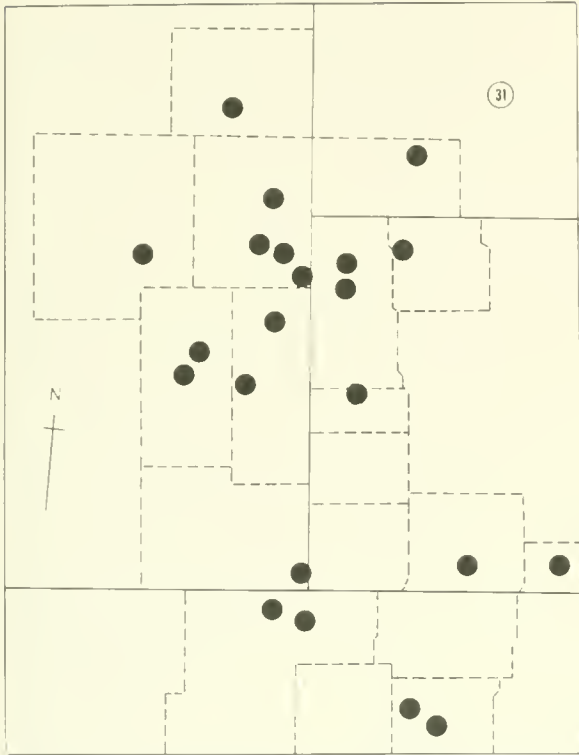
33. *Cryptantha propria* (Nels. & Macbr.) Payson

Cryptantha propria (Nels. & Macbr.) Payson, Ann. Mo. Bot. Gard. 14:317, 1927.

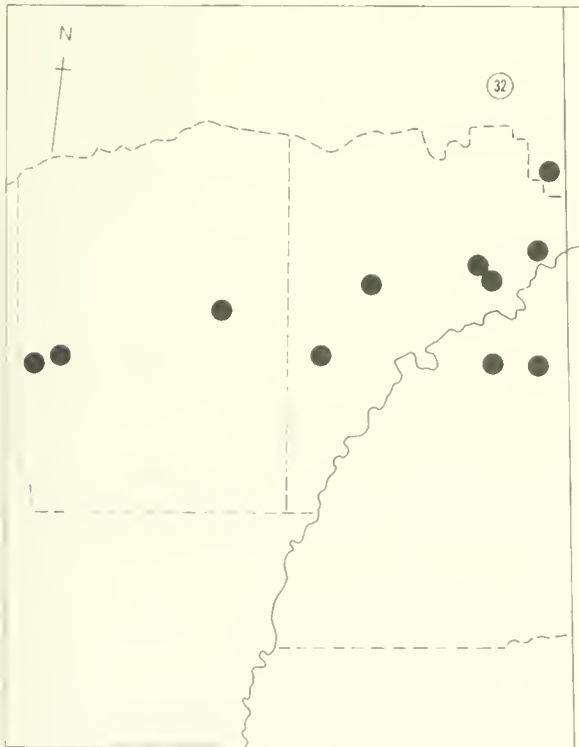
Krynitzkia fulvocanescens var. *idahoensis* Jones, Contr. West. Bot. 13:6, 1910. (Type: Jones 6474, near Weiser, Idaho, 28 April 1910.)

Oreocarya propria Nels. & Macbr. Bot. Gaz. 62:145, 1916.

Caespitose perennials from a strongly lignified taproot, 1-2.3 dm tall; stems several, 0.7-1.2 dm long, finely strigose and setose; leaves oblanceolate to spatulate, obtuse, 3-9 cm long, 0.4-1.2 cm wide, dorsal surface finely strigose and scattered appressed setose, ventral surface finely and uniformly strigose, without pustules; inflorescence narrow, 0.5-1.2 dm long, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 4-6 mm long, in fruit becoming 7-13 mm long, densely setose-hirsute; corolla white, the tube 3.5-4.5 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, papillose, about 0.5-1 mm long, limb 6-8 mm wide; style exceeding mature fruit 1.5-2 mm; nutlets ovate-lanceolate, 3-4 mm long, 2.5-3 mm wide, margins in



Map. No. 31. Southeastern Wyoming, southwestern South Dakota, western Nebraska, and north central Colorado. Range of *C. cana* (A. Nels.) Payson.



Map. No. 32. Northeastern Utah, Duchesne and Uintah Counties. Range of *C. breviflora* (Osterh.) Payson

contact, acute, dorsal surface densely and irregularly rugulose, with narrow high ridges, muricate between the ridges, ventral surface tuberculate, or with some of the tuberculations joined to form short ridges, scar open, linear, and without an elevated margin. Collections: 6 (0); representative: J. B. Leiberger 2049 (UC, GH, POM, US); J. B. Leiberger 2223 (UC, GH, US); R. J. Davis 4496 (GH); H. M. Tucker 1022 (GH, IDS); M. E. Jones 4674 (POM).

Holotype: J. B. Leiberger 2049, collected in Malheur County, Oregon, at Vale, 14 May 1896, GH. Photograph at BRY. Isotypes at UC, GH, POM, US.

Distribution: Southwestern and western Idaho and eastern Oregon in Malheur County. Growing in clay soils, 2,000 to 4,000 feet. Map No. 33. April to June.

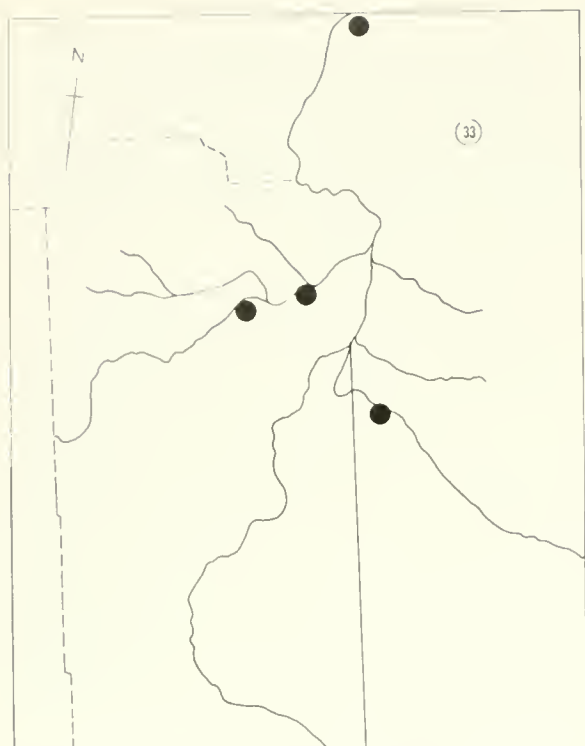
Cryptantha propria, a relatively sporadic species occurring in western Idaho and eastern Oregon, is not often collected throughout its range. In general appearance it is not unlike *C. humilis* var. *humilis*, *C. cana*, or *C. breviflora*. The latter two species are far removed geographically, occurring in Wyoming and Utah respectively. This species is probably most closely related to *C. humilis*, however, very distinct in its racemose inflorescence and the uniformly strigose ventral leaf surface which lacks pustules.

34. *Cryptantha fulvocanescens* (Wats.) Payson

Densely caespitose perennials from a strongly lignified taproot, 0.8-3 dm tall; stems many from a multiple caudex, 0.5-1.3 dm long, white hairy at the base, setose-hirsute upward; leaves spatulate or oblanceolate, acute to obtuse, 1.5-7 cm long, 0.4-1.2 cm wide, uniformly strigose, pustules mainly confined to the dorsal surface; inflorescence narrow or somewhat open at maturity, 0.3-1.9 dm long, white or yellowish setose, foliar bracts inconspicuous; calyx segments linear, 4-6 mm long in anthesis, in fruit becoming 9-13 mm long, densely white or yellowish setose, pedicels 2-10 mm long; corolla white, the tube 7-11 mm long, crests at base of tube evident or lacking, fornicies yellow, emarginate or rounded, 0.7-1.3 mm long, limb 7-9 mm broad; style exceeding mature fruit 3-7 mm; nutlets lance-ovate, 3.5-4.5 mm long, 2-3 mm wide, one to two usually maturing, margins acute to obtuse, in contact when more than one nutlet matures, both surfaces densely and uniformly muricate, scar open or nearly closed, elevated margin lacking.

Key to the varieties of *C. fulvocanescens*

- 1. Murications on the nutlet rounded; corolla 9-13 mm long; inflorescence narrow, white setose at maturity 34a. var. *fulvocanescens*
- 1. Murications on the nutlet with one or two setose projections; corolla 7-9 mm long; inflorescence broader and usually yellowish at maturity 34b. var. *schmoides*



Map No. 33. Parts of western Idaho and eastern Oregon. Range of *C. propria* (Nels. & Macbr.) Payson.



Map No. 34. Parts of western United States. Range of *fulvocanescens* var. *fulvocanescens* (Gray) Payson; var. *echinoides* (Jones) Higgins.

34a. var. *fulvocanescens*

Cryptantha fulvocanescens (Wats.) Payson var. *fulvocanescens*

Eritrichium glomeratum var. ? *fulvocanescens* S. Wats. Bot. King Exp. 243. 1871.

Eritrichium fulvocanescens Gray, Proc. Am. Acad. 10:61. 1875.

Krynitzkia fulvocanescens Gray, Proc. Am. Acad. 20:280. 1885.

Oreocarya fulvocanescens (Wats.) Greene, Pitt. 1:58. 1887.

Oreocarya nitida Greene, Pl. Baker. 3:21. 1901. (Type: Deer Run, Colorado, 11 June 1901, C. T. Baker 95.)

Cryptantha fulvocanescens (Wats.) Payson, Ann. Mo. Bot. Gard. 14:319. 1927.

Densely caespitose perennial, 1-3 dm tall; inflorescence narrow, white setose; pedicels 2-3 mm long; corolla white, the tube 9-11 mm long, crests at base of tube evident or lacking, fornices yellow, rounded to acute; nutlets lanceolate, 3.5-4 mm long, 2-2.5 mm wide, the dorsal surface with rounded murications, scar straight, closed or slightly open. Collections: 58 (viii); representative: A. Cronquist 9096 (POM, UTC); A. H. Holmgren 3225 (US); G. Heller 3517 (ND-G, US); Fendler 632 (GH); C. F. Baker 561 (ND-G, US); C. F. Baker 95 (UC, POM, GH, RM, US); E. C. Higgins 999, 1012, 1307 (BRY).

Holotype: Fendler 632, collected in Santa Fe County, New Mexico, near Santa Fe, 1847, GH. Photograph at BRY. Isotypes at PH, US.

Distribution: Western Colorado, northwestern New Mexico, northeastern Arizona, and eastern Utah. Growing on sandy soil, 4,000 to 7,500 feet. Map No. 34. April to August.

Cryptantha fulvocanescens var. *fulvocanescens* is most likely to be confused with *C. breviflora* but differs in the longer corolla tube, narrower inflorescence, longer style, and different pubescence.

34b. var. *echinoides* (Jones) Higgins

Cryptantha fulvocanescens (Wats.) Payson var. *echinoides* (Jones) Higgins, Great Basin Naturalist 29:30. 1969.

Krynitzkia echinoides Jones, Proc. Calif. Acad. Sci. 11: 5:709. 1895.

Oreocarya echinoides (Jones) Macbr. Contr. Gray Herb. 48:31. 1916, as to synonymy, not as to specimens cited.

Cryptantha echinoides (Jones) Payson, Ann. Mo. Bot. Gard. 14:321. 1927.

Caespitose perennials, 0.8-3.6 dm tall; inflorescence narrow to somewhat open at maturity, yellowish setose; pedicels 3-10 mm long; corolla white, the tube 7-9 mm long, crests at base of tube lacking or sometimes evident, fornices yellow, emarginate; nutlets lance-ovoid, 4-4.7 mm long, 2.5-3 mm wide, the dorsal surface with one to two setose projections terminating each murication, scar asymmetrical, and without an elevated margin. Collections: 19 (vi); representative: M. E. Jones 5297p (POM); M. E. Jones 5312ac (POM); Eastwood and Howell 9265

(UTC); R. H. Peebles 14688 (ARIZ, US); Reveal, Gentry and Davidsee 781 (BRY); A. Cronquist 10212 (BRY, NY); L. C. Higgins 1008, 1344 (BRY).

Lectotype: M. E. Jones 5297p, collected in Kane County, Utah, in Pahria Canyon, 26 May 1894, POM. Photograph at BRY.

Distribution: South-central Utah and north-central Arizona. Usually growing on heavy saline clay soils, 4,000 to 7,500 feet. Map No. 34. April to July.

"Payson cites *Eritrichium glomeratum* var. (?) *fulvocanescens*, Wats. Bot. King Exp. 243 (1871), as a synonym of *C. humilis*. This I believe is incorrect. Watson took a herbarium name of Gray's and described under it an aggregate species. When Gray finally published his name *E. fulvocanescens* he cited Watson's trinomial as a synonym and appears to have accepted the limits given it by Watson. Watson, however, found Gray's name on a specimen from New Mexico collected by Fendler (no. 632). He accepted that specimen as belonging to his variety and indicated it as the source of his botanical name. He erred in taxonomic judgment, though, in placing with it certain material from Nevada and possibly Utah that belongs at least in part to *C. humilis*. Payson placed particular emphasis on these latter specimens. However, since Watson included the Fendlerian New Mexican plant in his concept and indicated it as the source of his name, then, it should be taken as the type of *fulvocanescens*, both as variety and species. Consequently the name applies to a very different plant from that described as *Oreocarya humilis* by Greene." (Johnston 1932)

The variety *echinoides* was entirely misunderstood by Macbride (1916). From the specimens he cited from western Nevada and adjacent California, it is evident that he never saw a specimen of true *echinoides*. It differs from the typical plant in that the murications are setose, and the nutlets are usually larger.

35. *Cryptantha jonesiana* (Payson) Payson

Cryptantha jonesiana (Payson) Payson, Ann. Mo. Bot. Gard. 14:323. 1927.

Oreocarya jonesiana Payson, Univ. Wyo. Publ. Bot. 1:168. 1926.

Coarse perennials, 0.5-1.5 dm tall; stems many, arising from a thick multiple caudex, 0.2-0.7 dm long, setose; leaves spatulate, 1-4 cm long, 0.4-1.3 cm wide, coarsely appressed setose-pustulate, leaf bases also setose with dense white hairs; inflorescence narrow, somewhat capitate, with one to three flowers in the axis of the bracts below the terminal cluster; calyx segments lanceolate to nearly linear, in anthesis 5-7 mm long, in fruit becoming 7-10 mm long, densely setose, with ascending, yellowish bristles; corolla white, the tube 10-15 mm long, campanulate in the throat, fornicies low and broad, papillose, crests at

base of tube lacking, limb 9-13 mm wide; nutlets lanceolate, 3.5-4.5 mm long, densely and uniformly muricate, or with a few short, low ridges, scar narrow, open, and without an elevated margin. Collections: 11 (v); representative: W. P. Cottam 5247 (UT); M. E. Jones s.n. (POM); D. Atwood 1301 (BRY); Higgins and Reveal 1265, 1275, 1299 (BRY); L. C. Higgins 1322, 1308 (BRY).

Holotype: M. E. Jones s.n., collected in Emery County, Utah, on the San Rafael Swell, 15 May 1914, POM. Photograph at BRY.

Distribution: Endemic to the San Rafael Swell in Emery County, Utah. Usually growing on barren clay hills, 4,000 to 7,000 feet. Map No. 35. April to June.

Cryptantha jonesiana is probably most closely related to *C. fulvocanescens*, but resembles it not at all. This handsome plant can be distinguished by its very large corolla, low broad fornicies, spatulate leaves, and harsh pubescence.

36. *Cryptantha thyrsiflora* (Greene) Payson

Cryptantha thyrsiflora (Greene) Payson, Ann. Mo. Bot. Gard. 14:283. 1927.

Eritrichium glomeratum var. *hispidissimum* Torr. Bot. Mex. Bound. Surv. 140. 1859, at least in part.

Oreocarya thyrsiflora Greene, Pitt. 3:111. 1896.

Oreocarya hispidissima (Torr.) Rydb. Bull. Torrey Bot. Club 33:150. 1906.

Oreocarya urticacea Wootton & Standl. Contr. U. S. Natl. Herb. 16:166. 1913. (Type: Canyoncito, Santa Fe County, New Mexico, 18 June 1897, A. A. & E. G. Heller 3731.)

Oreocarya dura Nels. & Macbr. Bot. Gaz. 62:144. 1916. (Type: E. L. Johnston 418, 1907, central Colorado.)

Oreocarya monosperma Osterh. Bull. Torrey Bot. Club 46:55. 1919. (Type: Trinidad, Las Animas Co., Colorado, 20 July 1918, Osterhout 5754.)

Short-lived perennials or sometimes biennial, 1.7-4 dm tall; stems stout, 1-several, arising from the base, 0.5-1.8 dm long, conspicuously spreading setose; leaves oblanceolate, obtuse, 5-12 cm long, 0.5-1.4 cm wide, conspicuously spreading setose, pustulate on both surfaces, with some finer strigose hairs beneath, the petioles ciliate-hirsute; inflorescence very broad and open, cymules much elongating, 1-2 dm long, 0.6-2.5 dm wide, setose, foliar bracts 2-3 cm long, but not very conspicuous due to the width of the inflorescence; calyx segments linear, in anthesis 3-4 mm long, in fruit becoming 6-9 mm long, setose; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornicies yellow, emarginate, papillose, about 0.5 mm long, limb 5-8 mm wide; style exceeding mature fruit 1-1.5 mm; nutlets ovate to ovate-lanceolate, 2.5-3.5 mm long, 1.5-2 mm wide, usually two to four maturing, acute, margins in contact, dorsal surface low rugulose and tuberculate, sometimes with murications between the rugae, ventral surface similar but with fewer ridges or sometimes almost smooth, scar subulate, the margin not elevated. Collections: 110 (xv); representative: A. Nelson 7306 (RM, COLO, US); M. E. Jones 972 (RM,

US, UTC); C. F. Baker, F. S. Earle & Tracy 13 (ND-G, RM, US); W. A. Weber 4389 (ARIZ, COLO); R. C. Rollins 1865 (ND, RM); U. T. Waterfall (COLO, UTC); M. Ownbey 1311 (COLO, RM, UTC); L. C. Higgins 2030, 3290, 3823, 3830, 2042 (BRY, WTSU).

Lectotype: E. L. Greene s.n., collected in southeastern Wyoming, at Cheyenne, 6 July 1892, ND-G. Photograph at BRY.

Distribution: Western Nebraska and southeastern Wyoming, south throughout eastern Colorado, New Mexico, and into Oklahoma. Growing in gravelly loam soil, 4,500 to 9,600 feet. Map No. 36. Late May to September.

Early collections of this species were often referred to *C. celosoides*, but it is probably not very closely related to that plant. The broad inflorescence is the outstanding characteristic of the species, but in addition the flowers of *thyrsiflora* are much smaller and the blooming season later than in *C. celosoides*. In observing the types of *O. urticacca*, *dura*, and *monosperma* it is apparent that they are exact synonyms of *thyrsiflora*.

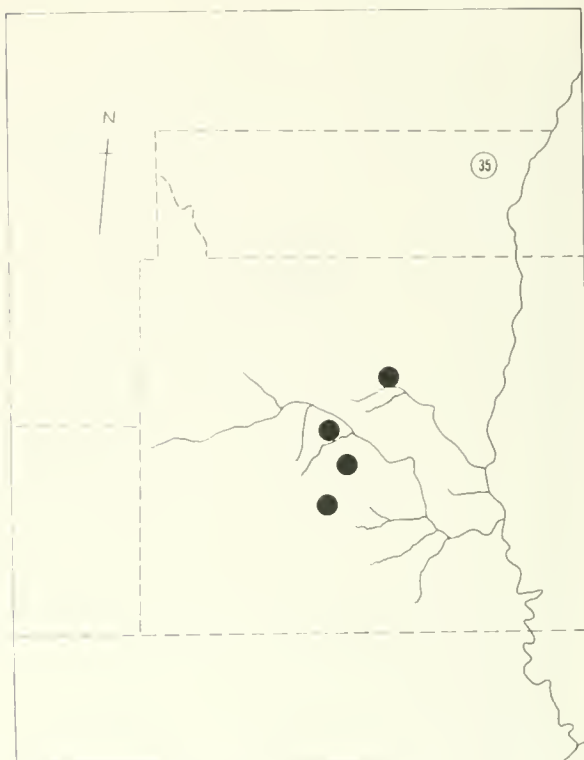
37. *Cryptantha elata* (Eastw.) Payson

Cryptantha elata (Eastw.) Payson, Ann. Mo. Bot. Gard, 14:285, 1927.

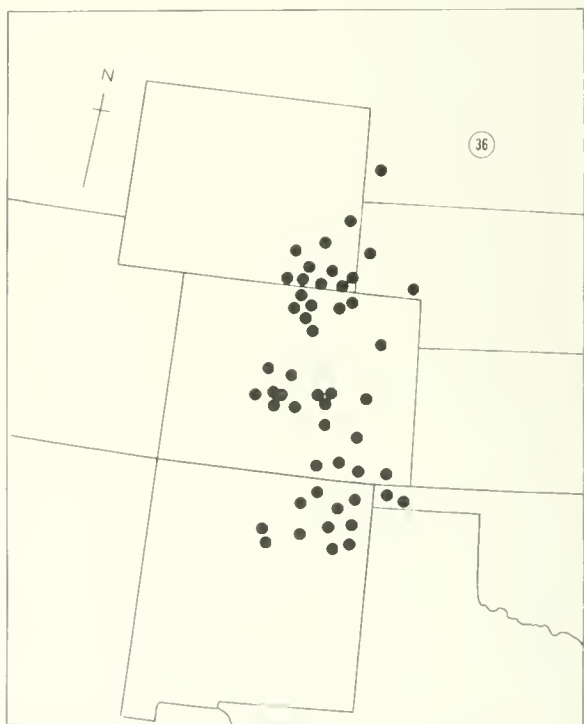
Oreocarya elata Eastw. Bull. Torrey Bot. Club 30:241, 1903.

Short-lived perennials, 3-5 dm tall; stems 1-6, erect, stout, weakly setose with spreading white hairs, 0.9-1.5 dm long; leaves oblanceolate to spatulate, 2-5 cm long, 0.4-1.3 cm wide, apices acute to obtuse, the blade tapering abruptly to the narrow petiole, dorsal surface strigose and appressed setose, ventral surface strigose, both surfaces pustulate; inflorescence spreading in age, 1.5-3.5 dm long, setose, foliar bracts inconspicuous; calyx segments lanceolate, in anthesis 3-4.5 mm long, in fruit becoming 7-8 mm long, hirsute; corolla white, the tube 3.5-5 mm long, fornicies yellow, rounded, papillose, about 1 mm long, crests at base of tube well developed, limb 6-8 mm wide; style exceeding mature fruit 0.5-2 mm; nutlets lanceolate-ovate, 4-4.5 mm long, 2-2.5 mm wide, usually all four maturing, margins in contact, dorsal surface densely tuberculate and somewhat rugulose, the surface also covered with dense, minute papillae, ventral surface similar but the roughenings less prominent, scar closed, or narrowly open at the base, and without an elevated margin. Collections: 11 (in); representative: A. Eastwood s.n. (CAS, GH); S. L. Welsh 6952 (BRY); G. F. Osterhout 5996 (RM); W. A. Weber 11294 (BRY, COLO); L. C. Higgins 1479 (BRY).

Lectotype: A. Eastwood s.n., collected in Mesa County, Colorado, near Grand Junction on the road to the coal mines, growing on bare clay hills charac-



Map No. 35. Emery County, Utah. Range of *C. jonesiana* (Payson) Payson.



Map No. 36. Parts of western United States. Range of *C. thyrsiflora* (Greene) Payson.

teristic of the region, 25 May 1892, CAS. Photograph at BRY. Isotypes at GH, NY, US.

Distribution: West central Colorado in Mesa County, and east-central Utah in Grand County. Growing on heavy clay soil, 4,500 to 5,500 feet. Map No. 37. May to June.

This species resembles *C. insolita* from southern Nevada, but is probably not very closely related to that taxon. It differs in the shorter spatulate leaves and larger differently marked nutlets which have the scar closed. In practice this plant is so distinct that it is not to be confused with any other species in this subgenus. Additional collections of this very narrow endemic are badly needed in order to determine the exact limits of the species.

38. *Cryptantha sericea* (Gray) Payson

Cryptantha sericea (Gray) Payson, Ann. Mo. Bot. Gard. 14:286, 1927.

Krynitzkia sericea Gray, Proc. Am. Acad. 20:279, 1885.

Oreocarya sericea Greene, Pitt. 1:58, 1887.

Oreocarya affinis perennis A. Nels. Erythea 7:67, 1899. (Type: Green River, Wyoming, 31 May 1897, A. Nelson 3035.)

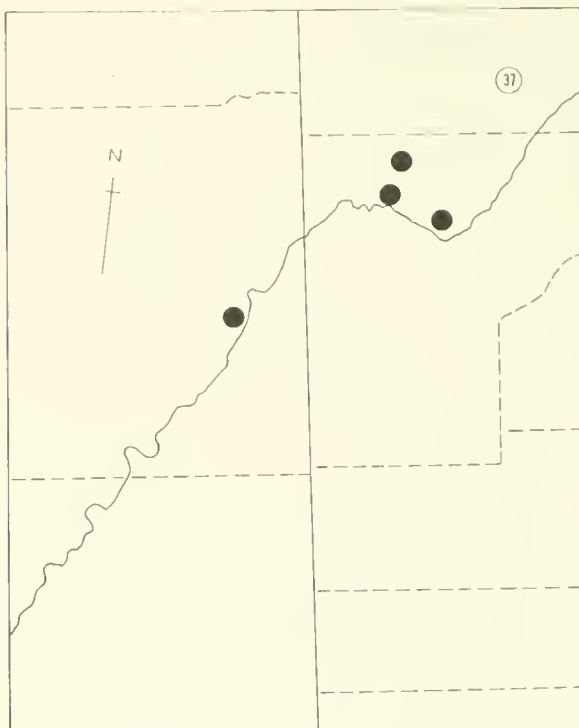
Oreocarya argentea Rydb. Bull. Torrey Bot. Club 31:637, 1904. (Type: Rifle, Garfield County, Colorado, 1900, Osterhout 2122.)

Oreocarya perennis Rydb. Bull. Torrey Bot. Club 33:150, 1906.

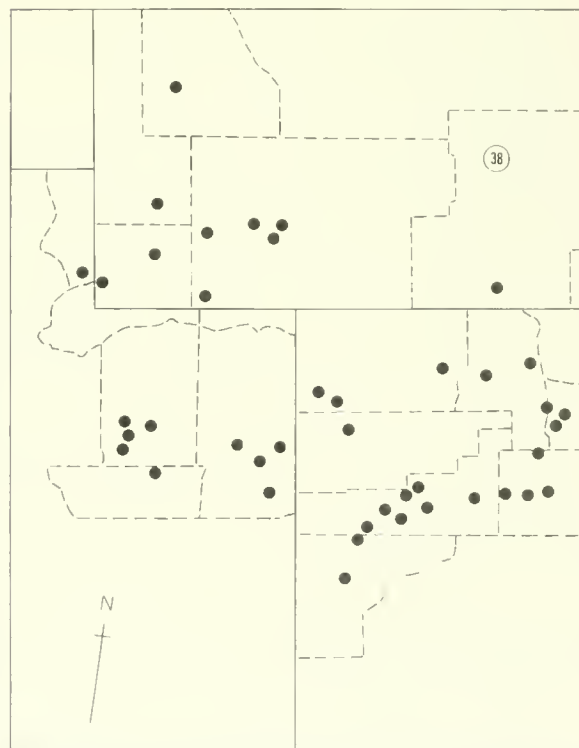
Oreocarya procera Osterh. Bull. Torrey Bot. Club 47:211, 1920. (Type: Glenwood Springs, Garfield County, Colorado, 18 June 1899, Osterhout 1867.)

Cryptantha sericea var. *perennis* (Nels.) Payson, Ann. Mo. Bot. Gard. 14:288, 1927.

Perennials, 1.5-4.3 dm tall; stems 1-several, branched from the base, 0.5-1.2 dm long, setose with spreading hairs; leaves oblanceolate to spatulate, obtuse, 2.5-10 (15) cm long, 0.5-2 cm wide, dorsal surface strigose and slightly appressed to spreading setose, pustulate, ventral surface silky-strigose, pustules lacking or very inconspicuous; inflorescence narrow to somewhat open, 0.5-3.2 dm long, setose-hispid, foliar bracts 2-5 cm long; calyx segments lanceolate, 2.5-4 mm long in anthesis, in fruit becoming 6-8 mm long; pedicels 0.5-1 mm long; corolla white, the tube 2.5-3.5 mm long, crests at base of tube conspicuous, fornicies yellow, depressed, broad, 0.5-0.6 mm long, limb 7-9 mm wide; style exceeding the mature fruit 0.5-1.3 mm; nutlets lanceolate, 2.5-3.5 mm long, 1.5-2 mm wide, usually all four maturing, margins acute or narrowly winged, in contact, dorsal surface with low rounded tuberculations, also somewhat rugulose and muricate, ventral surface similar but the markings less evident, scar straight, closed, and without an elevated margin. Collections: 80 (xii); representative: C. L. Porter 4583 (MONT, RM, WTU); R. C. Rollins 1772 (ND, UTC); B. Maguire 12378 (UTC); L. Williams 464 (RM); S. L. Welsh and E. M. Christensen 6572 (BRY); W. A. Weber 6111 (ARIZ, COLO, RM, UTC, CS); G. E. Osterhout 5119 (RM); L. C. Higgins 1048, 1055 (BRY).



Map No. 37. Mesa Co., Colorado and Grand Co., Utah. Range of *C. clata* (Eastw.) Payson.



Map No. 38. Southwestern Wyoming, northeastern Utah, and adjoining Colorado. Range of *C. sericea* (Gray) Payson.

Leotype. H. Engelmann s.n., collected in Wyoming at Bridger Pass, 1856. GH. vide Payson.

Distribution: Southwestern Wyoming, northwestern Colorado, and northeastern Utah. Growing on heavy clay soils, 4,200 to 7,000 feet. Map No. 38. Late May to August.

The name *sericea* has always been a stumbling block in the way of any satisfactory treatment of this group of plants. Payson (1927) was faced with the problem of selecting a type from the collections available to Dr. Gray at the time he described *sericea*. The specimens that were considered to compete for the type of *sericea* were as follows:

- Sheet 1 contains four specimens:
- a. Bridger's Pass, 1856, H. Engelmann equals *O. argentea* Rydb.
 - b. Wasatch Mts., 1844, Fremont equals *O. humilis* Greene
 - c. Clover Mts., Nevada, 1868, Watson equals *O. humilis* Greene
 - d. Mountain Hot Springs, Yellowstone Park, 1885, Tweedy 816 equals *C. celosioides*
- Sheet 2 contains three specimens:
- a. Montana Terr., 1867 equals *C. celosioides*
 - b. Summit, California, 1871, Bolander equals *C. nubigena* Greene
 - c. Grass Valley, Utah, 1875, Ward 49 equals *C. abata* Johnst
- Sheet 3 contains two specimens at the present time and probably five (including fragments) in Gray's time:
- a. Southern Montana, 1880, Watson 287 equals *C. celosioides*
 - b. A specimen of *celosioides* without data equals *C. celosioides*
 - c. Fragment, Baker County, Oregon, 1879, Cusick equals *C. subretusa* Johnst
 - d. Fragment from southern Wyoming equals *C. caespitosa*
 - e. Fragment from Scotts Bluff, 1858 equals *C. cana*

The specimens that were considered to compete for the type of *sericea* were then *O. argentea*, *humilis*, *C. celosioides*, *abata*, *nubigena*, *subretusa*, *caespitosa*, and *cana*. By a process of elimination, a type for *sericea* was selected—that from Bridger's Pass, collected by Engelmann—as this was the only specimen that fit the published description, the maturity of the plant Dr. Gray had in mind, and the geographical range.

Cryptantha sericea is similar in appearance to *C. celosioides* but can be recognized at once by the silky-strigose ventral surface of the leaves, which lack pustulate hairs and the differently marked nutlets.

39. *Cryptantha aperta* (Eastw.) Payson

Cryptantha aperta (Eastw.) Payson, Ann. Mo. Bot. Gard. 14: 295, 1927.
Oreocarya aperta Eastw. Bull. Torrey Bot. Club 30: 241, 1903.

Caespitose perennial, 1.2-2 dm tall; stems several, slender, arising from a woody root, 0.3-0.5 dm long, strigose and conspicuously white setose-hispid; leaves

spatulate to oblanceolate, somewhat folded, and with the midrib strongly developed, obtuse, 2-3.5 cm long, 0.3-0.6 cm wide, both surfaces setose-hispid and pustulate, with fine appressed hairs beneath the bristles; inflorescence open, branched from near the base, with simple or two-forked spikes, 1-1.3 dm long, the individual spikes becoming 4-7 cm long, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 2.8-3 mm long, in fruit becoming 7-9 mm long, densely setose; corolla white, the tube 2.6-3 mm long, crests at base of tube conspicuous, fornicies yellow, truncate, distinctly papillose, about 0.5 mm long, limb 4-6 mm wide; style exceeding mature fruit 1.5-2 mm; nutlets ovate-lanceolate, 2-2.6 mm long, 1.4-1.6 mm wide, usually all four maturing, margins acute, in contact, dorsal surface indistinctly carinate, tuberculate, somewhat rugulose, and indistinctly mucronate, ventral surface indistinctly roughened, scar closed, and without an elevated margin. Collections: 1 (0); representative: A. Eastwood s.n. (CAS).

Holotype: A. Eastwood s.n., collected in Mesa County, Colorado, at Grand Junction, 27 June 1892, CAS. Photograph at BRV.

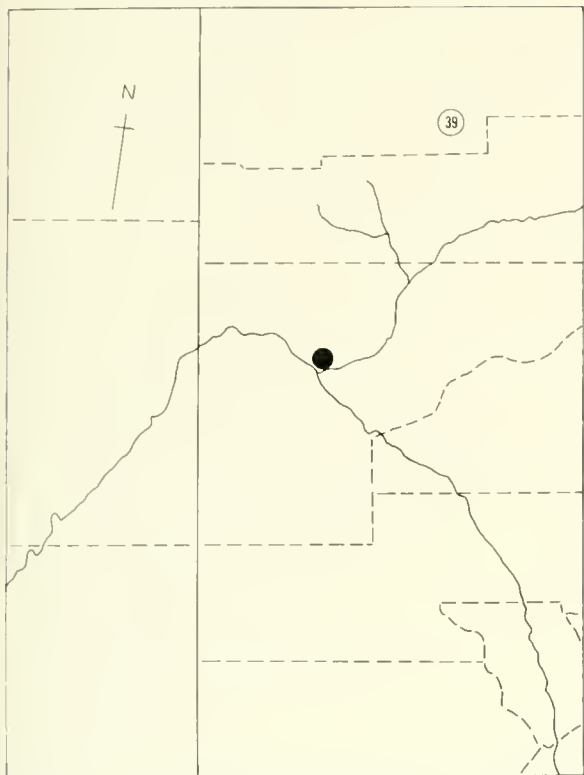
Distribution: Known only from the type locality, Mesa County, Colorado. Probably growing on clay soil characteristic of the region, 4,000 to 5,500 feet. Map No. 39. May to July.

This species still remains obscure because of the lack of herbarium material. In observing the type specimen it appears that the plant is quite distinct, with its broad inflorescence and the ornamentation on the nutlet. It is perhaps closely related to *C. thyrsoiflora*, but is entirely distinct.

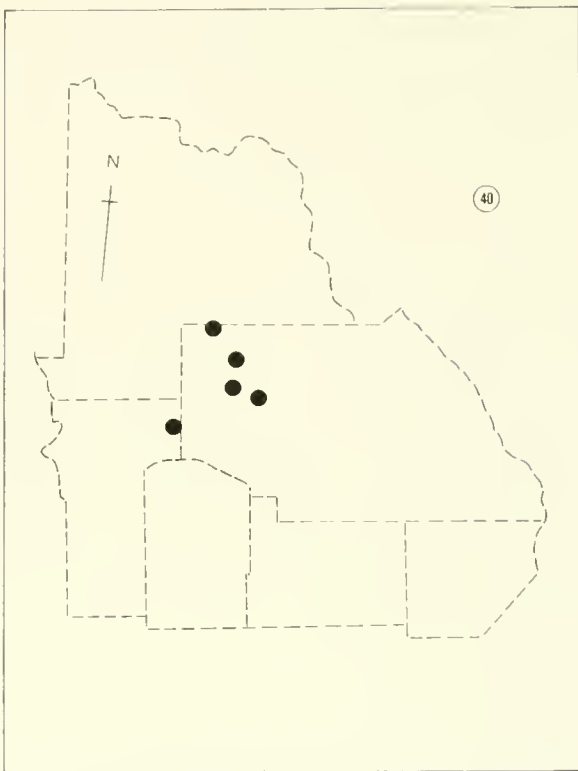
40. *Cryptantha weberi* Johnst.

Cryptantha weberi Johnst. Journ. Arn. Arb. 33: 72, 1952.

Caespitose perennials, 1-1.8 dm tall; stems numerous, erect, 0.2-0.5 dm long, strigose, and weakly setose; leaves numerous, narrowly oblanceolate, 3-8 cm long, 0.3-0.7 cm wide, densely hispid-villous, with pustules on both surfaces; inflorescence cylindrical, narrow, 0.4-1 dm long, hispid-villous; foliar bracts evident on lower part of inflorescence; calyx segments lanceolate, in anthesis 3-4 mm long, in fruit becoming 5-6 mm long, hispid-villous; corolla white, the tube 3-3.2 mm long, crests at base of tube conspicuous, fornicies yellow, emarginate, somewhat papillose, about 0.5 mm long; style exceeding mature fruit 1.5-1.8 mm; nutlets ovate, 2-2.3 mm long, 1.3-1.8 mm wide, all four usually maturing, margins acute or narrowly winged, dorsal surface tuberculate, and with short irregular transverse ridges, ventral surface nearly smooth, scar open, triangular or narrowly cuneate, elevated margin lacking. Collections: 11 (v); representative: W. A. Weber 5778



Map No. 39. Mesa County, Colorado. Range of *C. aperta* (Eastw.) Payson.



Map No. 40. Central Colorado, Saguache and Hinsdale Counties. Range of *C. weberi* Johnston.

(COLO, GH, LL); J. H. Langenheim 4047 (RM); H. Gentry 2405 (ARIZ); J. Barrell 92-55 (CS); S. A. Spongberg 62-55 (CS); W. A. Weber 9411 (UT); L. C. Higgins 2256, 2268, 2269, 3719, 3727 (BRY, WTSU).

Holotype: W. A. Weber 5778, collected in Saguache County, Colorado, along road to Stone Cellar Ranger Station and Saguache Park, near junction of main highway, 4 miles west of Cochetopa Pass, volcanic ash deposit, 9,700 feet, 28 July 1950, GH. Photograph at BRY. Isotypes at COLO, LL.

Distribution: Saguache and Hinsdale counties, Colorado. Growing on volcanic ash deposits, 9,000 to 10,500 feet. Map No. 40. July and August.

This delicate little *Cryptantha* from the high mountains of Colorado is one of the most distinct in the entire subgenus and is not confused with any other species because of the narrow inflorescence, pubescence, and the very distinctive nutlets. It keys out in Payson's monograph to *C. rugulosa*, but is only remotely related to that species.

41. *Cryptantha rugulosa* (Payson) Payson

Cryptantha rugulosa (Payson) Payson, Ann. Mo. Bot. Gard. 14:295. 1927.

Oreocarya rugulosa Payson, Univ. Wyo. Publ. Bot. 1:166. 1926.

Biennial or short-lived perennial, 1.2-3 dm tall;

stems slender, 1-several, 0.8-1.6 dm long, spreading setose-hispid; leaves oblanceolate to spatulate, obtuse to acute, strigose and conspicuously setose-hispid, pustulate on both surfaces; inflorescence 0.2-2 dm long, hispid; foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 4-5 mm long, in fruit becoming 7-9 mm long, strigose and spreading hirsute; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornice rounded, distinctly papillose, about 0.5 mm long, limb 5-7 mm wide; style exceeding mature fruit 1-1.5 mm; nutlets lanceolate, 2.8-3.2 mm long, 1.3-1.7 mm wide, all four usually maturing, margins in contact, acute, dorsal surface with short low ridges, also somewhat tuberculate, ventral surface smooth or nearly so, scar open, subulate, without an elevated margin. Collections: 30 (vii); representative: B. Maguire 22021 (ARIZ, UTC); Maguire and Becraft 2729 (RM, UTC); W. P. Cottom 9569 (UT); B. F. Harrison 11658 (BRY); M. E. Jones s.n. (POM, RM); L. C. Higgins 1463, 1474, 1614, 1621, 1720 (BRY).

Holotype: M. E. Jones s.n., collected in Juab County, Utah, at Fish Springs, 4 June 1891, RM. Photograph at BRY. Isotypes at UC, POM.

Distribution: Central Utah to northeastern Nevada. Growing in clay or gravelly loam soils, 4,500 to 6,500 feet. Map No. 41. May to July.

Cryptantha rugulosa is closely related to *C. spicu-*

lijera and *C. interrupta*, but differs in the very setose-hispid indument, differently marked nutlets which are smooth on the ventral surface, and different geographical range.

42. *Cryptantha interrupta* (Greene) Payson

Cryptantha interrupta (Greene) Payson, Ann. Mo. Bot. Gard. 14:296, 1927.

Oreocarya interrupta Greene, Pitt. 3:111, 1896.

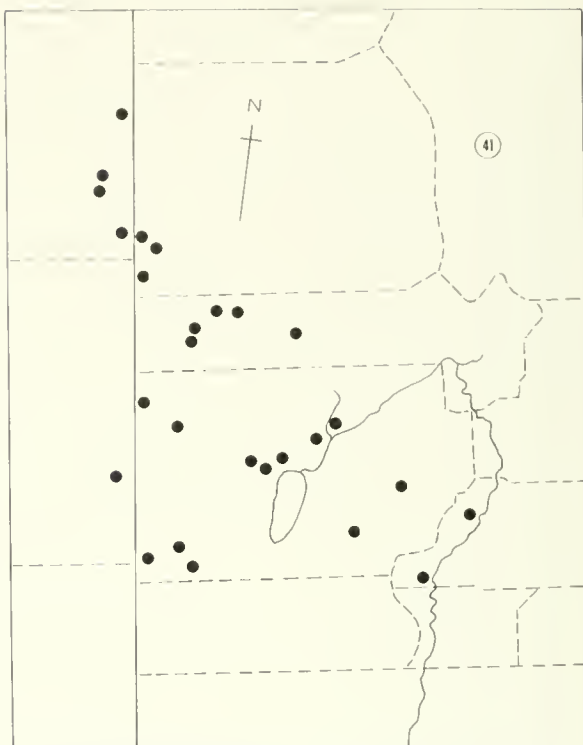
Long-lived perennial, 1.7-6 dm tall; stems few to several, slender, 1-3.5 dm long, strigose and weakly setose with slender white hairs; leaves oblanceolate to spatulate, obtuse, 1.5-7 cm long, 0.4-1.2 cm wide, dorsal surface densely strigose, and appressed setose pustulate, upper surface more finely strigose, setose hairs less conspicuous, pustules fewer; inflorescence narrow, interrupted, 1-2.5 dm long, densely setose, cymes somewhat elongating at the top, foliar bracts evident on lower part of stem; calyx segments lanceolate, 2-3 mm long in anthesis, in fruit becoming 5-8 mm long, setose; corolla white, the tube 2-2.5 mm long, crests at base of tube very conspicuous, fornicies light yellow, slightly emarginate, about 0.5 mm long, limb 5-6 mm wide; style exceeding mature fruit by less than 1 mm; nutlets lanceolate, 3.3-3.6 mm long, 1.7-2 mm wide, all four usually maturing, margins in contact, acute, both surfaces tuberculate with scattered, rounded tubercles, or sometimes nearly smooth, scar slightly open, linear, margin not elevated. Collections: 10 (iv); representative: A. A. Heller 9185 (NY, PII, RM, US); Hitchcock 1005, 929 (US); R. C. Rollins 2542 (UTC); Gentry and Davidse 1824 (BRY, NY); L. C. Higgins 1721, 1724 (BRY).

Neotype: L. C. Higgins 1721, collected about 8 miles east of Wells, Elko County, Nevada, 13 July 1968, BRY.

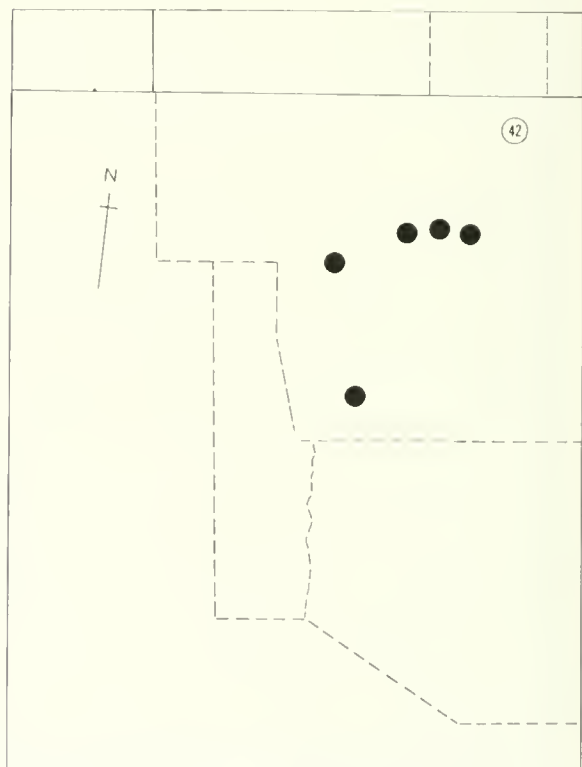
Distribution: Apparently endemic to Elko County, Nevada. Growing on clay soil, in the pinyon-juniper community, 5,000 to 7,500 feet. Map No. 42. June to August.

Dr. Greene stated that he had not seen this plant in any herbarium, but it was collected by him in the mountains of eastern Nevada. He also said, "it abounds in open woods some miles east of Wells." In an attempt to locate this collection of Greene's from east of Wells, no specimen could be found which fit his description. Payson also stated that he was unable to locate the specimen. This type specimen is apparently lost or has been destroyed; as a result a neotype has been selected, Higgins 1721.

This distinctive plant is most closely related to *C. spiculifera*, but differs in the shorter style, tuberculate nutlets, and the longer stems. In a collection by Gentry and Davidse 1824, from Harrison Pass the nutlets were almost smooth; otherwise the plant was quite the same.



Map No. 41. Western Utah and adjoining Nevada. Range of *C. rugulosa* (Payson) Payson



Map No. 42. Northeastern Nevada. Range of *C. interrupta* (Greene) Payson

43. *Cryptantha spiculifera* (Piper) Payson

Cryptantha spiculifera (Piper) Payson, Ann. Mo. Bot. Gard. 14:298. 1927.

Oreocarya spiculifera Piper, Contr. U.S. Natl. Herb. 11:481. 1906.

Oreocarya cilio-hirsuta Nels. & Macbr. Bot. Gaz. 55:378. 1913. (Type: Nelson and Macbride 1799, Muidoka, Idaho, 23 June 1912.)

Perennial, 1.5-3 dm tall; stems 1-several, 1.2-2 dm long, strigose, and spreading setose; leaves oblanceolate, acute to obtuse, 2-7 cm long, 0.3-0.6 cm wide, dorsal surface densely strigose and spreading setose, pustulate, ventral surface similar, petioles conspicuously setose ciliate-margined; inflorescence narrow, 0.4-1.5 dm long, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 4-5 mm long, in fruit becoming 6-10 mm long, strigose and spreading setose; corolla white, the tube 3-4 mm long, crests at base of tube conspicuous, fornicies yellow, rounded, nearly glabrous, about 0.5 mm long, limb 5-9 mm wide; style exceeding mature fruit 1.5-2 mm; nutlets lanceolate to ovate-lanceolate, 2.8-4 mm long, 1.5-2.2 mm wide, one to four nutlets maturing, margins acute, in contact, dorsal surface rugulose, or tuberculate, and with some inconspicuous murications, scar subulate, the margin not elevated. Collections: 65 (ii); representative: A. Cronquist 2396 (GH, IDS, UTC); J. S. Cotton 359 (WTU); R. J. Davis 3803 (GH, IDS); J. F. Macbride 875 (GH, RM, UTC); M. E. Peck 19918 (GH, ORE); Sandberg and Leiberger 164 (GH); Maguire and Holmgren 26223 (GH, UTC, WTU); L. C. Higgins 1635, 1636 (BRY).

Holotype: J. H. Sandberg and J. B. Leiberger 164, collected in Adams County, Washington, at Ritzville, 6 June 1893, US. Photograph at BRY. Isotypes at UC, GH, WTU.

Distribution: Southeastern Washington to southern Idaho and eastern Oregon. Growing on sandy or clay soils, 1,500 to 7,000 feet. Map No. 43. May to July.

Cryptantha spiculifera is a fairly well defined species characterized by narrow radial leaves with their ciliate-margined petioles. In various parts of its range, it may be confused with *C. interrupta*, *C. humilis*, or *C. celosioides*. It differs from *C. interrupta* by the narrower leaves, rugulose nutlets, and the longer style. It can be distinguished from *C. humilis* by its taller habit, rugose nutlets which are not at all muricate, and the different pubescence. From *C. celosioides* it differs in the narrower leaves, a stronger tendency to a multiple caudex, somewhat different nutlets, and a more southerly range.

The plant described as *C. cilio-hirsuta* by Nelson and Macbride is almost identical to the type of *C. spiculifera*, and so is placed in synonymy under that species.

44. *Cryptantha shackletteana* Higgins

Cryptantha shackletteana Higgins, Great Basin Natur-

alist 29:28-30. 1969.

Caespitose perennial herb, 1-3 dm tall; stems slender, weak, 1-several, 0.7-1.8 dm long, strigose and spreading setose with slender weak hairs; leaves linear, 2-13 cm long, 0.1-0.5 cm wide, strigose on both surfaces, and with a few inconspicuous pustulate hairs on the dorsal surface; inflorescence narrow, nearly capitate, 0.2-0.8 dm long; calyx segments linear or narrowly lanceolate, in anthesis 3-5 mm long, in fruit becoming 7-10 mm long, setose, with yellowish spreading hairs; corolla white, the tube 3-3.3 mm long, crests at base of tube evident, fornicies yellow, emarginate, 0.5 mm long, limb 5-6 mm wide; style exceeding mature fruit 1.3-1.6 mm; nutlets lanceolate, 3.3-3.6 mm long, 1.6-2 mm wide, usually all four maturing, the margins acute, in contact, dorsal surface muricate and rugulose with low inconspicuous ridges, the ventral surface similar but the markings much less evident, scar open, subulate, and without an elevated margin. Collections: 2 (0); representative: H. T. Shacklette 6183 (US); Welsh and Moore 8629 (BRY).

Holotype: S. L. Welsh and G. Moore 8629, collected in Alaska, on steep south-facing slope of Eagle Bluff, about 1 mile northwest of Eagle. Growing with *Artemisia frigida* and *Agropyron smithii*, 26 July 1968, BRY.

Cryptantha shackletteana is probably closely related to *C. spiculifera* but differs in the longer and narrower leaves with only inconspicuous pustulate hairs, the more capitate inflorescence, more elongated nutlets with less evident markings, and weaker stems.

45. *Cryptantha celosioides* (Eastw.) Payson

Cryptantha celosioides (Eastw.) Payson, Ann. Mo. Bot. Gard. 14:299. 1927.

Cynoglossom glomeratum Nutt. ex Pursh. Fl. Am. Sept. 2:729. 1814, not *Cryptantha glomerata* Lehm.

Myosotis glomerata Nutt. Gen. Pl. 1:112. 1818.

Rochelia glomerata Torr. Ann. Lye. N.Y. 2:226. 1827.

Eruichium glomeratum A. DC. Prod. 10:131. 1846.

Krynitzkia glomerata Gray, Proc. Am. Acad. 20:279. 1885.

Oreocarya glomerata Greene, Pitt. 1:58. 1887.

Oreocarya affinis Greene, Pitt. 3:110. 1896. (Type: Sand hills near Red Buttes, Wyoming, 5 July 1896, Greene.) not *O. affinis* (Gray) Greene.

Oreocarya celosioides Eastw. Bull. Torrey Bot. Club 30:240. 1903. (Type: T. J. Howell, collected on the banks of the Columbia River, eastern Washington Territory, July 1881.)

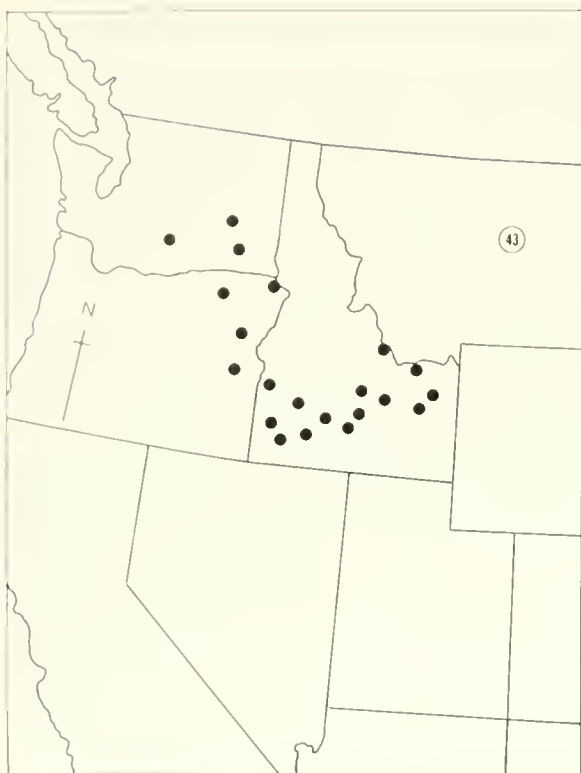
Krynitzkia pustulata Blankenship, Mont. Agr. Coll. Stud. Bot. 1:96. 1905. (Greene, Red Buttes, Wyoming, 5 July 1896.) not *C. pustulata* (Rydb.) Payson.

Oreocarya sericea sensu Piper, Contr. U.S. Natl. Herb. 11:482. 1906, not *C. sericea* (Gray) Payson.

Oreocarya macounii Eastw. Bull. Torrey Bot. Club 40:480. 1913. (Type: Moose Mt. Creek, Saskatchewan, 6 July 1880, John Macoun.)

Oreocarya perennis Rydb. Fl. Rocky Mts. 722. 1917, in part, not *O. affinis perennis* A. Nels.

Oreocarya sheldonii Brand, Fedde, Rep. Spec. Nov. 49:73. 1923. (Type: Deep Creek, Wallowa County, Oregon, 16 June 1897, Sheldon 8315.)



Map No. 43. Parts of northwestern United States. Range of *C. spiculifera* (Piper) Payson.



Map No. 44. Alaska. Range of *C. shacklettiana* Higgins

Cryptantha sheldonii (Brand) Payson, Ann. Mo. Bot. Gard. 14:301. 1927.

Cryptantha macounii (Lastw.) Payson, Ann. Mo. Bot. Gard. 14:303. 1927.

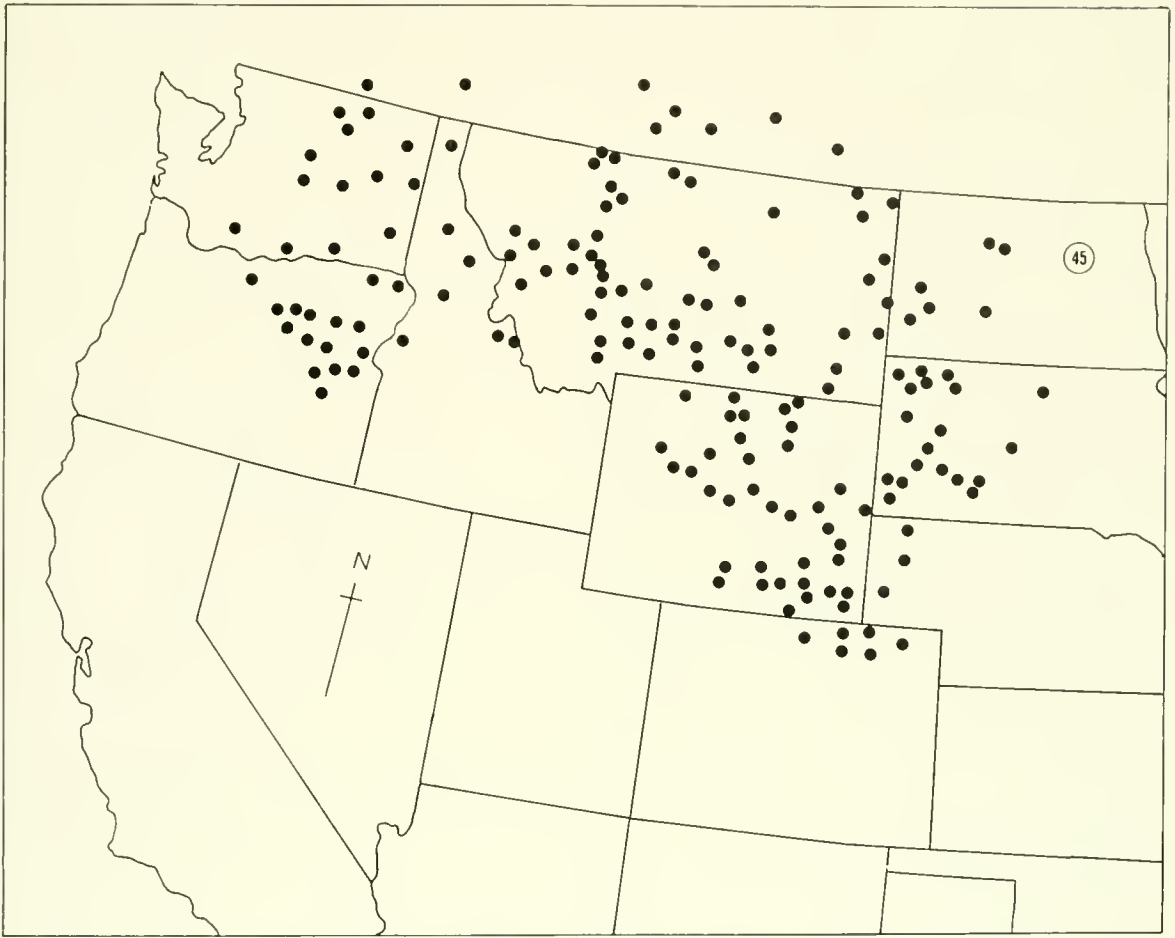
Cryptantha bradburiana Payson, Ann. Mo. Bot. Gard. 14:307. 1927.

Biennial or short-lived perennial, with or without a branched caudex; stems 1-several, 1-6 dm tall, often relatively robust, strigose, setose-hirsute, and subtomentose with pustulate bristles; leaves oblanceolate to spatulate, obtuse to acute, 2.5-9 cm long, 0.4-1.5 cm wide, strigose, setose, and subtomentose, pustulate on both surfaces; inflorescence narrow to open and very broad, 1-3.8 dm long, setose-hirsute; calyx segments lanceolate, 3-6 mm long in anthesis, in fruit becoming 7-12 mm long, setose-hirsute; corolla white, the tube 3-7 mm long, crests at base of tube evident, fornicies yellow, rounded or emarginate, about 0.5 mm long, limb 7-12 mm wide; style exceeding mature fruit 1.5-6 mm; nutlets lanceolate to ovate-lanceolate, 2.8-5 mm long, 1.5-2.6 mm wide, two to four maturing, margins acute or narrowly winged, in contact, dorsal surface tuberculate to deeply and sharply rugose, sometimes papillose between the markings, ventral surface similar but the markings less evident, scar closed or narrowly open at the base, elevated margin lacking. Collections: 457 (xxiv); representative: A. Nelson 1956 (ND-G, RM); M. Ownbey 1043 (IDS, RM); C. L. Hitchcock 17955 (RM, WTU); W. E. Booth 55110 (MONT, RM); P. A. Rydberg and E. A. Bessey 4883 (MONT, RM); C. L. Porter 7752 (RM, WTU); Hitchcock and Muhlack 12553 (RM, UTC, WTU); Maguire and Holmgren 26615 (UC, CAS, IDS, UTC, WTU); A. R. Kruckeberg 2197 (UC, CAS, ORE, UTC, WTU); T. J. Howell s.n. (UC, CAS); J. W. Thompson 11696 (MONT, US, WTU); H. T. Rogers 613 (UC, CAS, UTC); L. C. Higgins 1535, 1538, 1558, 1689, 1693, 1697, 1701, 1704 (BRY).

Lectotype: Bradbury s.n., collected in Upper Louisiana, supposed to be about the Big Bend of the Missouri in what is now South Dakota, PH. Photograph at BRY.

Distribution: Eastern Oregon from Grant County to northern Washington and southern British Columbia, east through the lower parts of northern Idaho to Montana, thence south and east into North Dakota, Nebraska, and Colorado. Growing on dry open slopes and valleys, plains and foothills, occasionally ascending to moderate elevations in the mountains, 1,500 to 8,500 feet. Map No. 45. May to August.

Cryptantha celosioides is a very widespread and polymorphic species with a great amount of variation throughout its range. The species *C. bradburiana*, *sheldonii*, *macounii*, and *celosioides* as recognized by Payson in his monograph have here been combined. The basis for this wholesale combining of species is that no differential characters of high enough magnitude exist to separate out species or even varieties with any consistency. The consistent characters used



Map No. 45. Parts of northwestern United States and adjoining Canada. Range of *C. celosoides* (Eastw.) Payson.

to distinguish species throughout this subgenus seem to entirely break down in the present case; so until more information can be gleaned and utilized, this complex is best treated as a single taxon, even though this is not entirely satisfactory.

This species is distinguished by its setose indument, large corollas, habit, and characteristic inflorescence.

46. *Cryptantha thompsonii* Johnst.

Cryptantha thompsonii Johnst. Contr. Arn. Arb. 3:88, 1932.

Oreocarya thompsonii (Johnst.) Abrams, Abrams Ill. Fl. Pac. St. 3:600, 1951.

Caespitose perennials, 1.5-3 dm tall; stems several from a woody caudex, 1-1.7 dm long, setose-hirsute; leaves oblanceolate, acute to obtuse, 4-8 cm long, 0.4-0.8 cm wide, yellowish tomentose and with scattered appressed setose bristles on both surfaces; inflorescence usually narrow, 0.2-1.3 dm long, foliar bracts evident to conspicuous; calyx segments lanceolate, in anthesis 3.5-4.5 mm long, in fruit becoming 9-12 mm long, setose; corolla white, the tube 3-4 mm long, crests at base of tube evident, fornicies yellow,

low, rounded or emarginate, papillose, limb 6-8 mm wide; style exceeding mature fruit 1-2 mm; nutlets lanceolate, 4-5 mm long, 2-3 mm wide, all four usually maturing, margins narrowly winged or knifelike, in contact, dorsal surface tuberculate and irregularly rugose, ventral surface smooth or slightly uneven, scar open, cuneate, and without an elevated margin. Collections: 25 (ii); representative: J. W. Thompson 8742 (GH, WTU); A. R. Kruckeberg 2750 (ORE, WTU); W. W. Canby 996 (UC); L. C. Higgins 1661, 1667 (BRY).

Holotype: J. W. Thompson 7663, collected in Kittitas County, Washington, on the crest of Iron Mountain, Mount Stuart Region, 1930, GH.

Distribution: Kittitas and Chelan counties in the Wenatchee Mountains of central Washington. Growing on steep talus slopes, 3,000 to 7,000 feet. Map No. 46. Late May to August.

Cryptantha thompsonii is a loosely caespitose species arising from a thick, very woody taproot. It is endemic to the high mountains of east-central Washington. The plant may be distinguished by its thick leaves, nutlets which are smooth on the ventral surface, and the scar which is evidently open for most

of its length. A very distinct species not to be confused with any other in the region where it grows.

47. *Cryptantha sobolifera* Payson

Cryptantha sobolifera Payson, Ann. Mo. Bot. Gard. 14:305, 1927.

Long-lived perennials, 1-1.8 dm tall; stems 1-several from the branched caudex, some of them sterile and prostrate and terminating in soboles, 0.5-0.7 dm long; leaves spatulate to oblanceolate, obtuse, 1.5-4 cm long, 0.5-0.8 cm wide, strigose, and setose-hirsute, also somewhat tomentose, pustules conspicuous on both surfaces, petioles ciliate-margined; inflorescence cylindric, narrow, 0.3-0.8 dm long, setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 3-5 mm long, in fruit becoming 6-7 mm long, strigose and conspicuously setose; corolla white, the tube 3.5-4 mm long, crests at base of tube well developed, fornices yellow, emarginate, distinctly papillose, about 1 mm long, limb 6-8 mm wide; style exceeding mature fruit 1.8-2.5 mm; nutlets ovate-lanceolate, 2.5-3.5 mm long, 1.4-1.7 mm wide, dorsal surface with low inconspicuous tubercles or ridges, or sometimes almost smooth, ventral surface smooth or nearly so, scar straight, closed, the margin not elevated. Collections: 3 (0); representative: M. E. Jones s.n. (POM); Pennell, Cotner and Schaeffer 23928 (US); Hitchcock and Muhlick 13021 (RM).

Holotype: M. E. Jones s.n., collected in Glacier County, Montana, at Upper Marias Pass, 10 September 1909, POM. Photograph at BRY.

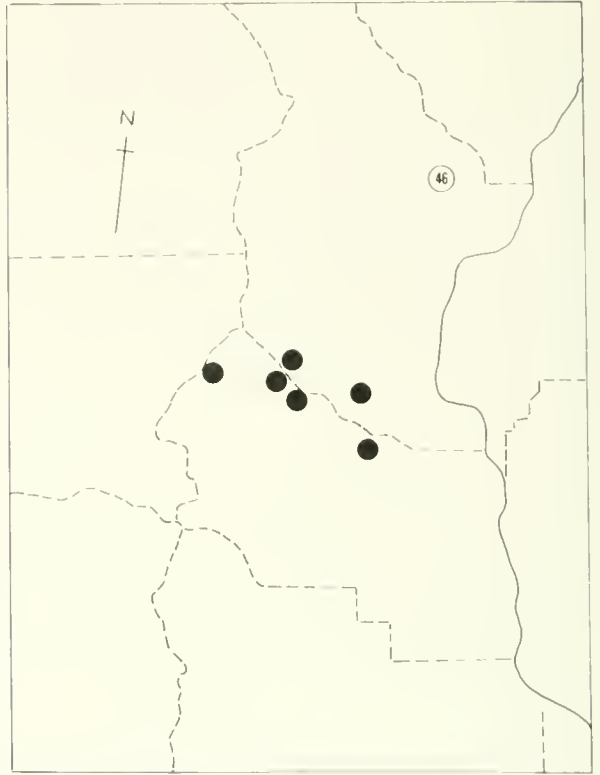
Distribution: Western Montana in the high Rocky Mountains. Growing on sandy soil or serpentine talus slopes, 5,000 to 10,000 feet. Map no. 47. Late June to September.

This species is not very well known or represented by herbarium specimens, and more collections of it are badly needed. It is perhaps most closely related to *C. celosoides*, but differs in the smooth ventral surface of the nutlets, the soboliferous leaves, and different flowering time.

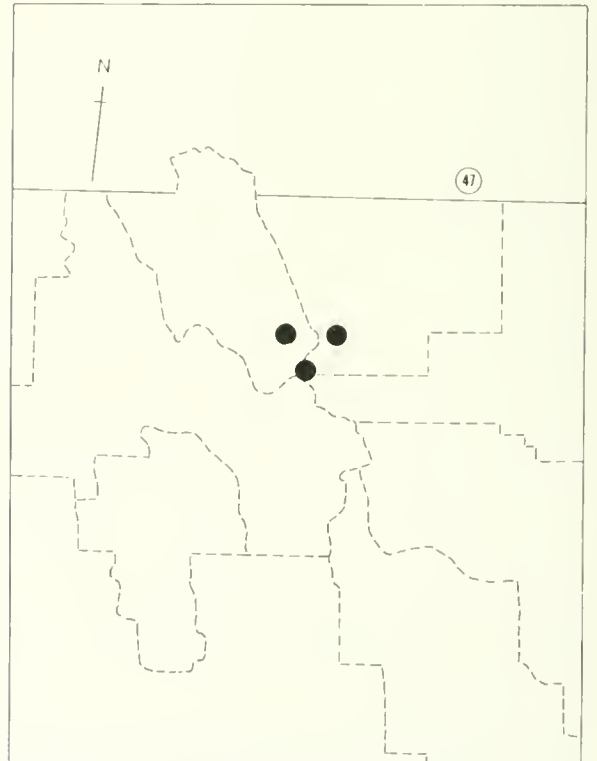
48. *Cryptantha grahamii* Johnst.

Cryptantha grahamii Johnst. Journ. Arn. Arb. 20:391, 1939.

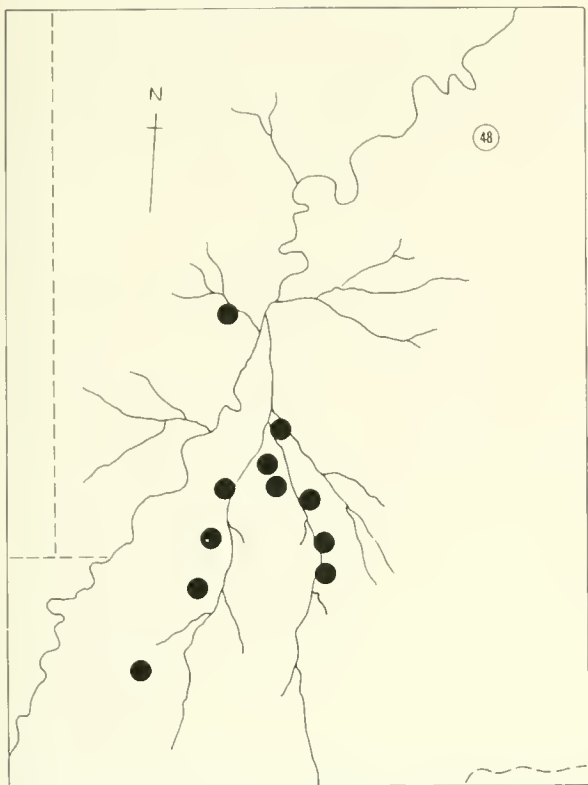
Long-lived perennial from a thick woody taproot, 1.5-2 dm tall; stems several, 0.4-1.2 dm long, weakly spreading setose; leaves spatulate to oblanceolate, 2-4.5 cm long, 0.4-1 cm wide, conspicuously setose-pustulate on both surfaces, with some finer pubescence beneath; inflorescence narrow, 0.4-1 dm long, setose, foliar bracts evident but not conspicuous; calyx segments lanceolate, in anthesis 5-7 mm long, in fruit becoming 7-9 mm long, abundantly setose;



Map No. 46. Central Washington, Kittitas and Chelan Counties. Range of *C. thompsonii* Johnston.



Map No. 47. Glacier County, Montana. Range of *C. sobolifera* Payson.



Map No. 48. Uintah County, Utah. Range of *C. grahamii* Johnston.

corolla white, the tube 3.5-5 mm long, constricted at the middle, crests at base of tube evident, fornicies yellow, emarginate, papillose, 0.5-1 mm long, limb 11-15 mm wide; style coarse, exceeding mature fruit 1.8-2.1 mm; nutlets lanceolate, 3-3.8 mm long, 1.7-2 mm wide, two to four maturing, margins in contact, acute, both surfaces of nutlet with inconspicuous small, low rounded tubercles, or some of these confluent into short irregular ridges, scar straight, open, narrowly linear, the margin not elevated. Collections: 17 (x); representative: R. C. Rollins 1707 (GH, RM); E. H. Graham 7924 (GH); Holmgren and Reveal 1879 (BRY, UTC); R. C. Rollins 1716 (GH); E. H. Graham 8962 (GH); L. C. Higgins 1602, 1607, 1610, 1876, 1885 (BRY).

Holotype: Edward H. Graham 7924, collected in Uintah County, Utah, on bench west of Green River north of mouth of Sand Wash, 4,500 feet, 28 May 1933. GH. Photograph at BRY.

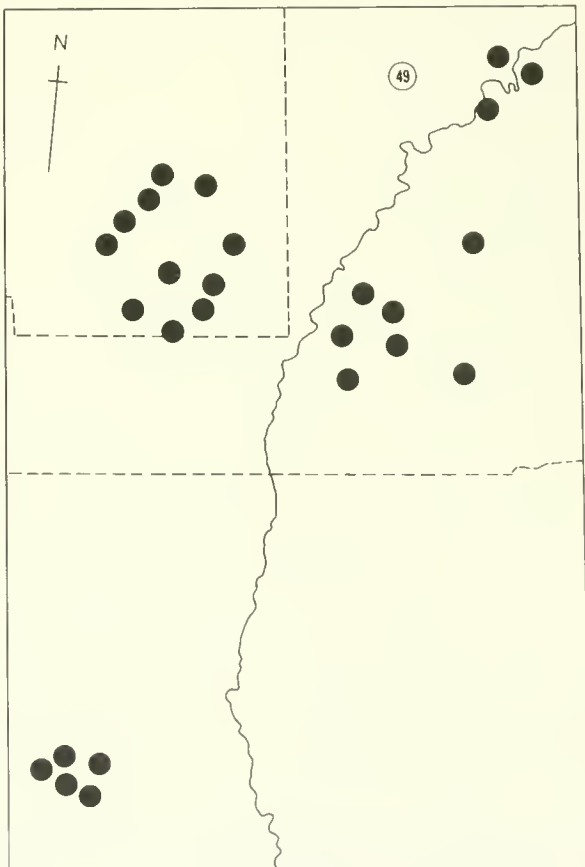
Distribution: Endemic to the Uintah Basin, Uintah County, Utah, along Willow Creek and the Willow Creep drainage basin. Growing on white shale, 4,300 to 6,000 feet. Map No. 48. May to June.

Cryptantha grahamii can be distinguished from other species of the Uintah Basin by its large corolla, tuberculate nutlets, coarse style, and the thick, black, woody caudex.

49. *Cryptantha rollinsii* Johnston.

Cryptantha rollinsii Johnston. Journ. Arn. Arb. 20:391. 1939.

Biennial herbs 1-3.5 dm tall; stems 1-several, 0.2-1 dm long, setose; leaves clustered at the base, gradually reduced upward, oblanceolate to spatulate, obtuse to acute, 2-5 cm long, 0.5-1.5 cm wide, setose and hispid, pustulate on both surfaces; inflorescence narrow to somewhat open at maturity, cylindrical to obovoid, racemes in dense glomerules, three to six flowered, hispid, 0.5-2 dm long; calyx segments linear, in anthesis 7-8 mm long, in fruit becoming 8-10 mm long, hispid; corolla white, campanulate, the tube 7-9 mm long, crests at base of tube evident, fornicies yellow, papillose, about 0.5-1 mm long, limb 7-8 mm wide; plants slightly heterostyled; nutlets lanceolate, 3-4 mm long, 1-1.5 mm wide, obscurely rugulose and tuberculate on the dorsal surface, ventral surface smooth, scar closed, and without an elevated margin. Collections: 42 (xii); representative: R. C. Rollins 3084 (GH, RM); R. C. Rollins 1715 (GH); Ripley and Barneby 7804 (GH); E. H. Graham 7870 (GH); B. F. Harrison 400H (BRY, GH); J. Brotherson 1049 (BRY); D. Atwood 1617 (BRY); Welsh and Christensen 6622 (BRY); L. C. Higgins



Map No. 49. Eastern and northern Utah. Range of *C. rollinsii* Johnston.

1056, 1068, 1324, 1606, 1880 (BRY).

Holotype: Reed C. Rollins 1715, collected in Uintah County, Utah, shale hillside on Thorne's Ranch near Willow Creek, 22 miles south of Ouray, 5,500 feet, 16 June 1937, GIL. Photograph at BRY.

Distribution: Central and northeastern Utah in Emery, Uintah, and Duchesne counties. Growing on white or red shale, 4,000 to 6,000 feet. Map No. 49. May to July.

Cryptantha rollinsii is very common in the Uintah Basin, and can be found on most shaley hillsides throughout the region. An isolated population also occurs in Emery County on the south end of the San Rafael Swell near Temple Mountain, but is undoubtedly the same species.

This distinctive plant may be recognized by its campanulate corolla, nearly smooth nutlets, non-caespitose habit, and single stem.

50. *Cryptantha wetherillii* (Eastw.) Payson

Cryptantha wetherillii (Eastw.) Payson, Ann. Mo. Bot. Gard. 14:324, 1927.

Krynitzkia glomerata var. *acuta* Jones, Zoe 2:250. 1891. (Type: Cisco, Utah, 2 May 1890, Jones.)

Oreocarya wetherillii Eastw. Bull. Torrey Bot. Club 30:242. 1903.

Biennial or short-lived perennials, 1-3.5 dm tall; stems 1-6, 0.5-0.8 dm long, branched from the base with one stout stem and usually several low slender stems; leaves clustered at the base, gradually reduced upward, spatulate to broadly oblanceolate, the apices obtuse to rounded, 2.5-5 cm long, 0.7-1.6 cm wide, strigose and appressed setose, dorsal surface conspicuously pustulate, ventral surface with few or no pustules; inflorescence becoming broad in age due to the elongation of the racemes, 0.6-3 dm long; calyx segments lanceolate, in anthesis 5-7 mm long, in fruit becoming 7-13 mm long, white setose; corolla white, the tube 7-10 mm long, crests at base of tube lacking, fornicies light-yellow, emarginate, papillose, about 1 mm long, limb 6-13 mm wide; style exceeding mature fruit 3-5 mm; nutlets lanceolate or ovate-lanceolate, 3.5-4 mm long, 2-2.5 mm wide, usually all four maturing, margins acute, in contact, dorsal surface distinctly tuberculate and often rugulose as well as with numerous murications between the larger roughenings, ventral surface similar but the markings not as distinct, scar open, linear, surrounded by a slightly elevated margin. Collections: 24 (v); representative: A. Eastwood s.n. (UC, CAS); M. E. Jones 6734 (UC, GIL, RM); B. Maguire 18229 (UC, UTC); W. P. Cottam 2073 (BRY); G. L. Pyrah (BRY, UTC); Welsh and Moore 2786 (BRY); L. C. Higgins 1476 (BRY).

Lectotype: A. Eastwood s.n., collected in Grand County, Utah, near Moab, Court House Wash, 25 May 1892, CAS. Photograph at BRY. Isotype at UC.

Distribution: East central Utah in Grand, Carbon, Emery, Wayne, and Garfield counties. Usually grow-

ing on heavy clay soils, 4,000 to 6,000 feet. Map No. 50. April to June.

Cryptantha wetherillii is a close relative of *C. longiflora*, but differs in the shorter corolla tube, tuberculate nutlets, ventral surface of the leaves without or with only a few pustules, and the flowers which are not strongly dimorphic.

51. *Cryptantha longiflora* (A. Nels.) Payson

Cryptantha longiflora (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:326, 1927.

Oreocarya longiflora A. Nels. Erythea 7:67. 1899.

Oreocarya horridula Greene, Pl. Baker. 3:20. 1901. (Type: Deer Run, Colorado, 11 June, on dry bank, C. L. Baker 133.)

Short-lived perennial or possibly biennial, 0.8-3 (5) dm tall; stems 1-several, 0.5-1 dm long, setose and spreading hirsute; leaves spatulate, obovate or oblanceolate, 2-7 cm long, 0.5-1.5 cm wide, both surfaces strigose and strongly hirsute, pustulate; inflorescence broad and open, 0.7-2.5 dm long, setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 7-10 mm long, in fruit becoming 10-16 mm long, setose; corolla white, the tube 12-14 mm long, crests at base of tube lacking, fornicies yellow, emarginate, broad, rounded, papillose, 0.5-1 mm long, limb 9-11 mm wide; style exceeding mature fruit 4-9 mm (heterostyled); nutlets lanceolate-ovate, 3-4 mm long, 2.2-2.6 mm wide, 2-4 maturing, both surfaces with tubercles and low rounded ridges, scar straight, closed or very narrowly open, with a slightly elevated margin. Collections: 36 (vi); representative: S. L. Welsh 6989, 6966 (BRY); R. C. Rollins 2181 (RM, UTC); W. A. Weber 3799 (COLO, UTC); D. Wiens 3061 (BRY, COLO); G. E. Osterhout 5995 (RM); A. H. Barnum 799 (DIX); C. F. Baker 133 (ND-G); L. C. Higgins 1478, 3314 (BRY).

Holotype: C. S. Crandall s.n., collected in Mesa County, Colorado, at Palisades, 14 May 1898, RM. Photograph at BRY.

Distribution: Western Colorado and eastern Utah along the Colorado River drainage. Growing on sandy to clay soils, 3,800 to 6,000 feet. Map No. 51. May and June.

This species is perhaps most closely related to *C. wetherillii*, but differs in several notable respects as discussed under that species.

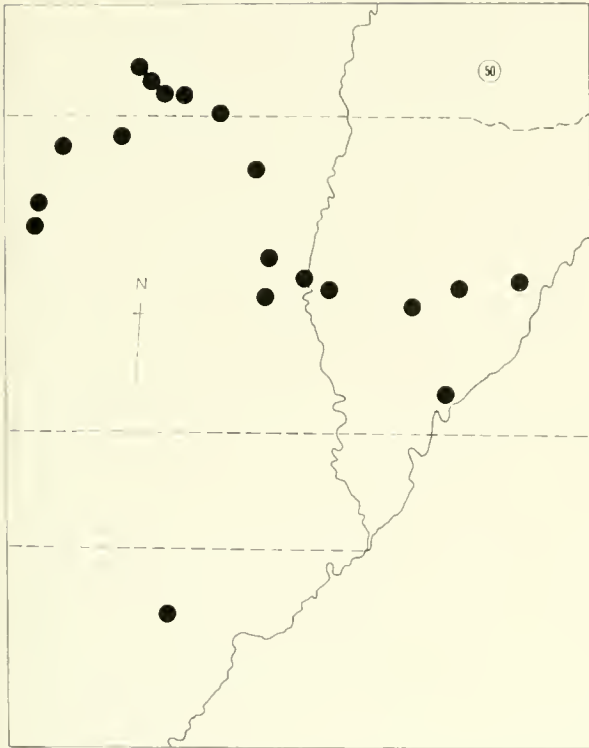
The type of *Oreocarya horridula*, described by Greene from Deer Run is the same in every respect as this taxon, so is placed in synonymy under it.

52. *Cryptantha tenuis* (Eastw.) Payson

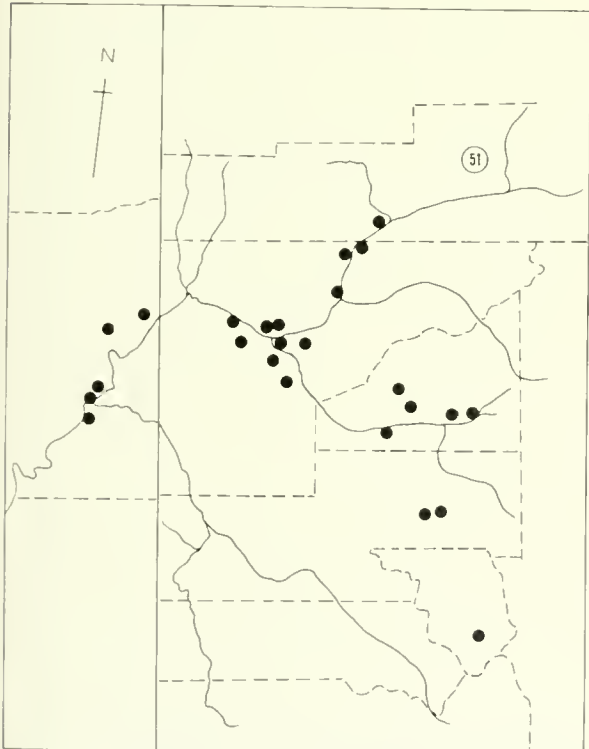
Cryptantha tenuis (Eastw.) Payson, Ann. Mo. Bot. Gard. 14:327, 1927.

Oreocarya tenuis Eastw. Bull. Torrey Bot. Club 30:244. 1903.

Caespitose perennials, 1.3-2.5 dm tall; stems



Map No. 50. Eastern Utah. Range of *C. wetherillii* (Eastw.) Payson.



Map No. 51. Western Colorado and eastern Utah. Range of *C. longiflora* (A. Nels.) Payson.

slender, 1-many, 0.8-1.2 dm long, strigose and weakly spreading setose; leaves linear-spatulate, mostly basal, obtuse, 2-5 cm long, 0.3-0.6 cm wide, dorsal surface strigose and weakly spreading setose, conspicuously pustulate, ventral surface uniformly strigose and without pustules; inflorescence narrow, interrupted, 0.6-1.4 dm long, weakly setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 4.5-6 mm long, in fruit becoming 7-9 mm long, white setose; corolla white, the tube 5.5-7 mm long, crests at base of tube lacking or sometimes evident, fornicies yellow, broad, emarginate, papillose, about 0.5 mm long, limb campanulate, 5-8 mm wide; style exceeding mature fruit 3-4 mm; nutlets lanceolate, 3-4 mm long, 1.8-2 mm wide, all four usually maturing, margins acute, nearly in contact, dorsal surface carinate, sharply and deeply rugose, ventral surface rugose, scar open, constricted above the base, and with an elevated margin. Collections: 40 (vii); representative: A. H. Holmgren 3237 (US); R. C. Barneby 13075 (CAS); A. Eastwood s.n. (UC, CAS); B. F. Harrison 11576 (BRY, UC); A. Cronquist 8978 (UTC); S. L. Welsh 6999, 7053, 7061, 7066 (BRY); D. Atwood 1541 (BRY); L. C. Higgins 1000, 537, 1281, 1326, 1334 (BRY).

Holotype: Alice Eastwood s.n., collected in Grand County, Utah, near Moab, in Court House Wash, 25 May 1892. CAS. Photograph at BRY.

Distribution: Southeastern Utah in Emery, Grand, Wayne, and San Juan counties. Growing on sandy to clay soils, 2,500 to 5,500 feet. Map No. 52. Late April to July.

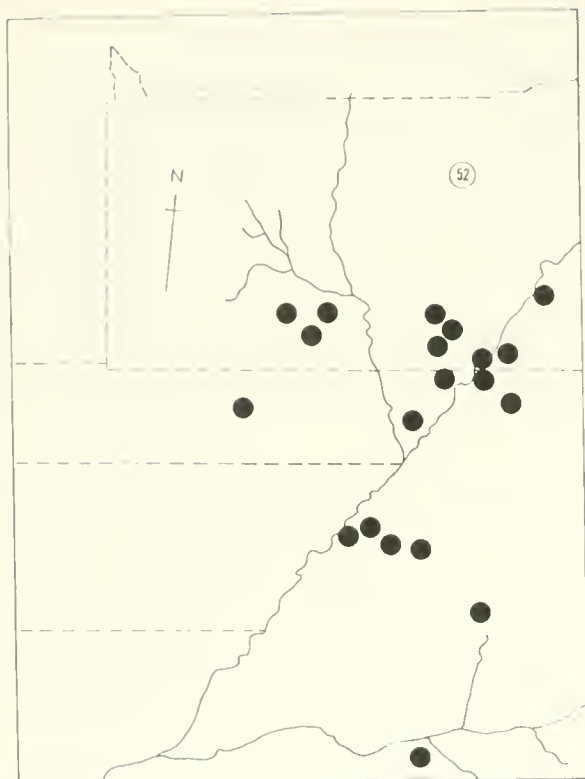
Cryptantha tenuis is often confused with *C. osterhoutii*, but differs in its taller habit, longer leaves, larger campanulate corolla, and the longer calyx and style.

53. *Cryptantha osterhoutii* (Payson) Payson

Cryptantha osterhoutii (Payson) Payson, Ann. Mo. Bot. Gard. 14:329. 1927.

Oreocarya osterhoutii Payson, Univ. Wyo. Publ. Bot. 1:167. 1926.

Densely caespitose perennials, 0.7-1.2 dm tall; stems slender, many, arising from the densely branched multiple caudex, 0.3-0.6 mm long, strigose and spreading setose; leaves spatulate to oblanceolate, obtuse, 1-3 cm long, 0.3-0.8 cm wide, dorsal surface strigose and appressed setose, pustulate, ventral surface strigose, not pustulate or the pustulae inconspicuous, petioles ciliate margined; inflorescence open, 0.3-0.8 dm long, weakly white setose, foliar bracts inconspicuous; calyx segments lanceolate, in anthesis 2.5-4 mm long, in fruit becoming 5-6.5 mm long, strigose and spreading white setose; corolla white, the tube 2-3 mm long, crests at base of tube usually evident but poorly developed, fornicies yellow, broad, emarginate, papillose, about 0.5 mm long, limb 5-7 mm wide; style exceeding mature fruit



Map No. 52. Southeastern Utah. Range of *C. tenuis* (Fastw.) Payson.



Map No. 53. Western Colorado and southeastern Utah. Range of *C. osterhoutii* (Payson) Payson.

0.2-0.7 mm; nutlets lanceolate, 2.7-3.2 mm long, 1.8-2.2 mm wide, usually less than four maturing, margins obtuse, not in contact, dorsal surface carinate, sharply tuberculate and rugose, ventral surface sharply tuberculate, scar open, constricted above the base, elevated margin evident but not conspicuous. Collections: 16 (ii); representative: W. A. Weber 6088 (ARIZ., COLO., CS., RM., UTC); G. F. Osterhout 6138 (COLO., RM); D. Atwood 1538A (BRY); B. F. Harrison 11923 (BRY); Welsh, Moore and Canter 2946 (BRY); G. Moore 399 (BRY); G. Moore 299 (BRY); S. L. Welsh 7070 (BRY).

Holotype: G. F. Osterhout 6138, collected in Monument Park, near Grand Junction, Mesa County, Colorado, 3 June 1921, RM. Photograph at BRY. Isotype at COLO.

Distribution: Mesa County, Colorado, and San Juan County, Utah. Growing in sandy soil, 2,500 to 6,000 feet. Map No. 53. May to June.

This very distinctive species is not often collected, but is one of the most distinct in the entire subgenus because of its small size.

54. *Cryptantha paradoxa* (A. Nels.) Payson

Cryptantha paradoxa (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:330, 1927.

Orcocarya paradoxa A. Nels. Bot. Gaz. 56:69, 1913.

Orcocarya gypsophila Payson, Bot. Gaz. 60:380, 1915. (Type: On dry gypsum hill in Paradox Valley, Colorado, 18 June 1914, Payson 458.)

Caespitose perennial, 0.4-1.2 dm tall; stems many, slender, 0.2-0.8 dm long, subtomentose near the base, weakly setose above; leaves oblanceolate to spatulate, usually folded, obtuse, 1.5-4 cm long, 0.2-0.4 cm wide, dorsal surface with appressed setose-pustulate hairs, ventral surface uniformly strigose and without pustulate hairs, the petioles ciliate-margined; inflorescence subcapitate, 0.1-0.4 dm long, setose, foliar bracts inconspicuous; calyx segments linear-lanceolate, in anthesis 5-6 mm long, in fruit becoming 6-8 mm long, weakly setose; corolla white, usually with a yellow tube 10-12 mm long, crests at base of tube lacking, fornices yellow, broad, slightly emarginate, papillose, about 0.5 mm long, limb 10-12 (15) mm wide; style exceeding mature fruit 4-9 mm; nutlets lanceolate, turgid, 2-3 mm long, 1.3-1.6 mm wide, all four usually maturing, margins acute to obtuse, not in contact, dorsal surface densely tuberculate and conspicuously rugose, ventral surface tuberculate, also somewhat rugulose, scar open, constricted below the middle, the margin elevated. Collections: 16 (vii); representative: E. P. Walker 91 (RM); Payson and Payson 4223 (GH, RM); E. B. Payson 458 (GH, RM); W. A. Weber 4722 (COLO., RM, UTC); A. Cronquist 9204 (UTC); B. Maguire 18282 (UTC); B. F. Harrison 9607 (BRY); Higgins and Reveal 1272 (BRY); L. C. Higgins 1314, 1317, 1319, 1901, 3298 (BRY).



Map No. 54. Western Colorado and eastern Utah. Range of *C. paradoxa* (A. Nels.) Payson.



Map No. 55. Southwestern Colorado, southeastern Utah, and parts of adjoining states. Range of *C. bakeri* (Greene) Payson.

Holotype: E. P. Walker 91, collected in Montrose County, Colorado, on dry gypsum hills in Paradox Valley, 17 June 1912, RM. Photograph at BRY. Isotypes at GH, POM, US.

Distribution: Western and southwestern Colorado and Emery County, Utah. Growing on clay or sandy soil, 4,000 to 7,000 feet. Map No. 54. May and June.

Cryptantha gypsophila is the same plant in every respect as *C. paradoxa*. Payson noted, "unfortunately the specimens of *paradoxa* had not been mounted and so were not available when *gypsophila* was described. However, there is no doubt that the two names are completely synonymous."

This delicate little species may be distinguished by its densely caespitose habit, short leaves, and the long dimorphic corollas.

55. *Cryptantha bakeri* (Greene) Payson

Cryptantha bakeri (Greene) Payson. Ann. Mo. Bot. Gard. 14:331. 1927.

Oreocarya bakeri Greene, Pitt. 4:92. 1899.

Oreocarya culophus Rydb. Bull. Torrey Bot. Club 31:637. 1904. (Type: Delores, Colorado, 1892, Crandall s.n.)

Biennial or short-lived perennials, 1-3 dm tall; stems 1-4 (6), 0.5-1 dm long, spreading setose-hirsute; leaves oblanceolate, obtuse, mostly basal, 3-6 cm long, 0.5-1.2 cm wide, dorsal surface strigose and spreading setose, pustulate, ventral surface uniformly strigose and with few or no pustulate hairs; inflorescence narrow, 0.6-2.5 dm long, setose-hirsute, foliar bracts evident, slightly surpassing the individual

cymes; calyx segments broadly lanceolate or ovate, in anthesis 3.5-4 mm long, in fruit becoming 6-8 mm long, conspicuously setose; corolla white, the tube 4-6 mm long, crests at base of tube lacking, fornicies yellow, emarginate, 1-1.5 mm long, limb 6-8 mm wide; style exceeding mature fruit 1-2 mm; nutlets ovate-lanceolate, 2.5-3 mm long, 1.5-2 mm wide, three to four usually maturing, margins obtuse, nearly in contact, dorsal surface deeply and sharply rugose, ventral surface tuberculate and short rugose, scar closed, surrounded by a definitely elevated white margin. Collections: 49 (vi); representative: Baker, Earle and Tracy 827 (ND-G); R. C. Rollins 2223 (RM, UTC); W. A. Weber 8732 (COLO); Eardman 39 (BRY, COLO); A. H. Holmgren 3374 (BRY, UTC); H. M. Schmolli 1281 (COLO, RM); A. Nelson 10408 (RM); D. Atwood 1539A (BRY). L. C. Higgins 1903, 1948, 3558 (BRY, WTSU).

Holotype: Baker, Earle and Tracy 827, collected on the Mancos River sage plains in southern Colorado, 8 July 1898, ND-G. Photograph at BRY. Isotype at POM.

Distribution: Southwestern Colorado, northeastern Arizona, and southeastern Utah. Growing on sandy or clay soils, 4,000 to 8,000 feet. Map No. 55. May to August.

This species is very distinct, however, very closely related to *C. flavoculata* and often confused with it. It can be distinguished by its leaves which lack pustules on the ventral surface, shorter corolla tube, the shorter style, and the nutlets which have the scar tightly closed and the margin elevated.

56. *Cryptantha mensana* (Jones) Payson

Cryptantha mensana (Jones) Payson, Ann. Mo. Bot. Gard. 14:333. 1927.

Krynitzkia mensana Jones, Contr. West. Bot. 13:4. 1910.
Oreocarya mensana (Jones) Payson, Univ. Wyo. Publ. Bot. 1:171. 1926.

Short-lived perennials, 1-1.5 dm tall; stems 1-several, 0.5-1.2 dm long, setose-hirsute, with some finer strigose hairs beneath; leaves oblanceolate to spatulate, obtuse, 3-8 cm long, 0.5-1.4 cm wide, lower surface setose with pustulate hairs, also finely strigose, ventral side strigose, less setose, and with fewer pustules; inflorescence broad, open, 0.4-1.2 dm long, setose, foliar bracts well developed; calyx segments lanceolate, in anthesis 4-5 mm long, in fruit becoming 7-8 mm long, setose-hirsute; corolla white, the tube 3-4 mm long, crests at base of tube lacking or nearly so, fornicees yellow, rounded, slightly papillose, about 0.5 mm long, limb 5-8 mm wide; style exceeding mature fruit 1.5-2 mm; nutlets ovoid, 3-3.5 mm long, 1.6-1.9 mm wide, margins obtuse, not in contact, dorsal surface rugose, tuberculate and somewhat muricate, ventral surface conspicuously tuberculate, scar open, constricted at the middle and surrounded by a high elevated margin. Collections: 20 (vi); representative: B. F. Harrison 5625 (RM); M. E. Jones 5445 (POM); S. L. Welsh 6915 (BRY); B. Maguire 18596 (UTC); A. Nelson 5625 (RM); G. L. Pyrah 15 (BRY); D. Atwood 1270, 1284 (BRY); Higgins and Reveal 1298 (BRY); Higgins and Welsh 1043 (BRY); L. C. Higgins 996, 1039, 1318, 3323 (BRY).

Holotype: M. E. Jones 5445p, collected in Emery County, Utah, 16 May 1894, POM. Photograph at BRY. Isotype at US.

Distribution: Central and eastern Utah in Emery, Carbon, and Grand counties. Growing on clay soils, 4,500 to 6,500 feet. Map No. 56. Late April to July.

Cryptantha mensana is closely related to *C. flavoculata*, but the short corolla and the more open inflorescence serve to distinguish it from that species.

57. *Cryptantha flavoculata* (A. Nels.) Payson

Cryptantha flavoculata (A. Nels.) Payson, Ann. Mo. Bot. Gard. 14:334. 1927.

Oreocarya flavoculata A. Nels. Frythea 7:66. 1899.

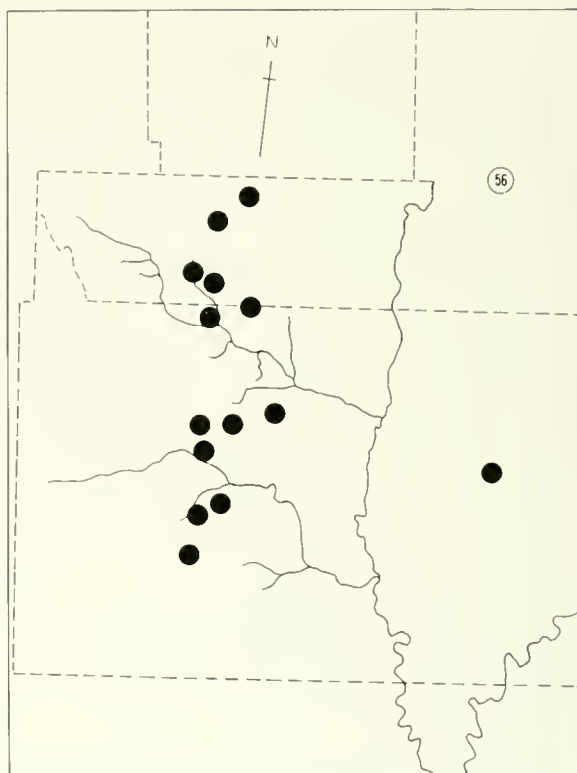
Oreocarya flavoculata spatulata A. Nels. Frythea 7:67. 1899. (Type: from gravelly hilltops near Evanston, Wyoming, Nelson 2977, 29 May 1897.)

Oreocarya cristata Eastw. Bull. Torrey Bot. Club 30:244. 1903. (Type: Grand Junction, Colorado, 17 May 1892, Eastwood.)

Oreocarya shockleyi Eastw. Bull. Torrey Bot. Club 30:245. 1903. (Type: Miller Mountain, Esmeralda County, Nevada, elevation 7,500 feet, Shockley 244.)

Oreocarya eastwoodae Nels. & Kennedy, Muhlenbergia 3:141. 1908. (Type: Mormon Mountains, Lincoln County, Nevada, P. B. Kennedy and L. N. Goodding 146.)

Caespitose perennial, 1-3.7 dm tall; stems 1-several, slender, 0.5-2 dm long, strigose and spreading



Map No. 56. Central and eastern Utah. Range of *C. mensana* (M. E. Jones) Payson.



Map No. 57. Parts of western United States. Range of *C. flavoculata* (A. Nels.) Payson.

setose with slender bristles; leaves linear-oblongulate to spatulate, obtuse to sometimes acute, 3-11 cm long, 0.3-1.5 cm wide, densely strigose and weakly setose, dorsal surface conspicuously pustulate, ventral surface with few pustules or sometimes silky-strigose; inflorescence narrow, or sometimes slightly open and lax, 0.5-3 dm long, foliar bracts evident but not conspicuous; calyx segments in anthesis linear-lanceolate, 5-6 mm long, in fruit becoming 8-10 mm long and becoming broadly lanceolate to ovate; corolla white or pale yellow, tube 7-10 mm long, crests at base of tube lacking, fornicies yellow, minutely papillose, 1-2 mm long, limb 8-12 mm wide; style exceeding mature fruit 4-8 mm (heterostyled); nutlets lanceolate to lance-ovate, 2.5-3.5 mm long, 1.8-2 mm wide, usually all four maturing, margins obtuse, in contact or slightly separated, dorsal surface muricate, tuberculate, and with conspicuously ridges, sometimes nearly foveolate, ventral surface tuberculate, rarely with ridges, scar open, constricted near the middle and surrounded by a high elevated margin. Collections: 188 (xix); representative: Maguire and Holmgren 26064 (ORE, UTC); I. W. Clokey 7668 (ARIZ, ORE, LL, UTC); B. Maguire 25234 (ARIZ, BRY, ORE, UTC); J. Beatley 4007 (BRY, LA); B. F. Harrison 10320 (BRY, UTC); A. Nelson 4572 (RM); A. Eastwood s.n. (UC); G. E. Osterhout 6006 (GH, RM, US); Kennedy and Goodding 146 (RM, US);

Shockley 244 (UC) L. C. Higgins 557, 997, 1026, 1061, 1112 (BRY); L. C. Higgins 3291, 3324, 3403 (BRY, WTSU).

Holotype: A. Nelson 4572, collected at Piedmont, Wyoming, 7 June 1898, RM.

Distribution: Southern Wyoming, western Colorado, Utah, Nevada, and southeastern California. Growing in a wide variety soils, 3,000 to 8,500 feet. Map No. 57. April to July.

This widespread species may be distinguished by its long corolla tube, very rugose nutlets with the scar open and the margin elevated, and the only slightly heterostyled flowers.

This species possesses a number of different forms, but they seem to be unworthy of named segregation from the main specific complex. In western Colorado the author is familiar with two forms, on the basis of setose-hispid and silky-strigose indument. For a limited locality it would seem that these two forms are worthy of some subspecific rank, but on an examination of a series of specimens it appears the variation is only local. *Oreocarya cristata* has very narrow leaves and so has a slightly different aspect. On the same basis of leaf width *spatulata shockleyi*, and *eastwoodae* were described. At the present time the author can see no difference on which to separate them.

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The Kilgore Research Center, and Brigham Young University for their financial help which made it possible to do the necessary field work. Special thanks is given to the curators of the many herbaria for making specimens available for study. What authenticity this study may possess is due in large part to the 7,000 sheets they made available for study, including the vast majority of types.

APPENDIX

Synonyms

The names presented in the following list consist of the synonyms of the species treated in the foregoing work. The names in the left column are the synonyms; those in the column on the right are the names of the species in the present treatment.

CYNAGLOSSUM

C. glomeratum Nutt. ex Pursh *C. celosioides* (Eastw.) Pays. p. 49

CRYPTANTHIA

C. andina Johnst. *C. subretusa* Johnst. p. 28
C. bradburiana Pays. *C. celosioides* (Eastw.) Pays. p. 50
C. clemensae Pays. *C. nubigena* (Greene) Pays. p. 27
C. confertiflora var. *flava* (A. Nels.) Brand *C. flava* (A. Nels.) Pays. p. 22
C. confertiflora var. *lutescens* (Greene) Brand *C. flava* (A. Nels.) Pays. p. 22
C. coryi Johnst. *C. palmeri* (Gray) Pays. p. 18
C. echinoides (Jones) Pays. *C. fulvocanescens* var. *echinoides* (Jones) Higgins p. 42
C. jamesii var. *cinerea* (Greene) Pays. *C. jamesii* var. *setosa* (Jones) Johnst. p. 16
C. macounii (Eastw.) Pays. *C. celosioides* (Eastw.) Payson p. 50
C. modesta Payson *C. abata* Johnst. p. 33
C. nana var. *commixta* (Macbr.) Pays. *C. humilis* var. *commixta* (Macbr.) Higgins p. 37
C. nana var. *ovina* Pays. *C. humilis* var. *ovina* (Pays.) Higgins p. 37
C. nana var. *shantzii* (Tidestr.) Pays. *C. humilis* var. *shantzii* (Tidestr.) Higgins p. 37
C. nana var. *nana* *C. humilis* var. *nana* (Eastw.) Higgins p. 37
C. pustulosa (Rydb.) Pays. *C. jamesii* var. *pustulosa* (Rydb.) p. 18
C. sericea var. *perennis* (A. Nels.) Pays. *C. sericea* (Gray) Pays. p. 45
C. sheldonii (Brand) Pays. *C. celosioides* (Eastw.) Pays. p. 50

ERITRICIUM

E. fulvocanescens Gray *C. fulvocanescens* var. *fulvocanescens* p. 42
E. glomeratum A. DC. *C. celosioides* (Eastw.) Pays. p. 49
E. glomeratum var. *fulvocanescens* S. Wats. *C. fulvocanescens* var. *fulvocanescens* p. 42
E. glomeratum var. *hispidissimum* Torr. *C. thyrsoflora* (Greene) Pays. p. 43
E. glomeratum var. *humile* Gray *C. humilis* var. *humilis* p. 36
E. glomeratum var. *virgatum* Porter *C. virgata* (Porter) Pays. p. 30
E. jamesii Torr. *C. jamesii* var. *jamesii* p. 17
E. leucophaceum (Dougl.) A. DC. *C. leucophaca* (Dougl.) Pays. p. 24
E. multicaule Torr. *C. jamesii* var. *multicaulis* (Torr.) Pays. p. 15
E. setosissima Gray *C. setosissima* (Gray) Pays. p. 29
E. virgatum Porter *C. virgata* (Porter) Pays. p. 30

HEMISPHEROCARYA

H. cinerea (Greene) Brand *C. jamesii* var. *setosa* (Jones) Johnst. p. 16
H. laxa (Macbr.) Brand *C. jamesii* var. *laxa* (Macbr.) Pays. p. 16
H. oblata (Jones) Brand *C. oblata* (Jones) Pays. p. 19
H. palmeri (Gray) Brand *C. palmeri* (Gray) Pays. p. 18
H. paysonii (Macbr.) Brand *C. paysonii* (Macbr.) Johnst. p. 19
H. abortiva (Greene) Brand *C. jamesii* var. *abortiva* (Greene) p. 17
H. suffruticosa (Torr.) Brand *C. jamesii* var. *jamesii* p. 17
H. suffruticosa var. *multicaulis* (Torr.) Brand *C. jamesii* var. *multicaulis* (Torr.) p. 15
H. suffruticosa var. *pustulosa* (Rydb.) Brand *C. jamesii* var. *pustulosa* (Rydb.) p. 18
H. suffruticosa var. *setosa* (Jones) Brand *C. jamesii* var. *setosa* (Jones) Johnst. p. 16
H. suffruticosa var. *typica* *C. jamesii* var. *jamesii* p. 17

KRYNITZKIA

K. depressa Jones *C. abata* Johnst. p. 33
K. echinoides Jones *C. fulvocanescens* var. *echinoides* (Jones) Higgins p. 42
K. fulvocanescens Gray *C. fulvocanescens* var. *fulvocanescens* p. 42
K. fulvocanescens var. *idahoensis* Jones *C. propria* (Nels & Macbr.) Pays. p. 40
K. glomerata Gray *C. celosioides* (Eastw.) Pays. p. 49
K. glomerata var. *acuta* Jones *C. wetherillii* (Eastw.) Pays. p. 54
K. glomerata var. *virginensis* Jones *C. virginensis* (Jones) Pays. p. 32
K. jamesii (Torr.) Gray *C. jamesii* var. *jamesii* p. 17
K. leucophaca (Dougl.) Gray *C. leucophaca* (Dougl.) Pays. p. 24
K. leucophaca var. *alata* Jones *C. confertiflora* (Greene) Pays. p. 21
K. multicaulis var. *abortiva* (Greene) Jones *C. jamesii* var. *setosa* (Jones) Johnst. p. 16
K. multicaulis var. *setosa* *C. jamesii* var. *setosa* (Jones) Johnst. p. 16
K. mensana Jones *C. mensana* (Jones) Pays. p. 58
K. oblata Jones *C. oblata* (Jones) Pays. p. 19
K. palmeri Gray *C. palmeri* (Gray) Pays. p. 18
K. pustulata Blankenship *C. celosioides* (Eastw.) Pays. p. 49
K. sericea Gray *C. sericea* (Gray) Pays. p. 45
K. setosissima (Gray) Gray *C. setosissima* (Gray) Pays. p. 29
K. virgata (Porter) Gray *C. virgata* (Porter) Pays. p. 30

MYOSOTIS

M. glomerata Nutt. *C. celosioides* (Eastw.) Pays. p. 49
M. leucophaca Dougl. in Lehm. *C. leucophaca* (Dougl. in Lehm.) Pays. p. 24
M. suffruticosa Torr. *C. jamesii* var. *jamesii* p. 17

ORLOCARYA

O. abortiva Greene *C. jamesii* var. *abortiva* (Greene) Pays. p. 17
O. affinis Greene *C. celosioides* (Eastw.) Payson p. 49
O. affinis perennis A. Nels. *C. sericea* (Gray) Pays. p. 45
O. alata (Jones) A. Nels. *C. confertiflora* (Greene) Pays. p. 21
O. aperta Eastw. *C. aperta* (Eastw.) Pays. p. 46

<i>O. argentea</i> Rydb.	<i>C. sericea</i> (Gray) Pays. p. 45	<i>O. mensana</i> (Jones) Pays.	<i>C. mensana</i> (Jones) Pays. p. 58
<i>O. bakeri</i> Greene	<i>C. bakeri</i> (Greene) Pays. p. 57	<i>O. monosperma</i> Osterh.	<i>C. thyrsiflora</i> (Greene) Pays. p. 43
<i>O. breviflora</i> Osterh.	<i>C. breviflora</i> (Osterh.) Pays. p. 40	<i>O. multicaulis</i> (Torr.) Greene	<i>C. jamesii</i> var. <i>multicaulis</i> (Torr.) Pays. p. 15
<i>O. caespitosa</i> A. Nels.	<i>C. caespitosa</i> (A. Nels.) Pays. p. 34	<i>O. multicaulis</i> var. <i>cinerea</i> (Greene) Macbr.	<i>C. jamesii</i> var. <i>setosa</i> (Jones) Johnst. p. 16
<i>O. cana</i> A. Nels	<i>C. cana</i> (A. Nels.) Pays. p. 40	<i>O. multicaulis</i> var. <i>laxa</i> Macbr.	<i>C. jamesii</i> var. <i>laxa</i> (Macbr.) Pays. p. 16
<i>O. capitata</i> Eastw.	<i>C. capitata</i> (Eastw.) Johnst. p. 22	<i>O. nana</i> Eastw.	<i>C. humilis</i> var. <i>nana</i> (Eastw.) Higgins p. 37
<i>O. celosioides</i> Eastw.	<i>C. celosioides</i> (Eastw.) Pays. p. 49	<i>O. nitida</i> Greene	<i>C. fulvocanescens</i> var. <i>fulvocanescens</i> p. 42
<i>O. cilio-hirsuta</i> Nels. & Macbr.	<i>C. spiculifera</i> (Piper) Pays. p. 49	<i>O. nubigena</i> Greene	<i>C. nubigena</i> (Greene) Pays. p. 27
<i>O. cinera</i> Greene	<i>C. jamesii</i> var. <i>setosa</i> (Jones) Johnst. p. 16	<i>O. oblata</i> (Jones) Macbr.	<i>C. oblata</i> (Jones) Pays. p. 19
<i>O. commixta</i> Macbr.	<i>C. humilis</i> var. <i>commixta</i> (Macbr.) Higgins p. 30	<i>O. osterhoutii</i> Pays.	<i>C. osterhoutii</i> (Pays.) Pays. p. 55
<i>O. confertiflora</i> Greene	<i>C. confertiflora</i> (Greene) Pays. p. 21	<i>O. palmeri</i> (Gray) Greene	<i>C. palmeri</i> (Gray) Pays. p. 18
<i>O. cristata</i> Eastw.	<i>C. flava</i> (A. Nels.) Pays. p. 58	<i>O. paradoxa</i> A. Nels	<i>C. paradoxa</i> (A. Nels.) Pays. p. 56
<i>O. crymophila</i> (Johnst.) Jeps. & Hoover	<i>C. crymophila</i> Johnst. p. 28	<i>O. paysonii</i> Macbr.	<i>C. paysonii</i> (Macbr.) Johnst. p. 19
<i>O. depressa</i> (Jones) Macbr.	<i>C. abata</i> Johnst. p. 33	<i>O. perennis</i> Rydb.	<i>C. celosioides</i> (Eastw.) Pays. p. 45
<i>O. disticha</i> Eastw.	<i>C. jamesii</i> var. <i>disticha</i> (Eastw.) Pays. p. 17	<i>O. procera</i> Osterh.	<i>C. sericea</i> (Gray) Pays. p. 45
<i>O. dolosa</i> Macbr.	<i>C. humilis</i> var. <i>shantzii</i> (Tidestr.) Higgins p. 37	<i>O. propria</i> Nels. & Macbr.	<i>C. propria</i> (Nels. & Macbr.) Pays. p. 40
<i>O. dura</i> Nels. & Macbr.	<i>C. thyrsiflora</i> (Greene) Pays. p. 43	<i>O. pustulosa</i> Rydb.	<i>C. jamesii</i> var. <i>pustulosa</i> (Rydb.) Harringt. p. 18
<i>O. eastwoodae</i> Nels. & Kennedy	<i>C. flavoculata</i> (A. Nels.) Pays. p. 58	<i>O. rugulosa</i> Pays.	<i>C. rugulosa</i> (Pays.) Pays. p. 47
<i>O. echinoides</i> (Jones) Macbr.	<i>C. humilis</i> var. <i>humilis</i> p. 42	<i>O. salmonensis</i> Nels. & Macbr.	<i>C. salmonensis</i> (Nels. & Macbr.) Pays. p. 25
<i>O. elata</i> Eastw.	<i>C. elata</i> (Eastw.) Pays. p. 44	<i>O. sericea</i> (Gray) Greene	<i>C. sericea</i> (Gray) Pays. p. 45
<i>O. euphous</i> Rydb.	<i>C. bakeri</i> (Greene) Pays. p. 57	<i>O. sericea</i> sensu Piper	<i>C. celosioides</i> (Eastw.) Pays. p. 49
<i>O. flava</i> A. Nels.	<i>C. Flava</i> (A. Nels.) Pays. p. 22	<i>O. setosissima</i> (Gray) Greene	<i>C. setosissima</i> (Gray) Pays. p. 29
<i>O. flavoculata</i> A. Nels.	<i>C. flavoculata</i> (A. Nels.) Pays. p. 58	<i>O. shantzii</i> Tidestr.	<i>C. humilis</i> var. <i>shantzii</i> (Tidestr.) Higgins p. 37
<i>O. flavoculata spatulata</i> A. Nels	<i>C. flavoculata</i> (A. Nels.) Pays. p. 58	<i>O. sheldonii</i> Brand	<i>C. celosioides</i> (Eastw.) Pays. p. 49
<i>O. fulvocanescens</i> (S. Wats.) Greene	<i>C. fulvocanescens</i> (S. Wats.) Pays. p. 42	<i>O. shoekleyi</i> Eastw.	<i>C. flavoculata</i> (A. Nels.) Pays. p. 58
<i>O. glomerata</i> Greene	<i>C. celosioides</i> (Eastw.) Pays. p. 49	<i>O. spicata</i> Rydb.	<i>C. virgata</i> (Porter) p. 30
<i>O. gypsophila</i> Pays.	<i>C. paradoxa</i> (A. Nels.) Pays. p. 56	<i>O. spiculifera</i> Piper	<i>C. spiculifera</i> (Piper) Pays. p. 49
<i>O. hispida</i> Nels. & Kennedy	<i>C. humilis</i> var. <i>humilis</i> p. 36	<i>O. stricta</i> Osterh.	<i>C. stricta</i> (Osterh.) Pays. p. 26
<i>O. hispidissima</i> (Torr.) Rydb.	<i>C. thyrsiflora</i> (Greene) Pays. p. 43	<i>O. subretusa</i> (Johnst.) Abrams	<i>C. subretusa</i> Johnst. p. 28
<i>O. hispidissima</i> Wooton & Standl.	<i>C. oblata</i> (Jones) Pays. p. 19	<i>O. suffruticosa</i> (Torr.) Greene	<i>C. jamesii</i> var. <i>jamesii</i> p. 17
<i>O. hoffmannii</i> (Johnst.) Abrams.	<i>C. hoffmannii</i> Johnst. p. 33	<i>O. suffruticosa</i> var. <i>abortiva</i> (Greene) Macbr.	<i>C. jamesii</i> var. <i>abortiva</i> (Greene) Pays. p. 17
<i>O. horridula</i> Greene	<i>C. longiflora</i> (A. Nels.) Pays. p. 54	<i>O. suffruticosa</i> var. <i>cinerea</i> (Greene) Pays.	<i>C. jamesii</i> var. <i>setosa</i> (Jones) Johnst. p. 16
<i>O. humilis</i> Greene	<i>C. humilis</i> (Gray) Pays. var. <i>humilis</i> p. 36	<i>O. suffruticosa</i> var. <i>multicaulis</i> (Torr.) Pays.	<i>C. jamesii</i> var. <i>multicaulis</i> (Torr.) Pays. p. 15
<i>O. insolita</i> Macbr.	<i>C. insolita</i> (Macbr.) Pays. p. 32	<i>O. tenuis</i> Eastw.	<i>C. tenuis</i> (Eastw.) Pays. p. 54
<i>O. interrupta</i> Greene	<i>C. interrupta</i> (Greene) Pays. p. 48	<i>O. thompsonii</i> (Johnst.) Abrams	<i>C. thompsonii</i> Johnst. p. 51
<i>O. jonesiana</i> Pays.	<i>C. jonesiana</i> (Pays.) Pays. p. 43	<i>O. thyrsiflora</i> Greene	<i>C. thyrsiflora</i> (Greene) p. 43
<i>O. lemmonii</i> Eastw.	<i>C. jamesii</i> var. <i>setosa</i> (Jones) Johnst. p. 16	<i>O. tumulosa</i> Pays.	<i>C. tumulosa</i> Pays. p. 31
<i>O. leucophaea</i> (Dougl.) Greene	<i>C. leucophaea</i> (Dougl.) Pays. p. 24	<i>O. urticacca</i> Wooton & Standl.	<i>C. thyrsiflora</i> (Greene) Pays. p. 43
<i>O. longiflora</i> A. Nels	<i>C. longiflora</i> (A. Nels.) Pays. p. 54	<i>O. virgata</i> (Porter) Greene	<i>C. virgata</i> (Porter) p. 30
<i>O. lutea</i> Greene	<i>C. confertiflora</i> (Greene) Pays. p. 21	<i>O. virgata</i> forma <i>spicata</i> (Rydb.) Macbr.	<i>C. virgata</i> (Porter) p. 30
<i>O. lutescens</i> Greene	<i>C. flava</i> (A. Nels.) Pays. p. 22	<i>O. virginensis</i> (Jones) Macbr.	<i>C. virginensis</i> (Jones) Pays. p. 32
<i>O. macbridii</i> Brand	<i>C. humilis</i> var. <i>humilis</i> p. 36	<i>O. wetherillii</i> Eastw.	<i>C. wetherillii</i> (Eastw.) Pays. p. 52
<i>O. macounii</i> Eastw.	<i>C. celosioides</i> (Eastw.) Pays. p. 49		
		ROCHELIA	
		<i>R. glomerata</i> Torr.	<i>C. celosioides</i> (Eastw.) Pays. p. 49

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