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BORAGINACEAE OF THE SOUTHWESTERN UNITED STATES

Larry C. Higgins¹

Abstract.—The borage Family Boraginaceae is treated for the southwestern United States. Treated are 18 genera, 113 species, and 24 varieties from Arizona, New Mexico, and the desert regions of southeastern California. A key to the genera and species is included along with detailed descriptions, distribution data, chromosome counts when known, and comments for many of the taxa. A proposed new combination is Plagiobothrys scouleri (H. & A.) I. M. Johnston var. cusickii (E. L. Greene) Higgins.

This paper was prepared for the “Flora of the Southwestern United States,” a project initiated by Dr. Noel H. Holmgren of the New York Botanical Garden and Dr. James Reveal of the University of Maryland. The project was funded by the National Science Foundation for a two-year period and then dropped. This paper was prepared during that interval.

The Family is both large and taxonomically complex. In the present treatment 113 taxa are recognized as occurring mainly in the states of Arizona and New Mexico, but also including the desert regions of southeastern California.

Generic limits within the family are fairly well defined; however, species are not so easily separated. The genus Cryptantha is such an example, in which both flowering and fruiting specimens are needed for precise identification. A more perplexing group is that of Plagiobothrys, with its great variability in nodule forms, flowers, and habitats that all run together, especially in the section Allocarya. In the southwestern area the problems in the Boraginaceae are not as great as in other areas, such as the Great Basin and the coastal ranges of California.

Most borages are of little or no economic value, but form a very conspicuous part of the early spring flora throughout the southwest.

The following new combination in Plagiobothrys is necessary at this time: Plagiobothrys scouleri (H. & A.) I. M. Johnston var. cusickii (E. L. Greene) L. Higgins Comb. et. stat. nov., based upon Allocarya cusickii Greene, pitt. 1:17, 1887.

Boraginaceae

Borage Family

Plants herbaceous, shrubby or arborescent, usually bristly hairy; leaves simple, alternate, or rarely opposite or whorled, entire, variously pubescent; inflorescence cymose, cymes glomerate, racemose or spikelike, frequently scorpioid and unilateral, usually bracteate; calyx usually deep 5-lobed or parted; corolla sympetalous, 5-lobed, regular or rarely somewhat irregular, sometimes crested with folds or saccate-intruded appendages (fornices) in the throat; stamens 5, borne on the corolla tube alternate with the lobes, included or less often exerted; ovary superior, 2-carpellate,
usually 4-ovulate, entire or the carpels usually deeply 2-lobed, at maturity becoming tough and bony; fruit commonly breaking up into 4 simple-seeded mericarps (nutlets); style simple, entire or 2-lobed, produced from the pericarp at the apex of the fruit or borne between the nutlets on the receptacle, or on an upward elongation of the receptacle (gynobase); endosperm none or scarce; embryo straight or curved.

A family of about 100 genera and 2,000 species of worldwide distribution, with two principle centers of distribution; one about the Mediterranean region of the Mideast and the other in southwestern United States (Fig. 1).

The Boraginaceae are of little economic value, but some genera have numerous species that have been cultivated as ornamentals, principally in the genera Myosotis (forget-me-not), Heliotropium (heliotrope), Anchusa, and Echium (blue-weed).

The classification of the family is based primarily upon the characteristics of the fruit. In many cases it is nearly impossible to recognize the genus and species without the specimen having mature fruit.

1. Ovary entire or shallowly lobed, the style terminal .............................................. 2
   - Ovary deeply 4-lobed, the style gynobasic .............................................. 4
2(1). Style twice cleft, the four branches each bearing a stigma ....................... 1. Cordia
   - Style cleft or divided once or simple or none .............................................. 3
3(2). Style distinctly cleft or divided to the base .............................................. 2. Tiqualia
   - Style simple, very short, or absent ............................................................. 3. Heliotropium
4(1). Stigma geminate or style bifid ................................................................. 5
   - Stigmas solitary and simple, capitate or disk-shaped .................................. 8
5(4). Corolla irregular, oblique, stamens unequal ............................................... 4. Echium
   - Corolla regular or nearly so, stamens equal ............................................... 6
6(5). Corolla large, 2.5–8 cm long, lobes acute; stamens very long, reaching at least to corolla sinuses and frequently much beyond .................................................. 5. Macromeria
   - Corolla of small or medium size, less than 2.5 cm long; stamens very short, not equalling corolla sinuses ................................................................. 7
7(6). Corolla lobes acute or acuminate, erect; style long, exserted, anthers sagittate ..
   - Corolla lobes rounded or obtuse, ascending, spreading or recurved; style included or short exserted; anthers oblong ................................................. 6. Onosmodium
8(4). Nutlets attached near the apical end, widely spreading in fruit, armed with barbed or hooked prickles ................................................................. 9
   - Nutlets attached near base or middle, erect or parallel .................................. 10
9(8). Nutlets subglobose, armed all over with barbed prickles; prickles; perennials; corolla usually blue or purplish ......................................................... 8. Cynoglossum
   - Nutlets flat, armed on the margins with hooked bristles; slender annuals; corolla white .............................................................. 9. Pectocarya
10(8). Fruiting calyx distinctly irregular, three of the lobes nearly distinct, the other united enclosing the fruit, with 7–9 long glochidiate processes .................................. 10. Harpagonella
   - Fruiting calyx regular or nearly so, not armed with glochidiate processes ........... 11
11(10). Corolla-lobes convolute in the bud; small herbs with usually ebracteate racemes and smoothly basally attached nutlets ........................................... 11. Myosotis
   - Corolla-lobes imbricate in the bud ......................................................... 12
12(11). Corolla bright yellow or orange, the throat open and not crested (with fornices) ............................................................ 12. Amsinckia
– Corolla white or blue, sometimes light yellow; the throat usually crested .......... 13

13(12). Nutlets with definite medial ventral groove formed by the nonfusion of the pericarpial walls ......................................................... 13. Cryptantha
– Nutlets with the pericarpial wall fused at least above the middle and commonly forming a medial ventral keel ........................................ 14

14(13). Dorsal surface of nutlets not encircled by an upturned rim or flange, with glochidiate appendages ...................................................... 15
– Dorsal surface of nutlets encircled by an upturned rim or flange which is usually toothed or lacerate, commonly with uncinate hairs or glochidiate appendages ...................................................... 16

15(14). Corolla white, throat very short and shallow, tube exceeded by or rarely just exceeding calyx; nutlets with a median dorsal keel; style usually shorter than nutlets .............................................................. 14. Plagiobathyrs
– Corolla blue, throat cylindrical or funnelform, tube usually much surpassing calyx; nutlets usually lacking a dorsal keel; style usually exceeding nutlets ...... .............................................................. 15. Mertensia

16(14). Nutlets not armed with conspicuous prickles, oblique, sometimes with a toothed rim or flange; low depressed pulvinate plants of high altitudes 16. Eritrichium
– Nutlets conspicuously armed with barbed prickles along the margins and also sometimes dorsally; plants with tall, well developed stems ........................................ 17

17(16). Annuals; pedicels erect in fruit; gynobase subulate, as long as the nutlets .......... .............................................................. 17. Lappula
– Perennials or biennials; pedicels recurved in fruit; gynobase broad and pyramidal, about half the length of the nutlets ........................................ 18. Hackelia

1. Cordia L.

Trees or shrubs; leaves small to large, usually evidently petiolate, with entire, crenate or serrate margins; inflorescence mostly co-rumbose, ebracteate; flowers homomorphous or heterostyled or functionally more or less unisexual; corolla campanulate to funnel form, small to large, white, yellow, orange, or red, usually 5 merous; stamens exerted to included; filaments often hairy toward the base; style terminal on ovary, dichotomous, simple at the base, the two branches in turn forked to produce 4 ultimate branches; stigmas 4, clavate to spatulate or capitate; fruit a drupe with watery or glutinous mesocarp, or a nut; endocarp bony; seeds 1–4.

About 250 species of tropical or warm temperate areas, with the majority of the species and the greatest diversity in America.

1. Cordia parvifolia A. DC.

_Cordia parvifolia_ A. DC. Prodr. 9: 498. 1845.

(Coahuayanam, in western Michocan)
(The type probably came from near Mapimi, Durango, Mexico)

Shrub 1–3 m tall; stems with purplish black or dark gray bark, densely strigose when young but becoming glabrate with age, the lenticils small and pale gray; leaves obvate to ovate or nearly orbicular, serrate, 1–3 cm long, 3–15 mm wide, acute to rounded at apex, broadly cuneate at base, scabrous with short strigose hairs, pubescent at the base especially on the dorsal surface, veins conspicuous beneath, impressed above; pedicels 2–10 mm long, slender; inflorescence cymose, few flowered, headlike; calyx tubular-camp-
anulate, 5–8 mm long, 10–costate, abundantly hairy, grayish at base of tube, gradually becoming dark brown near and on the lanceolate teeth, the teeth 1.5–4 mm long; corolla white, thin, campanulate, 1.5–2.5 cm long, 1–3 cm broad, turning purplish or brownish in age; style heterostylyous; fruit 6–9 mm broad, enclosed within the enlarging calyx.

Alluvial flats, rocky hillsides and wash bottoms in the lower sonoran zone. Extreme southern Arizona, south into Sonora, Coahuila, Durango, and Zacatecas, Mexico, and in central Baja California. February to November.

This shrubby borage is very common just to the south of our area in Mexico, but has only been collected once in the United States by Altfiläisch, among Larrea, about 17 miles south of Tucson, Pima County, Arizona, in 1951.

2. Tiquilia Pers.

Plants herbaceous or suffrutticose; stems slender, forking, usually prostrate or widely spreading; leaves small, entire, usually strongly veined, subsessile or petiolate; flowers small, generally white, usually extra-axillary, along leafy twigs or at the forks of the branches, sometimes glomerate, commonly opening in late afternoon; calyx 5-parted, regular or slightly irregular; corolla with a short, cylindrical or ampullate tube and spreading lobes, throat naked or sometimes appendaged; stamens 4–5, included, their filaments adnate to the corolla-tube; style terminal on the ovary, short to long, bilobed or biparted; stigmas 2, not much differentiated from the style-branch; ovary 2-celled or sometimes 4-celled by the septumlike placenta, entire or 4–lobed; fruit dry, pyramidal or hemispheric, divided into usually 4 single-seeded nutlets; nutlets more or less broadly united ventrally or joined to the elongated gynobase.

References

1. Tiquilia greggii (Torr. & Gray) A. Richardson


Usually a small, erect, rounded shrub 2–5 dm tall; *stems* or old branches decidedly fruticose, the twigs pale and hispidulous or tomentose; *leaves* numerous, ovate or elliptic, 5–9 mm long, 2.5–6 mm broad; thickish, usually veinless, the margin revolute, the surfaces densely tomentulose; *flowers* in dense capitate clusters 1–2 cm in diameter, borne terminally on the leafy stems and uppermost branchlets; *bracts* inconspicuous, filiform, plumose, like the calyx-segments; *calyx* sessile, deciduous, 5–9 mm long, the segments filiform, plumose, unequal, purplish or grayish at maturity; *corolla* pink, densely villous in the bud, 6.5–8 mm long, the lobes rounded, 2–3.5 mm broad; *style* 2.5–3.2 mm long, the lobes 0.5–0.8 mm long, persistent on the mature fruit; *fruit* lance-ellipsoid, 2.2–5.5 mm long, 1–1.2 mm broad, thin-walled, by abortion always 1–celled and 1-seeded, dorsal surface shiny, sparsely hispidulous above the middle, ventral surface dull, the papyry tissue representing the three aborted cells of the fruit.

Widely distributed on limestone soils. Southern New Mexico in the Organ Mountains, western Texas and southward in eastern Chihuahua, western and southern Coahuila, to northern Zacatecas and Durango. May to October.

This plant is a Calciphile and usually restricted to limestone soils. It enters our area only along the southern boundary in extreme southern New Mexico.

2. Tiquilia canescens (DC.) A. Richardson


Suffrutescent perennial, often forming mats 2–6 dm in diameter; *stems* numerous, mostly prostrate but sometimes ascending, furcatebrately branched, older stems with exfoliating epidermis, rough, dark colored, leafy stems and branches pallid, tomentose; *leaves* numerous, white tomentose, the petiole slender, 2–7 mm long, at extreme maturity usually breaking off near the middle leaving a stub attached to the stem, the blade ovate to elliptic-lanceolate, obtuse to broadly acute at both ends 7–10(15) mm long. 2–7(9) mm broad, thickish, the margins somewhat revolute; *flowers* usually solitary in the leaf axils and along the main stem and branches; *calyx* sessile, persistent, at anthesis 3–4 mm long, in
fruit becoming 4–8 mm long, the segments lanceolate with long-attenuate tips; *corolla* 5–6(12) mm in total length, pink, rose, or white, the lobes broad and rounded, 1.8–3(4.5) mm wide, 1.5–2(3.5) mm long, usually villous in the bud, margins frequently erose; style seated in the pericarp at the apex of the fruit, persistent, 1.5–2.5 mm long; *fruit* at maturity ovoid or globose, glabrous or hairy, 2.5–3 mm in diameter, 2–2.5 mm high, not lobed; *nutlets* bony, densely and minutely tuberculate.

Rocky ridges, hillsides, and bajadas, mostly on limestone soils below 4,000 feet elevation; lower sonoran life zone. Southeastern California and southern Nevada, east to southwestern Utah, through Arizona and New Mexico into Texas and south through most of the desert area of Mexico. March to May.

Plants from south of our range tend to have pubescent fruits, while those in our range tend to have glabrous fruits; however, there seems to be no geographical correlation, so is not recognized nomenclaturally. Variety *pulchella* (Johnston), Richardson seems to be worthy of at least some recognition, as it can be separated from typical material by the larger flowers 9–12 mm long, 5–8 mm wide, and by the bluish or lavender rather than white corolla. This variety is best developed in the Kofa Mountains of Arizona and just west into California in the Chocolate and Chuckwalla mountains.

3. *Tiquilia gossypina* (Woot. & Standl.) A. Richardson


Plant prostrate, forming mats 2–6 dm in diameter; stems numerous, dichotomously branched, spreading from a woody taproot, the younger branchlets villulose-hispidulous; leaves clustered, borne mostly on very short branchlets along the main stem, the petioles 1–2 mm long, broadest (1–1.5 mm) at the base, becoming indurate, usually pallid, the margin hispid-ciliate, the blade usually ovate (rarely ovate or elliptic), 5–17 mm long, 1.1–4.2 mm wide, usually broader than the petiole; flowers borne among the leaves; *calyx* sessile, broadly and permanently attached in the leaf axil, at anthesis 2.5–3.5 mm long, the segments lanceolate, united at the base, villulose-ciliate below the middle, frequently terminated with a stiff bristle; *corolla* usually pink, 4–8 mm long, 4–5 mm broad, the lobes rounded, spreading; *style* 1.5–2.2 mm long, somewhat flattened, apex bilobed; *fruit* ovoid; *nutlets* oblong-ovoid, usually only 1 or 2 maturing, 1.5–2.0 mm long, papillate or vesicular papillate, scar open, nearly as long as the nutlet, surrounded by a nonpapillate ridge.
Sandy dunes and dry open slopes or on gypsum flats, mostly below 5,000 feet elevation. Central Utah and Arizona.

5. **Tiquilia hispidissima** (T. & G.) A. Richardson


Plants prostrate perennials forming mats to 6 dm in diameter; *stems* numerous, dichotomously branched, spreading from a woody taproot. The young branchlets hispidulose-appressed; *leaves* clustered, on short brittle branches, the petioles very short, elliptic or somewhat rectangular, glabrous, with pungent bristles along the margins, the blade linear or narrowly lanceolate, 4–8 mm long, 0.5–2 mm broad; *flowers* axillary, solitary; *calyx* sessile at anthesis 2.5–3.5 mm long, the segments narrowly triangular or subulate, united at the base, ciliate or villous with scattered sharp bristles; *corolla* usually pink 2.5–6.5 mm long, 4–5 mm broad, the lobes rounded, spreading; *style* 1.5–4.2 mm long, cleft at the apex; *fruit* ovate; *nutlets* ovoid, 1–1.5 mm long.

Occurring mainly on gypsumous soils, or occasionally calcareous soils in central New Mexico and Trans-Pecos Texas.

This plant is closely allied to *T. latior* from farther west in Utah and Arizona, but is distinguished from that taxa by its linear leaves, less ciliate petioles, and smaller ovoid, white colliculate nutlets.

6. **Tiquilia nuttallii** (Benth. ex. Hooker) A. Richardson


Prostrate annual herb forming mats 1–3.5 dm broad; *stems* slender, dichotomously branched, somewhat brittle, finely strigose; *leaves* ovate to nearly suborbicular, 4–8 mm long, narrowly revolute, often hirsute on the margins, dorsal surface with 2–3 pairs of distinct veins, hirsute, ventral surface thinly strigose with impressed veins, the petioles slender, usually as long or longer than the blade; *flowers* in compact clusters in the forks and at the ends of the branchlets; *calyx* sessile, 4–5 mm long, the segments linear-subulate, villous or setulose on the back, the margins sparsely but conspicuously hirsute; *corolla* pink or nearly white, 3–4 mm long, the limb 2–2.5 mm broad, the tube with 5 triangular scales near the base; *style* about 1 mm long; *fruit* ovate-ovoid; *nutlets* oblong-ovoid, smooth and shiny, somewhat mottled with brownish patches, scar closed or narrowly linear.

Dry sandy or alkaline plains and hillsides, up to 7,000 feet elevation. Eastern Washington to California on the eastern slope of the Sierra Nevada Mountains eastward to Wyoming, Utah, and Arizona, also in Argentina. May to August.

7. **Tiquilia plicata** (Torr.) A. Richardson


Matted perennial from a deep woody root; *stems* several, freely dichotomously branched, the branches puberulent or glabrate; *leaves* obovate, 4–9 mm long, densely hairy with felt-like grayish pubescence, strongly plicate, the ventral surface with 4–7 pairs of deeply impressed veins, the petioles about as long as the blade; *flowers* clustered in the forks and at the ends of the branchlets; *calyx* 2–3 mm long, the segments subulate, tomentose especially inside; *corolla* 4–6 mm long, 2–3 mm broad, bluish or lavender; *style* about 2 mm long, cleft 1/2 to 3/4 of its total length; *fruit* ovoid; *nutlets* ovoid, 1–3 usually maturing, about 1 mm long, smooth, shiny, the scar orbicular.

Sandy desert flats and bajadas in the Larrea-Ambrosia association, mostly below 3,000 feet elevation. Southern California and Northern Mexico eastward to southern Nevada and western Arizona. April to July.

8. **Tiquilia palmeri** (A. Gray) A. Richardson

Prostrate or ascending perennials 1–3 dm tall, or forming mats 2–10 dm broad; stems many, dichotomously branched from the woody root, white-barked, with the bark exfoliating in age; leaves obovate to ovate, grayish strigose to setulose, 4–9 mm long, 3–5 mm wide, the blade equal to or occasionally much shorter than the petiole, which is 3–11 mm long, irregularly veined with 2–3 pairs of moderately impressed veins; calyx 2–3.5 mm long, ovate, the segments linear-subulate, villose; corolla lavender, 5–7 mm long, 5–6(8) mm broad; style 3–4 mm long, cleft about half its length; fruit ovoid; nutlets subglobose, ca. 1 mm long, smooth, shiny, 1 or more usually aborted.

Sandy places usually below 500 feet elevation. Southeastern California and western Arizona to northern Mexico, along the Colorado River to above Needles.

A plant closely allied with T. plicata but easily recognized by the leaves with 2–3 pairs of impressed veins.

3. Heliotropium L.

Heliotrope

Annual or perennial, herbaceous or more or less shrubby plants; stems erect or ascending

1. Plant very succulent, glabrous, usually glaucous ........................................ 1. H. curassavicum

— Plant not succulent, hairy, never glaucous .................................................. 2

2(1). Plant perennial, rhizomatous, the parts above the ground renewed annually ...

................................................................. 2. H. greggii

— Plant annual ................................................................. 3

3(2). Corolla 8–15 mm wide, with a long-exserted tube; style elongate, many times longer than the stigma ..................................................... 3. H. concolvaluceum

— Corolla 2–4 mm wide, usually with an included tube; style short, about as long as the stigma ........................................ 4. H. fruticosum

1. Heliotropium curassavicum L.

*Heliotropium curassavicum* L. Sp. Pl. 1: 130. 1753. (Curaçao, in Dutch West Indies)


*H. curassavicum var. obovatum* A. DC, Prodrornus 9: 538. 1845. (Douglas, Columbia River) = var. obovatum.


Annual or short-lived perennial herbs; stems branched, prostrate or decumbent, suc-
culent or rubbery, glabrous, frequently glaucous, 1–6 dm long; leaves oblong to obovate or spatulate, glabrous, thick and succulent, 1–4 cm long, 3–20 mm broad, apex obtuse to acutish; inflorescence terminal or extra-axillary and lateral along the leafy stems, cymes scorioid, single or paired, densely flowered, in fruit elongating, 6–12 cm long; bracts lacking; calyx parted to near the base, sessile, the segments lanceolate to oblanceolate, equal, fleshy, at anthesis 1–3 mm long, slightly accrescent in fruit; corolla white or bluish, the throat often with a violet purple eye, 1.5–3.5(5) mm long, 3–15 mm wide, the limb ascending or loosely outcurved; stigma conic, obscurely 4–lobed at apex; fruit subglobose, obscurely didymous, separating into 4 nutlets.

Sandy to clayey alkaline soils along beaches, near ponds, streams, playa lakes or similar areas. Throughout the United States and south into Mexico, widely distributed on all continents.

H. curassavicum, in our flora, can be divided into three varieties with some consistency by the following key.

1. Plant scarcely glaucous, slender, only slightly succulent; leaves narrowly oblong to linear; calyx less than 2 mm long, spreading; corolla 1–2.5 mm long, mostly in southern and eastern New Mexico ........................................... var. curassavicum

2. Plants conspicuously glaucous, thickish, usually very succulent; leaves obovate or broadly oblong to oblong, equal, fleshy, at anthesis 2–3 mm long, the lobes erect; corolla 2.5 mm or longer ................................................................. 2

2(1). Corolla 5–9(16) mm broad, at most only purplish-tinged at the throat; fruit 2.5 mm wide; northern New Mexico, rare ........................................... var. oculatum A. DC.

Corolla 3–5(7) mm broad, usually becoming distinctly purple or purplish at the throat; fruit 1.5–2 mm wide; southeastern California, southern Nevada and western Arizona ........................................... var. oculatum I. M. Johnston ex Tidestr.


Plants perennial, arising from a deep rhizome; stems numerous, prostrate or loosely decumbent, ascendingly branched, 5–15 cm long, strigose with closely appressed hairs; leaves numerous, thickish, lanceolate to linear, strigose, 10–25(30) mm long, 2–5 mm wide, midrib conspicuous but veins absent, margins revolute; inflorescence at first glomerate, then elongating into a unifloral cyme 10–50 cm long, 5–10–flowered; bracts few and inconspicuous; calyx 5–lobed, 2–3 mm long, the segments lanceolate, strigose; corolla white with a yellow eye, fragrant, the tube 3–5 mm long, the limb 7–12 mm broad; style short about 1 mm long, puberulent, the tip bidentate; fruit radially 4–lobed, very pubescent, 3 mm wide, 1.5 mm high, usually 4 nutlets maturing.

Frequent along roadsides and in bar ditches, in sand, gravel, or clay soils, usually forming colonies where water collects temporarily. Southeastern New Mexico, Trans-Pecos Texas, and south through Coahuila and eastern Chihuahua to northern Zacatecas and northeastern Durango, Mexico. April to September.

3. Heliotropium convolvulaceum (Nutt.) A. Gray


Euploca convolvulacum Nutt. Trans. Amer. Philos. Soc. 5: 190. 1837. (Nuttall, sandy banks of the Arkansas)

E. grandiflora Torr. in Emory, Notes Mil. Recon. 147. 1848. (Emory, Rio Grande below Santa Fe, New Mexico)

Erect annual 1–4 dm tall; stems simple below, branched above with ascending branches, strigose to spreading hispid; leaves numerous, the blade lanceolate to ovate, 10–45(50) mm long, 4–15(20) mm broad, entire, apex acute, strigose to hispid, the petiole slender 3–8 mm long; flowers extra-axillary, borne along the leafy branches; bracts leaflike, numerous; calyx in anthesis 4–6 mm long, in fruit becoming 6–8 mm long, the segments linear-lanceolate, slightly unequal, strigose or appressed setose; corolla white with a yellow throat, fragrant, the tube 8–12 mm long, strigose outside, the limb broadly funnelform, 15–22 (30) mm wide, not lobed, pentagonal, plicate in the bud; style slender, 3–4 mm long; fruit laterally compressed, hairy, 2–lobed, 3–4 mm long; nutlets paired.

An abundant plant especially on sand dune areas or sandy soils. California eastward to Utah, Wyoming, and Nebraska and southward into Chihuahua Mexico. June to December.

The morning glory heliotrope is a very striking and handsome plant especially in late summer and fall when it covers low sandy areas. In California and western Arizona a phase of the species has conspicuous spreading setose or hispid pubescence. This is variety californicum (E. L. Greene) Johnston.

4. Heliotropium fruticosum L.

Heliotropium fruticosum L. Syst. Nat. ed. 10. 913. 1759. (Browne, Jamaica)


Annuals; stems sparingly branched from the base and above, spreading-ascending, 0.5–2.5(4) dm long, strigose with whitish hairs; leaves elliptic to oblanceolate, 1–2(3.5) cm long, 2–7 mm broad, acute to rounded at apex, broadly cuneate at the base, strigose, midribs producing coarser hairs with pubulate bases, dark green above, paler beneath, the margin narrowly and tightly revolute; inflorescence spikelike; flowers extra axillary; bracts leaflike, conspicuous; calyx elliptic, 1–1.5 mm long in anthesis, the segments narrowly ovate-lanceolate, unequal, strigose and somewhat pubulate; corolla small, white, the tube 1–1.5(2.5) mm long, the limb 3–4 mm wide, finely strigose on the outside, also papillate; style 0.6–0.8 mm long; fruit depressed-globose, puberulent with fine white hairs, 1.2–1.5 mm high; nutlets rounded on the back, brownish, lateral faces each bearing a central pit.

Sandy to rocky slopes, ridges and wash bottoms, 5,000 feet elevation or less. Colombia and Venezuela northward in the West Indies and Central America to Mexico and southern Arizona in the United States.

4. Echium L.

Blueweed

Plants biennial or possibly perennial; stems erect, hispid; leaves alternate, entire; inflorescence of a series of sympodial scorpioid cymes which are usually bracteate; calyx 5-parted; corolla blue to violet purple, irregular, tubular-funnelform; fornicaces lacking, the throat thus open; stamens unequally exserted on the corolla, the longer ones surpassing the corolla; style exserted from the corolla, 2–cleft at apex; gynobase flat or nearly so; nutlets erect, rugose, attached at their bases, the scar large and sometimes surrounded by a low rim.

A genus of about 50 species native to Europe, the Mediterranean region, South Africa, and the Atlantic islands. (From Greek echion, name for several members of the Boraginaceae, echion, in turn, comes from echis, viper.)

1. Echium vulgare L.

Echium vulgare L. Sp. pl. 139. 1753. (Europe)

Plants biennial or short-lived perennials; stems erect, usually solitary, (2)4–6(10) dm tall, hispid, the hairs often pustulate; leaves mostly basal, reduced upward, oblanceolate to linear oblong, the cauline sessile, setose-hirsute, also finely tomentose, 3–15(22) cm long, 8–15(35) mm broad; inflorescence virgate, elongate, occupying most of the stem cymose-paniculate with numerous, aggregated scorpioid cymes 2–5 cm long; bracts conspicuous, lanceolate to ovate-lanceolate 0.5–3 cm long; pedicels short, 1 mm or less long; calyx 5–6 mm long in anthesis, in fruit becoming 6–9 mm long, setose-hirsute; corolla 10–15(20) mm long, irregular, bright blue, pubescent externally; fornicaces lacking, the tube open; stamens conspicuously exserted from the corolla; style exserted, hairy, 17–20 mm long; nutlets about 3 mm long, rugose. N = 18, 16.
Roadsides, fields, and waste places; native of southern Europe, now widely introduced in the eastern United States and westward to Washington, Colorado, and New Mexico. June to September.

_Echium vulgare_ is known from our area only by a single collection made by Cockerell at Mesilla, New Mexico.

5. **Macromeria** Don.

Plants erect, abundantly rough-hairy, usually branched near the base; _stems_ usually several from the branched caudex, abundantly pubescent; _leaves_ lanceolate to obovate, entire, strongly veined; _flowers_ in terminal leafy-bracted, scorpionid racemes, whitish, greenish-white or yellowish; _calyx_ deeply 5-parted; _corolla_ much surpassing the calyx, trumpet shaped, the lobes erect or recurved, ovate, acute; _anthers_ just surpassing the corolla lobes to long exserted, the versatile anthers oblong, obtuse, the filaments elongate-filiform; _ovary_ 4-lobed; _style_ exserted from the corolla tube, enlarged and persistent at the base; _nutlets_ ovoid to globular, usually all 4 maturing.

A genus containing about 8 species in Mexico and southwestern United States.

1. **Macromeria viridiflora** DC.

_Macromeria viridiflora_ DC. Prodrornus 10: 68. 1846.

_In Mexico_


Plants erect perennials; _stems_ several, branched only from the base, 3–10 dm tall, setose-hispid with spreading bristles 2–3 mm long; _leaves_ at base ob lanceolate, the upper ones becoming lanceolate to elliptic, sessile, entire, strongly veined, 3–10(15) cm long, (6)10–23 mm broad, grayish pubescent with spreading setose hairs; _calyx_ in fruit 13–17(20) mm long, setose, the segments linear; _corolla_ trumpet shaped, greenish yellow, 40–50 mm long, canescent, the lobes ovate, erect, 4–5 mm long; _anthers_ barely exserted; _filaments_ flattened, elongate; _limits_ versatile, 3–4 mm long, oblong; _style_ tardily elongating, inconspicuously geminate, exceeding the corolla lobes 5–10 mm; _nutlets_ ovoid, to nearly globose, smooth or slightly pitted, all 4 maturing.

Open or wooded areas in the higher mountains, 6,000 to 10,000 feet elevation. Eastern Arizona and western New Mexico, south into Mexico. July to September.

It is reported that the Hopi Indians used a mixture of this plant with tobacco in their "rain bringing" ceremony.

6. **Onosmodium** Michx.

Plants rough-hairy perennial herbs; _stems_ erect or ascending, several branched from the base; _leaves_ largely or nearly all caudine, alternate, entire, strongly veined; _inflorescence_ 5-parted, the segments unequal, narrow, sometimes disarticulating at the base; _corolla_ white or yellow, tubular, slightly enlarged at the throat, 5-lobed, glabrous within, more or less hairy outside, the lobes erect, acute or acuminate, the sinuses in flexed; _fornices_ lacking; _anthers_ 5, included; _style_ exserted; _nutlets_ globular, 4 mm long or less, smooth or sometimes sparingly pitted, broadly attached at the base to the depressed gynobase, commonly only 1 or 2 maturing.

A genus consisting of about 5 species in the United States and Canada. *(Named for its resemblance to Onosma, an old world genus of the Boraginaceae)*

Reference


1. **Onosmodium molle** Michx.

_In Mexico_


Perennial herbs; _stems_ several arising from a woody root, branching above or often from the base, erect, 3–6(12) dm tall, coarsely and loosely pubescent throughout; _leaves_ 4–8 cm long, 10–20 mm broad, acutish, prominently 5–7 nervet on both surfaces, trigose or spreading setose, minutely pustulate on the ventral surface; _bracts_ leaflike, often 2–rank-
ed, 10-24 mm long; calyx 6-12 mm long, the segments lanceolate-linear, acute, setose with spreading bristles; corolla greenish white, 12-20 mm long, canescent on the outside, the acute lobes 3-4 mm long; style exceeding the corolla lobes 5-10 mm; nutlets ovoid, acut- ish, 3.5-4 mm long, dull, smooth, little if at all pitted.

In open rocky woods, prairies, wastelands, and moderately dry hillsides, United States and adjacent Canada from the Appalachian Mountains to the Rocky Mountains and south into New Mexico and Texas. March to July.

In the past monographers have recognized O. molle, occidentale, bejariense, helleri, hispidissimum, and subsetosum as distinct species; however, I believe that these represent weak variants of the same species. In our flora only the variety occidentale occurs, this phase just entering northeastern New Mexico in Union County.

7. Lithospermum L.

Puccoon

Plants annual or perennial, herbaceous or fruticose; stems usually erect, 1 to several,

1. Stems arising out of a basal cluster of leaves, the largest leaves at the base of the stem ........................................... 2
   Stems arising from a bud on a caudex, root-crown, or rhizome, the largest leaves usually on the midstem, the lowest leaves scalelike and very reduced .......... 5

2(1). Flowers heterostylic, none cleistogamic; corolla usually about as broad as long, funnelform, the throat unappendaged but conspicuously stipitate-glandular, the tube villous inside; plant spreading by rhizomes ...................... 1. L. cobrense
   Flowers monomorphic, sometimes cleistogamic; corolla usually longer than broad, salverform, the throat with fornice, only sparsely stipitate-glandular, the tube glabrous inside; plant with a taproot ................................................................. 3

3(2). Corolla-lobes erose or fimbriate; fruiting calyx usually drooping or nodding; nutlets smooth or somewhat pitted; cleistogamous flowers very abundant .......... 2. L. incisum
   Corolla-lobes with entire margins; fruiting calyx erect ........................................... 4

4(3). Nutlets roughened, strongly verrucose or rugose; chasmogamic flowers abundant, large ...................................................... 3. L. parksii
   Nutlets smooth and shiny; chasmogamic flowers few or none, plant commonly almost completely cleistogamic ........................................... 4. L. confine

5(1). Flowers heterostylic; corolla tube not narrowly constricted at top .......... 5. L. multiflorum
   Flowers not heterostylic; corolla tube cylindrical, elongate, narrowly and distinctly constricted at the top ........................................... 6. L. viride

Reference

1. Lithospermum cobrense E. L. Greene


Plant perennial, stoloniferous, forming colonies; stems erect, simple, 2–6 dm tall, strigose to somewhat setose; leaves at base of plant withering before anthesis, oblanceolate, 5–10 cm long, 5–16 mm broad, the caulin leaves very numerous, crowded, much smaller than the basal ones, narrowly oblone to linear, obtuse, sessile, 1–3.5(5) cm long, 2–5 mm broad, the margins loosely revolute; inflorescence scorpoid, simple or gyninate, loosely flowered, racemes 10–20 cm long at maturity; bracts conspicuous; calyx at anthesis 5–7 mm long, in fruit becoming 6–10 mm long, the segments linear-oblong, unequal, strigose; pedicels 3–5 mm long in fruit, much shorter in flower; corolla funnelform, pale yellow, the tube 7–9 mm long, villous inside, stipitate glandular, the limb (12)15–20 mm broad, margins entire; style heteromorphic, 2–8 mm long; nutlets white, lustrous, plump, smooth or sometimes obscurely tuberculatd, 2.5–3 mm long.

Dry to moderately moist openings in oak or pine forests, 5,000 to 10,000 feet elevation. Southern Arizona and New Mexico east to western Texas and south in the mountainous areas of Chihuahua and Durango, Mexico. June to August.

2. Lithospermum incisum Lehm.


*Lithospermum incisum* Lehm. Asperf. 303. 1818. (Missouri)


Plant perennial, from a stout woody taproot; stems clustered, 0.5–3(6) dm tall, strigose or occasionally weakly setose; leaves mostly cauline, the lowermost reduced and chaffy or rarely developed and oblanceolate, the other linear-oblong to narrowly lanceolate, loosely revolute, numerous, 2–6 cm long, (1)2–4(6) mm wide; inflorescence racemose, the flowers extra-axillary, those developing early in the season showy, yellow, well developed; bracts very conspicuous; calyx 5–12 mm long in fruit, the segments linear, very unequal; pedicels recurving in fruit; corolla salverform, yellow, the tube 12–30(40) mm long, the limb 10–15(20) mm wide, the lobes erose or fimbriate; style heteromorphic, 5–30 mm long; nutlets ovate, with a conspicuous ventral keel, 3–3.5 mm long, gray, shiny, sparsely pitted, the scar sunken and bearing a nearly central projection that is attached by a ridge to the dorsal part of the prominent collar. N = 12.

Widely distributed in various habitats, but usually in sandy or gravelly soils along roadsides, on prairies or in wasteland. In the United States chiefly on the Great Plains and along the Rocky Mountains, but extending westward into Arizona and Nevada, north into Canada and south into Mexico. March to August.

Flowers developing early in the season are very showy with long styles; however, they are nearly always sterile. Those developing later in the growing season are cleistogamous, mostly fertile, and with short styles.

3. Lithospermum parkii I. M. Johnston


Plant perennial, with a deep, thick, somewhat woody taproot; stems erect or ascending, 2–5(6) dm tall, simple or several, weakly setose with spreading pubescence; leaves at base of stem 5–9 cm long, 4–13 mm broad, oblanceolate, obtuse at apex, usually drying up by anthesis, the cauline leaves numerous, linear to oblance-linear, gradually reduced in size; inflorescence terminal and extra-axillary, scorpoid, the racemes unilaterial and 10–20 cm long; bracts conspicuous; calyx at anthesis
4-12 mm long, in fruit 9-15 mm long, the segments linear; pedicels 1-5 mm long; corolla salverform, yellow, the tube 5-17 mm long, the limb (7)12-20 mm broad, the tube finely strigose on the outside, the lobes entire; forniceae conspicuous, 0.5-0.8 mm long, invaginate, sparsely glandular; style slender and elongate, 4-15 mm long; nutlets opaque, verrucose or rugulose, about 3 mm long, attachment scar triangular, about 1.7 mm broad.

Rocky open ridges and slopes mostly on exposed limestone soils. Eddy County, New Mexico, in the Guadalupe Mountains, south through western Texas into northern Chihuahua, Mexico. March to August.

*L. parksi*i is principally a species which occurs to the south and east of our range. Our plants belong to variety *parksi*i, but variety *rugulosum* Johnston is a more southerly ranging plant of Coahuila and Nuevo León, Mexico. This plant is small and less robust with smoother, shiny nutlets.

4. **Lithospermum confine** l. M. Johnston

*Lithospermum confine* l. J. Johnst. J. Arnold Arbor 33: 346-347. 1952. (Mueller 2378, Canyon de los Capulines, about San Enrique, Hacienda San José de Raices, Nuevo León, Mexico, 6 August 1935)

Plants perennial; stems several, erect, strigose, 2-4 dm tall; leaves at base oblanceolate, obtuse at apex, 2-6 cm long, (1)3-10 mm wide, strigose, cauline leaves lanceolate to linear, the margin narrowly revolute; inflorescence terminal, at maturity the racemes 5-10 cm long; bracts conspicuous; calyx at anthesis 4-5 mm long, in fruit becoming 6-10 mm long, the segments linear; pedicels erect, 2-10 mm long; corolla yellow, chasmogamic flowers with the corolla tube 7-10 mm long, the limb 5-6 mm wide, the lobes entire; forniceae trapeziform, invaginate, slightly glanduliferous; style 5-10 mm long; cleistogamic flowers inconspicuous 1-3 mm long, style 1.5-3 mm long; nutlets whitish, smooth, 3-3.5 mm long, 2-2.5 mm wide, smooth, the base more or less constricted.

Dry open slopes, canyons, to moderately moist oak and evergreen woodlands. Southern New Mexico and Arizona south into western Texas, and Coahuila, to Nuevo León, Mexico. April to July.

5. **Lithospermum multiflorum** Torr. in A. Gray

*Lithospermum multiflorum* Torr. in A. Gray, Proc. Amer. Acad. Arts 10: 52. 1874. (No type indicated, originally given as from "Colorado in the lower mountains, to New Mexico and Texas")

Plant perennial; stems erect, 1 to several, 2-5 dm tall, simple or late in season ascendingly branched, pubescence thin, grayish, strigose, frequently pubescent; leaves at the base poorly developed, ovate to lanceolate, scalelike, acute, 3-10 mm long, usually dyed stained, the cauline gradually becoming larger and better developed, sessile, lanceolate to lance-linear, 2-7 cm long, 3-9 mm wide; inflorescence simple or forked, terminal on the stem and branches, 5-15 cm long at maturity, late in season producing some very fertile cleistogamic flowers; calyx of normal flowers 4-6 mm long at anthesis, the segments linear, very unequal, in fruit becoming 6-10 mm long; pedicels in anthesis 1-3 mm long, in fruit 3-8 mm long; corolla orange-yellow, the tube 8-10 mm long, limb 8-9 mm broad; forniceae very obscure, these and the throat conspicuously stipitate glandular; style 3-9 mm long, heterostyled; nutlets ovoid, white or brownish, usually smooth 2.5-3.5 mm long, 2-2.5 mm wide, usually only one maturing.

Widely distributed in the mountains, 5,000 to 10,000 feet elevation, mostly in open areas on sandy or gravelly soils. Eastern Utah and northern Arizona, east to Colorado and south through New Mexico, and western Texas into the mountainous areas of Chihuahua, Mexico. June to October.

6. **Lithospermum viride** E. L. Greene

*Lithospermum viride* E. L. Greene, Bot. Gaz. 6: 158. 1881. (E. L. Greene, Mimbres Mountains near Georgetown, Grant County, New Mexico. 1877)

*L. palmieri* S. Wats. Proc. Amer. Acad. Arts 18: 122. 1883. (E. Palmer 903, Sierra Madre, south of Saltillo, Coahuila, Mexico)

Plant perennial; stems few to numerous, 2-10 dm tall, simple or loosely ascendingly branched, pubescence of two kinds, the more abundant spreading or retrorsely appressed, the less abundant spreading and ascending, more rigid and shorter; leaves all cauline, the basal third of stem with scalelike leaves that are 3-20 mm long, the largest leaves near the middle of the stem, 2-5.5(8) cm long, 8-32
mm broad, the blade elliptic to lance-ovate, with an evident midrib and 1 or more pairs of prominent veins, the upper surface dark green, scabrous, pubescent, lower surface velvety strigose and paler; inflorescence simple or forked, terminal on the stems, in age elongating, loosely flowered, 10–30 cm long; bracts leaflike; flowers all monomorphic; calyx at anthesis 8–13 mm long in fruit becoming 10–18 mm long, the segments linear, very unequal; pedicels in anthesis 1–2 mm long in fruit 3–10 mm long; corolla greenish yellow, pubescent externally, with a large cylindrical tube 10–30 mm long, limb small reflexed; fornicees lacking, but abundantly glanduliferous in the throat; style slender and elongate 10–30 mm long; nutlets ovoid, plump, white or brownish, smooth or obscurely pitted, 3.5–4.5 mm long, 2.7–3 mm broad.

Usually on limestone soils in the mountainous areas, 6,000 to 10,000 feet elevation. Arizona and southern New Mexico, southeast through Trans-Pecos Texas and Coahuila into the mountains of Nuevo Leon, Mexico. June to September.

8. Cynoglossum L.
Hound’s Tongue

Plants biennial or perennial rarely annual; stems mostly tall, erect, commonly coarse and pubescent; leaves alternate, the basal ones long petioled, the upper sessile; inflorescence elongating, racemose, bractless or bracted only at the base; calyx 5-parted, to below the middle, spreading or reflexed and somewhat accrescent at maturity; corolla funnelform or salverform, purple, blue, or white, the tube short, the lobes broad, spreading imbricate, the throat closed by the 5 fornicees; stamens included; filaments short; anthers oblong or elliptic; nutlets 4, depressed-ovoid or orbicular, glochidiate, ascending or divaricate, attached above the middle.

A cosmopolitan genus of about 75 species. (Greek kuno, dog, and glossa, tongue, because of leaf texture in some of the species)

1. Cynoglossum officinale L.
Cynoglossum officinale L. Sp. pl. 134. 1753. (Europe)

Biennial; stems stout, erect, 4–5 dm tall, leafy to the top, villous-tomentose throughout; leaves at base of plant oblong to oblong-lanceolate, 15–30 cm long, 2–7 cm wide, the upper leaves lanceolate, acute or acuminate, sessile or clasping; inflorescence racemose, the racemes several to many, simple or branched, much elongating in fruit; bracts evident or lacking; calyx 5–7 mm long in fruit, the segments ovate-lanceolate, obtuse to acutish, villous-strigose; pedicels 5–12 mm long; corolla reddish purple to blue, the broad tube 3–5 mm long, the limb 6–8 mm broad; style subulate, 4–5 mm longer than mature fruit; nutlets ascending on the pyramidal gynobase, 5.5–6 mm long, flattish on the upper surface and margined, glochidiate all over, splitting away from the gynobase at maturity but hanging attached to the subulate style.

Dry to somewhat moist open areas in mixed evergreen or oak woodlands, 5,000 to 9,000 feet elevation. Native to Europe and Asia, now widely introduced in the United States westward to Montana, Utah, and Arizona. May to July.


Small annual herbs; stems slender, spreading; leaves linear, with closely appressed strigose hairs; inflorescence a series of leafy-bracteate false racemes which constitute most of the plant; calyx 5-parted, the narrow lobes spreading or reflexed in fruit; corolla white, the tube shorter than the calyx, the lobes ovate, the throat nearly closed by the 5 fornicees; stamens included; style very short; stigma capitate; nutlets 4, flattened, attached above the middle, obovate-spathulate to nearly linear, spreading, usually paired, mostly marginated with hooked hairs that are spreading or recurving; gynobase broadly pyramidal.

About 10 species of western North America and western South America. (From the Greek pektos, combed, and karyon, nut, from the row of bristles on the margin of the nutlet.)
1. Nutlets orbicular or nearly so, both the body and the very thin conspicuous wing with slender unicinate bristles .......................................................... 1. *P. setosa*
   — Nutlets oblong or linear, the body without unicinate bristles .......................................................... 2
   
2(1). Nutlets with the margins pectinately lacerate or toothed most of their length, also commonly uncinate-bristly near the distal end .......................................................... 3
   — Nutlets with the margins entire or undulate, armed only at the distal end where densely uncinate-bristly .......................................................... 5

3(2). Nutlets conspicuously recurved; the margin narrow with nearly distinct teeth .. .......................................................... 2. *P. recurvata*
   — Nutlets nearly straight .......................................................... 4

4(3). Margin of nutlets broad and conspicuous, the teeth confluent ............ 3. *P. platycarpa*
   — Margin of nutlets narrow, the teeth usually not confluent ................ 4. *P. linearis*

5(2). Nutlets all winged margined .......................................................... 5. *P. penicillata*
   — Nutlets heteromorphic, 1 of each divergent pair wingless, or merely margined, the other with a broad somewhat incurved unicinate-toothed wing .......................................................... 6. *P. heterocarpa*

1. **Pectocarya setosa** A. Gray


*P. setosa* var. *holoptera* I. M. Johnst. Ibid. 70: 39. 1924. (I. M. Johnston 6489, Granite Well, Mohave Desert, California)

Stems usually simple at base, but branched just above with ascending branchlets, 5-20 cm tall, setose with spreading bristlelike hairs, also thinly strigose; leaves linear to linear-oblancoaleate, 5-20 mm long; calyx 3-4 mm long in fruit, the segments narrowly linear, armed with 3-6 straight divergent bristles; nutlets divergent in pairs, broadly obovate to orbicular, 2 of them bordered all around with a thin scarious wing, 2 wingless, the body and usually the wings producing slender uncinate bristles, the wing usually slightly undulate and slightly curved upward and saucerlike.

Dry, usually sandy or gravelly slopes, hillsides or flats, up to 7,000 feet elevation. Eastern Washington and Idaho, south through western Utah, Nevada, and Arizona to southern and lower California. April to June.

2. **Pectocarya recurvata** I. M. Johnston


Stems slender, diffusely branched from the base, the branches ascending, 5-25 cm long, sparsely strigose with closely appressed hairs; leaves linear to narrowly lance-linear, 1-3.5 cm long, 0.5-2 mm broad, acute, strigose or weakly setose, pustulate on the dorsal surface; calyx 2-3 mm long in fruit, the segments linear-lanceolate, strigose; nutlets divergent in pairs, linear, strongly recurved at full maturity, the wing divided to or almost to the body into prominent subulate straw-colored uncinate bristles, at the apex the wing prolonged into a short scarious tip, uncinate bristly on the margin.

Dry, sandy to gravelly slopes and mesa below 4,000 feet elevation. Southeastern California and Baja California, Mexico eastward to southern Nevada, southern Utah, Arizona, Hildago County, New Mexico, and south into Sonora, Mexico. March to April.

This delicate little plant is readily recognized because of its strongly recurved nutlets.

3. **Pectocarya platycarpa** (Munz. & Johnst.) Munz. & Johnst.


Stems slender, diffusely branched from the base, prostrate or widely ascending, 5-20(37) cm long, strigulose; leaves narrowly linear to linear-oblancoaleate, 1-3.5 cm long, 0.5-1.5 mm broad, cinereous-strigulose, acute; calyx
3–4 mm long in fruit, the segments linear-oblong, strigose, nearly as long as the nutlets; nutlets divergent in pairs, sometimes heteromorphic, linear-oblong to spatulate-oblong, 2.5–3(4) mm long, with a broad conspicuous winged margin bearing irregular uncinate teeth, the odd nutlet, when present, with a more deeply lacerate wing, and a more pubescent body.

Dry, gravelly or sandy mesas or bajadas or rocky hillsides usually below 4,000 feet elevation. Baja California, Mexico, and southwestern California eastward through southern Nevada into southwestern Utah, Arizona, southern New Mexico and extreme western Texas, El Paso County, and south into Sonora, Mexico. March to April.

4. Pectocarya linearis (R. & P.) DC.

Pectocarya linearis var. ferocula I. M. Johnst. Contr. Arnola Arbor. 3: 95. 1932. (Munz & Cronq 11846, Lady Harbor, Santa Cruz Island, California)

Stems slender, diffusely branched from the base, the branches prostrate to ascending, 8–25 cm long, strigose; leaves linear, 0.5–2.5 cm long, 0.5–1.5 mm broad, acute, strigose; calyx 1.5–2.5 mm long in fruit, the segments linear; nutlets divergent in pairs, 3–4 mm long, linear-oblong, the winged margin very narrow and producing 5–8 small, narrowly subulate, nearly distinct uncinate bristly teeth on each side, the body nearly straight, not recurved.

Dry, sandy, or gravelly slopes mostly below 4,000 feet elevation. Islands off the coast of southern California and on the mainland from Monterey County south to Baja California, Mexico, also South America in the dry arid regions. March to May.

P. linearis var. ferocula is the North American phase of the species. Although it is closely allied to the South American plant, the nutlets of var. ferocula tend to be monomorphic with slightly broader based teeth than in the typical material.

This plant is extremely rare in our flora, entering only near the extreme western boundary on the foothills of the San Bernardino Mountains, at the desert edge, and Kern County near Mohave.

5. Pectocarya penicillata (H. & A.) A. DC.


Stems many, diffusely branched from the base, prostrate or widely ascending, 5–15(25) cm long, cinereous-strigose; leaves linear, 1–2(3) cm long, 0.5–2 mm broad, setose-strigulose, pustulate on the dorsal surface; calyx 1.5–2 mm long in fruit, the segments linear, nearly as long as nutlets; nutlets divergent in pairs, monomorphic, oblong, 1.6–2.4 mm long, the margin unequal, upturned and incurved, broadest near the base and apex, subentire and armed only at the apex with uncinate-bristles, all the bristles slender and not dilated near the base.

Dry, sandy or gravelly hillsides, slopes or mesas, usually below 4,500 feet elevation, British Columbia and eastern Washington, south to southern California and eastward through Idaho to western Wyoming, and Arizona. February to June.

6. Pectocarya heterocarpa (I. M. Johnst.) I. M. Johnston


Stems slender, diffusely branched from the base, ascending or spreading, 5–15(25) cm long, strigose; leaves narrowly linear, 1–3 cm long, 0.5–2 mm broad canescent-strigulose, commonly pustulate on the dorsal surface; calyx 1.5–2 mm long in fruit, the segments narrowly lanceolate to elliptic; nutlets about 2 mm long, heteromorphic, divergent, 2 narrower and with or without a narrow-winged margin, and 2 with prominently winged margins, the wings uncinate bristly mostly at the apex, irregular, few toothed and with or without scattered bristles on the sides.

Dry, sandy, or gravelly bajadas or mesas mostly below 3,000 feet elevation. Southern California and Baja California, Mexico, eastward to southwestern Utah, extreme western Texas in El Paso County, and south into Sonora, Mexico. February to April.

10. Harpagonella A. Gray

Small pubescent annual; stems branching from near the base, prostrate or ascending; leaves linear-lanceolate or linear, canescent;
inflorescence racemose, floriferous to near the base of the stem, subbracteate; calyx unequal, 3 of the lobes distinct, the other 2 fused, the whole accrescent and closely enclosing the fruit, armed with 5-9 soft hooked spines; corolla white, minute; style entire; nutlets 1 or 2 dissimilar, thin-coreaceous, smooth to finely muricate, obliquely attached by the narrow base; gynobase depressed, small.

A monotypic genus of southwestern United States and northern Mexico. (Name diminutive of Latin harpago, grappling hook.)

1. Harpagonella palmeri A. Gray


Stems slender, diffusely branched from the base, nearly prostrate to ascending, 4-30 cm long; leaves linear or narrowly lanceolate, acute, 1-3.5 cm long, 1-3 mm broad, strigose, the dorsal surface evidently pubescent; calyx segments 1-1.5 mm long in anthesis, in fruit becoming 2-3.5 mm long; pedicels short, stout, recurving in fruit; corolla white, minute, 1.5-2 mm long; nutlets about 3 mm long, one enclosed in the indurate calyx tube, the other free, minutely muricate to nearly smooth, often covered with small trichomes.

Dry, sandy to gravelly mesas and bajadas mostly below 1,700 feet elevation. Los Angeles County to San Diego County and Baja California, Mexico, eastward to southwestern Arizona and Sonora, Mexico. February to April.

Rare and local species, usually occurring only during favorable years with sufficient moisture for good seed germination. A very unusual borage because of the highly modified asymmetrical calyx which resembles a grappling hook.

11. Myosotis L.

Forget-me-not

Annual or perennial herbs; stems slender, usually erect; leaves alternate, entire; inflorescence racemose, bracted or bractless; calyx 5-parted, cut to beyond the middle into lanceolate or triangular lobes; corolla blue, white, or rarely pink, the tube short, salverform, the throat with prominent fornice; stamens adnate to the corolla tube, included or exerted; nutlets 4, small, ovoid, smooth and shiny, sharply margined, the attachment scar flat; gynobase short and depressed.

A genus of about 30-35 species widely distributed in the temperate regions of the world. (From the Greek, mus, mouse, and otos, ear, because of appearance of the leaves of some species.)

1. Myosotis scorpioides L.

Myosotis scorpioides L. Sp. pl. 131. 1753. (Europe)

M. scorpioides var. palustris L. ibid. M. palustris Lam. Fl. Fr. 2: 253. 1778. (Europe)

 Fibrous rooted perennial herbs; stems 2-6 dm tall, often creeping at the base, commonly stoloniferous as well, strigose; leaves oblong to oblanceolate, sessile, 2-8 cm long, 7-15(20) mm broad, obtuse; inflorescence terminal, the racemes usually in pairs, becoming loose and open; bracts lacking; calyx in anthesis 1.5-2.5 mm long, in fruit becoming 3-5 mm long, the segments triangular, short, strigose, equaling or shorter than the tube; pedicels in fruit spreading, 4-7 mm long; corolla blue with a yellow eye, tube short about 2 mm long, the limb 5-8(10) mm broad; nutlets angled, keeled on the inside, smooth. N = 32.

In shallow water or moist places. Native of Europe, now widely distributed in North America as an escapee from cultivation.

Myosotis scorpioides was reported in Kearney and Peebles in Arizona Flora. They noted that the species had been planted in gardens around Flagstaff and that it may become naturalized in that area of our flora.


Fiddleneck

Taprooted, bristly-hairy annuals; stems usually simple below, branched above; leaves alternate, linear to ovate, entire; inflorescence racemose, scorpioid, usually bractless; calyx cleft to the base or nearly so, or some of the lobes connate so as to appear if fewer than 5 segments; corolla bright yellow or orange, tubular or salverform, glabrous, the throat without fornice; stamens included, the filaments short; nutlets 4, erect, angulate-ovoid, with a conspicuous ventral keel extending from the tip to near
the middle or below, often somewhat keeled dorsally also, the scar small and placed at the end of the ventral keel, often elevated and carunclelike; *gynobase* short pyramidal.

A genus of about 15 species of western North America and South America. (Named for William Amsinck, burgomaster of Hamburg and patron of its botanical garden during the early part of the 19th century.)

1. Sepals 5, essentially distinct; corolla tube with 10 traces at the base; nutlets muricate or rugose ............................................................. 1. *A. intermedia*
   - Sepals 3–4, reduced in number, unequal in width; corolla tube with 20 traces at the base; nutlets smooth or tessellate ............................................... 2

2(1). Nutlets smooth ........................................................................ 2. *A. vernicosa*
   - Nutlets tessellate ........................................................................ 3. *A. tessellata*

1. *Amsinckia intermedia* Fisch & Meyer


*A. cheirata* A. Gray, Proc. Amer. Acad. Arts 10: 54. 1876. (J. G. Cooper, sandy plains in the Mohave district of s.e. part of California, February 1861)

*A. parishii* Suksd. Werenda 1: 70. 1931. (First specimen cited is S. B. Parish 6043, San Bernardino Valley, California, 10 April 1907)

*A. nana* Suksd. Ibid. 84: 1931. (A. Eastwood 6016, Hermit Creek, Grand Canyon of the Colorado River, Arizona, 10 April 1917)

*A. diminuta* Suksd. Ibid. 88: 1931. (Norman C. Wilson, Diamond Creek Canyon, Arizona, April 1893)

*A. ridida* Suksd. Ibid. 91: 1931. (First specimen cited is E. Sleave 5134, Tamamoe Hills, near Tucson, Arizona, 27 March 1917)

*A. arizonica* Suksd. Ibid. (First specimen cited is A. Eastwood 6119, Glendale, Arizona, 17 April 1917)

*A. microphylla* Suksd. Ibid. (J. W. Tomey, Tucson, Arizona, 3 April 1894)

Stems simple to erectly or widely branched 3–8(10) dm tall, sparsely spreading bristly; leaves at base of plant linear or linear-lanceolate 2–7(10) cm long, 1–5 mm broad, the upper leaves becoming lanceolate or lance-ovate, clasping at the base, the apex acute, thinly hisrute and pustulate on both surfaces; inflorescence open and spikelike, the spikes much elongating in fruit 5–15(25) cm long; bracts evident only at the base; calyx 5–7(10) mm long in fruit, the segments linear-lanceolate to linear, the tips attenuate, hisrute-hispid the hairs often rufous; pedicels 1–3 mm long, erect; corolla orange yellow, the tube 8–10 mm long, 10 nerved, the limb 3–6 mm broad; style 3–4 mm long, slender; nutlets ovate, 2.5–3 mm long, incurved, grayish, narrowly keeled on the back, sharply rugose, also muricate or papillate between the rugae. N = 15, 17, 19. (Ray & Chisaki 1957)

Dry to moderately moist places from the deserts to the grassy hills and meadows, a common roadside weed below 5,000 feet elevation. Washington to Baja California, Mexico, and eastward to Idaho, Utah, and Arizona. March to June.

*Amsinckia intermedia* is a highly variable species, especially in leaf shape and size, pubescence, and nutlet ornamentation. Suksdorf recognized over 100 species that fall within this taxon.

2. *Amsinckia vernicosa* H. & A.

*Amsinckia vernicosa* H. & A. Bot. Beechey Voy. 370. 1838. (Douglas, California, probably on his trip from Monterey to Santa Barbara)

*A. carnosa* M. E. Jones Contr. W. Bot. 8: 35. 1898. (M. E. Jones, Shepherds Canyon, alt. 4,600 feet, 30 April 1897)

*A. glauca* Suksd. Werenda 1: 113. 1931. (A. A. Heller 7722, Sunset, Kern County, California, 20 April 1905)

Stems simple or sparingly branched above, 2–6 dm tall, glabrous and glaucous or green, or occasionally with a few scattered bristles above; leaves nearly glabrous, 2–8 cm long, 2–10(14) mm broad, ovate-lanceolate to linear-lanceolate below, clasping, conspicuously pustulate ventrally less so below, the pustules

References


sometimes producing a very short bristle, often ciliate-bristly on the margins; inflorescence open, terminating each branch, the spikes 3–12 cm long; bracts lacking or 1–2 at the base of the spike; calyx 8–11(15) mm long in fruit, the segments narrowly lanceolate, sometimes 2 or more partially united, hirsute-hispid with somewhat appressed and spreading pustulate bristles; corolla 10–12 mm long, limb 3–6 mm wide; style monomorphic; nutlets lance-ovate, 3–5 mm long, gray, smooth and shiny, the angles sharp and carinate, scar very narrow. N = 7.

Dry plains and hillsides, near sea level to moderate elevations in the mountains. Monterey and Fresno Counties, California, south to Kern County and east to the central Mohave Desert. March to May.

3. *Amsinckia tessellata* A. Gray


*Stems* branched just above the base and throughout, stout 3–6 dm tall, hispid, the bristles spreading, pustulate at base; leaves linear-lanceolate to ovate-lanceolate, 2–7 cm long, 4–15 mm broad, sessile, moderately hispid-pustulate on both surfaces; inflorescence spikelike, terminating each branch, the spikes 5–12(17) cm long; bracts lacking; calyx 9–13 mm long in fruit, the segments linear-lanceolate to oblong, 3 or 4 by fusion of 1 or 2 of the segments and then appearing notched at the apex, hispid, the back rufous, the margins white-ciliate; corolla orange, the tube 6–10 mm long, the limb 2.5–5 mm broad; style monomorphic; nutlets ovoid, 3–3.5 mm long, densely tessellate, carinate and often transversely rugose. N = 12.

Dry, mostly desert regions in sandy to rocky soils, on hillsides, bajadas, and mesas.

Eastern Washington, southeast of the Cascades and Sierra Nevada, to southern California, Nevada, western Utah, Arizona, and southern New Mexico. March to June.


**Catseye**

Annual, biennial, or perennial, herbaceous or fruticose plants; stems erect or ascending, usually with coarse stiff pubescence; leaves opposite at base, or alternate throughout, firm, veinless; flowers white or rarely yellow; inflorescence spikelike or racemose, bracted or bractless; calyx divided to the base, the lobes erect or convolute, linear or oblong, when mature investing the nutlets and falling away entire, or the calyx persistent and the nutlets falling away separately; corolla with a short to somewhat elongate cylindrical tube with or without scales at the base of tube, the fornice lower conspicuous; style slender, short or long, included; stigma capitellate; nutlets 1–4, erect, ovate to triangular, roughened or smooth, winged, margined or marginless, affixed laterally through a median ventral and commonly basal forked groove; gynobase usually columnar, subulate, or pyramidal.

An exclusively American genus of about 100 species of western North and South America. (From the Greek, *cryptos*, hidden, and *anthos*, flower, because of the minute corolla in some species.)

**References**


1. Plants annual, with slender stems (of longer duration in *C. racemosa*) ........................................ 2
   – Plants biennial or perennial ................................................................. 34

2(1). Calyx circumsicose at maturity; low diffuse plant; inflorescence compact, each flowe in axil of leafy bract .................................................. 1. *C. circumscissa*
   – Calyx not circumscissile ................................................................. 3
3(2). Gynobase subulate, protruding beyond the nutlets, bearing a sessile stigma on its tip; root and base of plant with a purple dye; each flower in the axil of a leafy bract ................................................. 2. C. micrantha
- Gynobase shorter than the nutlets; style developed; root or herbage usually with very little or no dye; flowers all or in part bractless (except C. maritima) .......... 4

4(3). Nutlets roughed or (in C. maritima) at least one of them so .......................................... 5
- Nutlets smooth and shining, not roughened ......................................................... 31

5(4). Margins of nutlets decidedly winged or knifelike ............................................. 6
- Margins of the nutlets rounded or obtuse ......................................................... 14

6(5). Pedicels usually evident, slender, 1–4 mm long; lateral angles of nutlets distinctly winged ......................................................... 7
- Pedicels obscure or none, less than 1 mm long ..................................................... 8

7(6). Nutlets homomorphous, broadly winged ......................................................... 3. C. holoptera
- Nutlets heteromorphic, narrowly winged ......................................................... 4. C. racemosa

8(6). Lateral margins of the nutlets usually distinctly winged; nutlets 4; calyx symmetrical ......................................................... 9
- Lateral margins of the nutlets knifelike or acute ................................................ 10

9(8) Corolla conspicuous, 4–7 mm broad; nutlets homomorphic ................. 5. C. oxygona
- Corolla inconspicuous, ca. 1 mm broad; nutlets heteromorphic, the odd one often wingless ................................................................. 6. C. pterocarya

10(8). Nutlets 1 or 2, odd nutlet axial ................................................................. 7. C. utahensis
- Nutlets 4; odd nutlet abaxial ............................................................................. 11

11(10). Nutlets homomorphous; obscurely roughened .............................................. 12
- Nutlets heteromorphous, plainly muricate ....................................................... 13

12(11). Nutlets lucid, somewhat bent, margin thickish ............................................. 8. C. pusilla
- Nutlets dullish, straight, margin thin, the back high, convex .......................... 9. C. costata

13(12). Nutlets 1.3–1.7 mm long, the margins of the lateral angles knifelike; calyx 2.5–3.5 mm long, in fruit; corolla 1 mm broad ......................................................... 10. C. inaequata
- Nutlets ca. 1 mm long, the margins of the lateral angles merely sharp; calyx ca. 3 mm long in fruit; corolla 1–2.5 mm broad ......................................................... 11. C. angustifolia

14(5). Nutlets decidedly heteromorphous ............................................................... 15
- Nutlets homomorphic ....................................................................................... 20

15(14). Mature calyx strongly appressed to the flattened rachis, decidedly gibbous on the axil side, persistent ................................................................. 12. C. dumetorum
- Mature calyx somewhat spreading, not at all gibbous ........................................ 16

16(15). Odd nutlet abaxial, surpassed by style ......................................................... 17
- Odd nutlet abaxial; style surpassed or occasionally reaching to the nutlet tips ...... 18

17(16). Nutlets 1.3–1.7 mm long; calyx 2–3 mm long ............................................. 10. C. inaequata
- Nutlets ca. 1 mm long, calyx 3–4 mm long ....................................................... 11. C. angustifolia

18(17). Odd nutlet smooth and shiny ................................................................. 13. C. maritima
- Odd nutlet tuberculare or pappilate ............................................................... 19

19(18). Spikes bracteate ....................................................................................... 14. C. minima
- Spikes naked .................................................................................................. 15. C. crassisebala
<table>
<thead>
<tr>
<th>Decision Path</th>
<th>Species</th>
</tr>
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<tbody>
<tr>
<td>20. (19). Style surpassing the nutlets</td>
<td>21. C. decipiens</td>
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<tr>
<td>21. (20). Spikes bractless or only sparingly so</td>
<td>22. C. decipiens</td>
</tr>
<tr>
<td>22. (21). Plant spring flowering; stems dichotomously branched from the base</td>
<td>23. C. recurvata</td>
</tr>
<tr>
<td>outward; plant usually low 5–15 cm high, and spreading</td>
<td>24. C. echinella</td>
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<tr>
<td>23. (21). Nutlets bent, lucid, gynobase narrowly pyramidal</td>
<td>25. C. gracilis</td>
</tr>
<tr>
<td>24. (23). Nutlets triangular ovate, with a suggestion of a median dorsal</td>
<td>26. C. mohavensis</td>
</tr>
<tr>
<td>ridge; plant dull dark green</td>
<td>27. C. fendleri</td>
</tr>
<tr>
<td>25. (24). Corolla conspicuous 2–5 mm broad</td>
<td>28. C. intermediella</td>
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<tr>
<td>26. (25). Nutlets only 1 or 2 in a normal fruit; style not more than half</td>
<td>29. C. maritima</td>
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<td>as long as nutlet</td>
<td>30. C. barbigera</td>
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<td>27. (25). Nutlets usually solitary</td>
<td>31. C. nevadensis</td>
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<td>28. (27). Mature calyx and nutlet conspicuously recurved or deflexed</td>
<td>32. C. gracilis</td>
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<td>29. (27). Nutlets ovate or triangular ovate</td>
<td>33. C. mohavensis</td>
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<td>30. (29). Stems spreading hirsute</td>
<td>34. C. fendleri</td>
</tr>
<tr>
<td>31. (4). Spikes bracteate, stems reddish</td>
<td>35. C. mohavensis</td>
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<tr>
<td>32. (31). Style reaching one-fourth–three-fourths height of nutlets; calyx</td>
<td>36. C. mohavensis</td>
</tr>
<tr>
<td>densely hispid-villous</td>
<td>37. C. mohavensis</td>
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<tr>
<td>33. (32). Margins of nutlets acute at least above the middle; Californian</td>
<td>38. C. mohavensis</td>
</tr>
<tr>
<td>34. (1). Corolla tube elongate, distinctly surpassing the calyx; flowers</td>
<td>35. C. mohavensis</td>
</tr>
<tr>
<td>usually heterostyled</td>
<td>36. C. mohavensis</td>
</tr>
<tr>
<td>35. (34). Nutlets smooth and shining</td>
<td>37. C. mohavensis</td>
</tr>
<tr>
<td>38. Nutlets more or less roughened or wrinkled at least on the dorsal surface</td>
<td>39. C. mohavensis</td>
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</tbody>
</table>
36(35). Corolla yellow ................................................................. 37
  — Corolla white ................................................................. 30. C. capitata

37(36). Inflorescence an elongate, cylindrical thryse; nutlets lanceolate, with acute margins, usually only one developing .............................................. 28. C. flava
  — 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 .................. 29. C. confertiflora

38(35). Nutlets muricate or verrucose ........................................ 31. C. fulvocanescens
  — Nutlets rugose or tuberculate ......................................... 39

39(38). Ventral or inner surface of the nutlets smooth or nearly so ................................................................. 40
  — Ventral surface of the nutlets distinctly roughened .................. 41

40(39). Corolla tube 7-10 mm long; calyx lobes 5-7 mm long in anthesis; plants not heterostyled; nutlets conspicuously tuberculate and short rugose ........ 32. C. oblata
  — Corolla tube 12-14 mm long; calyx lobes 7-9 mm long in anthesis; plants strongly heterostyled; nutlets finely tuberculate or rugose ........ 33. C. paysonii

41(39). Inflorescence 0.1-0.4 dm long; corolla tube 10-12 mm long; margins of nutlets not in contact; plants less than 1.2 dm tall .................................................. 34. C. paradoxa
  — Inflorescence 0.5-3 dm long; corolla tube 5-10 mm long; margins of nutlets in contact or nearly so; plants usually over 1.2 dm tall .............................................. 42

42(41). Scar of nutlets surrounded by an elevated margin but tightly closed; style 1-2 mm long; calyx 3.5-4 mm long in anthesis ............................................. 35. C. bakeri
  — Scar of nutlets conspicuously open; style 3-8 mm long; calyx 4.5-7 mm long in anthesis ................................................................. 43

43(42). Corolla tube 7-10 mm long; scar of nutlets conspicuously open and surrounded by a definite elevated margin ............................................. 36. C. flavoculata
  — Corolla tube 5-7 mm long; scar of nutlets slightly open and with only an inconspicuous elevated margin if any ............................................. 37. C. tenuis

44(34). Nutlets smooth on their dorsal surface ................................ 45
  — Nutlets more or less roughened on the dorsal surface .................. 47

45(44). Plants strong perennials; crests at base of corolla tube conspicuous; calyx not noticable accrescent, widespread species ................. 38. C. jamesii
  — Plants biennial or weak perennials; crests at base of corolla tube lacking; calyx noticable accrescent ................................................................. 39

46(45). Inflorescence capitate or nearly so; calyx segments in fruit 5-7 mm long, a narrow endemic of Coconino Co., Arizona .............................................. 39. C. atwoodii
  — Inflorescence broad topped due to the elongation of the cymules in age; calyx segments in fruit 7-10 mm long; SE New Mexico south into Texas and Mexico ................................................................. 40. C. palmeri

47(44). Ventral surface of nutlets smooth or nearly so ................................................................. 48
  — Ventral surface of nutlets rugose or variously roughened .............. 49

48(47). Nutlets bordered by a conspicuous wing; robust plants 5-10 dm tall, with long ebractate spikes; Arizona .............................................. 41. C. setosissima
  — Nutlets never conspicuously winged; plants 2-4 dm tall; inflorescence very broad and bracteate; NE New Mexico .............................................. 42. C. thyrsiflora

49(47). Scar somewhat constricted below the middle of the open portion, NE Arizona ................................................................. 43. C. osterhoutii
Scar triangular and not constricted below the middle or (closed in C. bakeri) .............................................................. 50

50(49). Cymules elongating and so the inflorescence broad; biennial or short-lived perennials; nutlets usually with an evident dorsal ridge .............................................................. 51

51(50). 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; known only from the type and may not exist any longer due to urbanization in the area .................................................. 44. C. insolita

— Surface of the leaves conspicuously setose-hispid with spreading bristles; inflorescence open, at least at maturity .............................................................. 52

52(51). Calyx lobes 7–12 mm long in fruit; nutlets 3–4.5 mm long, prominently carinate on the dorsal side .............................................................. 45. C. virginensis

— Calyx lobes 5–7 mm long in fruit; nutlets 2.5–3 mm long, with only an indistinct central ridge toward the apex .............................................................. 46. C. hoffmannii

53(50). Nutlets indefinitely tuberculate and rugose to nearly smooth; W Nevada and E California .............................................................. 47. C. tumulosa

— Nutlets definitely tuberculate, rugose or muricate .............................................................. 54

54(53). Scar of nutlets open .............................................................. 55

— Scar of nutlets closed .............................................................. 35. C. bakeri

55(54). Ventral surface of nutlets deeply rugose and tuberculate, the dorsal less so .............................................................. 48. C. abata

— Ventral surface of nutlets muricate or verrucose, the dorsal also or with some of the murications connected to form short irregular ridges .............................................................. 49. C. humilis

1. Cryptantha circumcissa (H. & A.) I. M. Johnston


Small annual herbs; stems erect or bushy branched, forming round clumps 0.2–1 dm tall, strigose to very hirsute; leaves oblong-lanceolate to nearly linear, 0.4–1.5 cm long, 1–2 mm broad, obtuse, strigose or hirsute, pubescent with small inconspicuous pustules, the petioles somewhat siliceous; inflorescence short, congested, the racemes obscure; bracts evident, appearing as if a continuation of the foliage leaves; calyx 2.5–4 mm long in fruit, oblong-ovate, connate to near the middle, the lobes falling away by a circumcission near the sinuses, hirsute, the tube siliceous, persistent; pedicels about 0.5 mm long; corolla minute, white, inconspicuous, 1–2(3) mm broad; style just exceeded by the nutlets or equalling them; gynobase about ⅔ height of nutlet; nutlets 4, homomorphous, or with the abaxial one slightly larger, triangular-ovate or oblong-lanceolate, 1.2–1.7 mm long, margins acute, the surfaces smooth or inconspicuously muricate, scar closed and forked below.

Dry, open, usually sandy slopes and plains, widely distributed in many plant communities, however in our area found mostly in the Larrea and Juniperus communities. Central Washington to Baja California, mostly east of the Cascade and Sierra Nevada ranges to southern Idaho, Utah, and Arizona; also Chile and Argentina. March to July.

2. Cryptantha micrantha (Torr.) I. M. Johnston

the branches ascending, rather numerous, hirsute also somewhat strigose; leaves oblong-lanceolate to linear-lanceolate, 3–6 cm long, 3–8(12) mm wide, hirsute, conspicuously pustulate on the dorsal side, less so above; inflorescence racemose, the racemes usually geminate, 0.4–0.7(1) dm long; bracts inconspicuous or evident on a few racemes; calyx 2.5–3.5 mm long in fruit, oblong-ovate, the segments lanceolate, connivent, midrib thickened and hirsute; pedicels ascending or recurved, 0.7–1.5 mm long; corolla white, minute; style evidently surpassing the nutlets; gynobase slender, nearly equaling the nutlets; nutlets 4, homomorphous, ovate to slightly oblong-ovate, 1.5–2.5 mm long, margins narrowly to broadly winged, the surface of the nutlets dark with lighter tuberculations, scar subulate, closed above, clearly open below.

Dry, gravelly, or rocky slopes and ridges mostly in the Larrea community. Inyo County, California, south to southern Imperial County, California, and eastward to Mohave and Yuma counties, Arizona, not common. February to April.

4. Cryptantha racemosa (S. Wats.) E. L. Greene


Long-lived somewhat suffrutescent annual; stems simple, with many ascending branches or diffusely branched from near the base, 1–10 dm tall, younger parts green, hirsute and also strigose, older parts brown, woody, with exfoliating epidermis; leaves oblong-lanceolate, acute, hirsute, conspicuously pustulate, 1.5–4(6) cm long, 2.5–4(12) mm broad; inflorescence paniculate, the racemes branched and loosely flowered, 0.3–1.5 dm long; bracts irregular and inconspicuous; calyx 2–4 mm.


Slender annual herbs; stems dichotomously branched throughout, 0.5–1.5 dm tall, root and lower part of the stem dye stained, strigose; leaves linear to oblong-ob lanceolate, 0.3–0.7 cm long, 0.8–1.4 mm wide, strigose to villous-hirsute, pustulate on the dorsal side; inflorescence short, dense, 1–4 cm long, the spikes unilateral solitary or geminate, numerous; bracts conspicuous, subtending each flower; calyx 1.8–2.5 mm long in fruit, ovate-oblong, slightly asymmetrical, conspicuously biseriate, the segments oblong-lanceolate, hirsute; pedicels 0.5–0.8 mm long; corolla inconspicuous to evident, 0.5–2.5(3.5) mm broad; style short, the stigma sessile; gynobase subulate, much longer than the nutlets; nutlets 4, homomorphous to slightly heteromorphous, the abaxial one the most persistent and slightly larger, lanceolate with apex attenuate, 1–1.3 mm long, margins rounded, plumose or brown, smooth or tuberculate, scar extending entire length of nutlet, narrow, only slightly broadened at the base.

Dry, open, sandy slopes and plains. Nevada and Utah, south to Baja California and Arizona, eastward to southern New Mexico and Transpecos Texas; also northern Mexico. March to June.

The species is easily recognized because of its dense bracteate spikes, dye-stained root, and the long, protruding gynobase.
long in fruit, oblowl-ovate, tardily deciduous, the segments linear-lanceolate, strigose and hisrate along the thickened midrib; pedicels 1–4 mm long, slender, frequently recurved; corolla very inconspicuous, about 1 mm broad; style much surpassing the nutlets; gynobase subulate, nearly equalling the consimilar nutlets; nutlets 4, heteromorphous, ovate, the acute tips slightly out-curved, odd nutlet next the abaxial calyx-lobes, 1–2 mm long, subpersistent, muricate or tuberculate or both, consimilar nutlets 0.8–1.5 mm long, the margins narrowly winged, dark with pale tuberculations, scar open or closed above, but opening out into a triangular areola below.

Dry, sandy slopes or rocky ridges mostly below 4,500 feet. Inyo County, California, south to northeastern Baja California and eastward to southern Nevada, southwestern Utah, and Mohave and Yuma counties, Arizona, not common. March to June.

Cryptantha racemosa is the only annual with stems that become somewhat woody or subfruticosc near the base.

5. Cryptantha oxygona (A. Gray) Greene

Erect annual herb; stems 1–4 dm tall, with several well-developed ascending branches from near the base, strigose also villous-hispid; leaves linear or linear-lanceolate, 1–4(6) cm long, 1–2(3) mm broad, strigose or short-hispid, obtusish, pustulate with small numerous inconspicuous pustules; inflorescence dense, the spikes geminate or ternate, 1–3(6) cm long; bracts lacking; calyx 2.5–4 mm long in fruit, ovate to oblong-ovate, obscurely biserial, the segments lanceolate, with somewhat thickened sparsely hisrate midribs, the margins silky strigose, somewhat connivent; pedicels short 0.5 mm long; corolla conspicuous, the limb 4–7 mm broad; style evidently surpassing the nutlets; gynobase about two-thirds as long as nutlets, nearly subulate; nutlets 4, homomorphous, oblowl-ovate, 2–2.5(3) mm long, margins narrowly winged or knifelike, dorsal side of nutlet low convex, muricate or tuberculate, scar closed or open above, open below with a broadly forked triangular areola.

Dry slopes and benches below 5,000 feet. California in the inner southern Coastal Ranges from western Merced and Fresno counties to Kern County, western Mohave Desert to Santa Rosa Mountains, Riverside County, eastward just into western Nevada. March to May.

A species closely related to C. pterocarya but having much larger corollas, and ranging more westward, just entering our flora along the western boundary in Kern County.

6. Cryptantha pterocarya (Torr.) E. L. Greene

Erect annual herb; stems 1–4 dm tall, ascendingly branched from the base and throughout, strigose or very short hisrate; leaves lanceolate to linear, 1–2.5(4) cm long, 1–3(5) mm broad, obtuse, strigose or hispid, dorsal surface conspicuously pustulate, ventral surface finely pustulate or the pustules nearly lacking; inflorescence open, the spikes geminate or rarely solitary or ternate, 2–6(12) cm long; bracts inconspicuous or lacking; calyx in fruit 2.5–3–5 mm long, very accrescent, broadly ovate, the segments ovate to ovate-lanceolate, the midrib slightly thickened and sparsely hisrate, the margins tawny strigose or hisrate; pedicels 0.5–1 mm long; corolla inconspicuous, 0.5–1(2) mm broad; style surpassing the body of nutlet but occasionally passed by the broad wing margin of nutlet; gynobase slender, about two-thirds height of nutlet; nutlets 4, homomorphous and all winged or heteromorphous and the axial one wingless, the body oblong-lanceolate or lanceolate, 2–2.5(3) mm long, margin of nutlet broad and winglike or narrow, entire but usually crenate, extending completely around


the nutlet, surface muricate, scar open or closed above, at the base opening into a dilated areola.

Dry sandy to gravelly washes and bajadas, below 6,000 feet. East of the Cascades and Sierra Nevada from southern Washington to northern Baja California, eastward to southern Idaho, Utah, Arizona, and northern Sonora, Mexico. March to June.

Cryptantha pterocarya can be separated into two rather weak varieties on the basis of the nutlets as follows:

1. Nutlets heteromorphic, axial one wingless ............................................. var. pterocarya
   − Nutlets homomorphic, all winged .................................................. var. cycloptera (Greene) Macbr.

Variety pterocarya tends to be more southerly ranging than variety cycloptera; also there are very few intermediates between the two varieties.

7. Cryptantha utahensis (A. Gray) E. L. Greenell


Erect ascendingly branched herb; stem solitary at base branched just above the base and throughout, 1–3(4) dm tall, strigose or appressed short hirsute; leaves few, scattered, reduced above, linear to linear-oblancoate 1–5(7) cm long, 1–4 mm broad, obtuse, short hirsute, conspicuously pustulate especially on the dorsal surface, less so above; inflorescence open, the spikes geminate or solitary, dense, 0.8–2.5(5) cm long; calyx 2–3(4) mm long in fruit, ovate to oblong, the base oblique-conic, spreading or recurving, the segments lanceolate, strongly connivent, the brownish thickened midrib occasionally bearing spreading or recurved bristles, the margins densely silky villous-hirsute; pedicels obscure; corolla conspicuous 2–4(5) mm broad; style just slightly shorter than nutlets; gynobase subulate, differing only slightly from the style; nutlets 1 or rarely 2, lanceolate, 1.7–2.5 mm long, margins acute or with a narrow knifelike wing, the surface pale, muricate, papillate, or occasionally spinulose, the back low convex or flat, scar open, linear and slightly dilated below into a small areola.

Dry, sandy or rocky washes and hillsides. Desert region of Inyo, San Bernardino, and Riverside counties, California, eastward through southern Nevada into southwestern Utah, and western Arizona in Mohave County. March to May.

8. Cryptantha pusilla (Torr. & Gray) E. L. Greene


Low annual herbs; stems numerous, prostrate to ascending, very slender, 0.3–1.5 dm tall, canescent, strigose to villous-hirsute; leaves mostly basal, scattered above, linear to linear-spathulate, 1–3 cm long, 1–2 mm wide, hispidulous and pustulate on the dorsal surface, less so ventrally; inflorescence compact, the spikes solitary or geminate, 2–8 cm long, densely flowered; bracts lacking or the bracts few and minute; calyx 2–2.5 mm long in fruit, broadly ovate, early deciduous, the segments ovate-lanceolate or oblong-lanceolate, hirsute, the midrib only slightly thickened; pedicels obscure; corolla minute, shorter than the calyx, about 0.6 mm wide; style conspicuously surpassing the nutlets; gynobase narrowly pyramidal, about equaling the nutlets; nutlets 4, homomorphous, lucid, broadly ovate, bent, 0.8–1.2 mm long, margins acute or knifelike, surface light brown or tan with pale tuberculations, scar subulate and expanded at base into a triangular areola.

Dry, sandy or gravelly slopes and washes. Southern Arizona east through southern New Mexico into Trans Pecos Texas; ranging southward into Sonora, Chihuahua, and Durango, Mexico. March to May.

Cryptantha pusilla is a relatively rare plant which just enters our area along the southern boundary or the Mexican border.

9. Cryptantha costata Brandegee

Cryptantha costata Brandegee, Bot. Gaz. 27: 453. 1899. (Brandegee, Borregos Springs, California, 1895)
Coarse low annual herbs; stems erect, few branched, 1–2 dm tall, densely villous-strigose and somewhat hirsute; leaves lanceolate to linear, 1–3 cm long, 2–4 mm wide, dorsal surface hispid, also pubescent, ventral surface villous-strigose and sparsely hispidulous the pustules few and inconspicuous; inflorescence open, the spikes rigid, solitary or geminate, 2–5 cm long; bracts remote, few; calyx in fruit 4–6 mm long, ovate-oblong, deciduous, the segments linear lanceolate, convivmt with slightly spreading tips, midrib thickened, hirsute, margins strigose; pedicels obscure; corolla inconspicuous, the tube shorter than the calyx, the lobes ascending; style very similar to the gynobase, much surpassing the nutlets; gynobase subulate; nutlets 4, homo- morphous, or slightly heteromorphous with the nutlet next the abaxial calyx- lobe the largest, triangular or oblong-ovate, 1.6–1.9(2) mm long, margins knifelike or narrowly winged, dorsal surface strongly convex, slightly rugulose or obscurely muricate, ventral surface flat or slightly concave, scar shallow, closed above opening below into a triangular-subulate areola.

Dry sandy washes and bajadas. Inyo County to San Diego County, California, eastward just into Arizona in Yuma County. February to May.

An interesting plant because of its unusual nutlets which have a flat ventral face and a very high, convex dorsal surface.

10. Cryptantha inaequata I. M. Johnston


Erect annual herbs; stems ascendingly branched, coarse, 2–4 dm tall, hispid and strigose; leaves linear to linear-oblanceolate, 1.5–4 cm long, 1–3(4) mm broad, acute, hispid, pubescent on the dorsal surface; inflorescence open, the spikes solitary or geminate, 4–12 cm long; bracts few and scattered or lacking; calyx in fruit 2–3(4) mm long, ovate-oblong, the segments lanceolate midrib moderately thickened and hirsute, axial lobe the most thickened and hirsute; pedicels very short, less than 0.5 mm long; corolla small, 1–2(3) mm broad; style conspicuously surpassing the nutlets; gynobase narrowly subulate, equalling consimilar nutlets; nutlets 4, heteromorphous, triangular-ovate, margins acute or knifelike, surface brownish with pale tuberculations, odd nutlet about 1.7 mm long, more persistent and slightly lighter in color than the others, next the abaxial calyx- lobe, the consimilar nutlets 1.3–1.5 mm long, scar subulate, closed above, narrowly triangular below.

Dry, usually clay soils, on desert slopes and rocky ridges. Inyo and San Bernardino counties, California, eastward to southern Nevada, southwestern Utah, and western Arizona in Mohave County. March to May.

This species is relatively rare throughout its range, but in certain localities, as north- east of Henderson, Nevada, it becomes more common, especially when the moisture supply is sufficient. The species is nearly always on heavy gumo clay soil.

11. Cryptantha angustifolia (Torr.) E. L. Greene


Diffuse annual herbs; stems much branched from near the base, ascending to nearly decumbent, 0.5–2(3) dm tall, hirsute to strigose-villos; leaves linear, 1.5–4 mm long, 1–2(4) mm wide, hispid or strigose, pubescent especially on the dorsal surface; inflorescence rather dense, the spikes geminate, 2.5–6(9) cm long, densely flowered; bracts lacking, calyx in fruit 2–4 mm long, ovate-oblong, ascending, strongly biseriate, the segments linear-lanceolate, midrib thickened and hirsute, the margins villous-hirsute and ciliate; pedicels obscure, less than 0.5 mm long, corolla inconspicuous to evident, 1–2.5 mm broad; style usually surpassing even the odd nutlet; gynobase columnar, equalling the consimilar nutlets; nutlets usually 4, heteromorphous, ovate-oblong, margins obtuse, acute, or narrowly winged, the surface brown with pale tuberculations or murications, odd nutlet next abaxial calyx- lobe, slightly larger than the consimilar nutlets which are about 1 mm long, scar very narrowly linear-lanceolate.

Dry, sandy or gravelly washes. South-
eastern California from the Death Valley region to northeastern Baja California and eastward to southwestern Utah, western Texas, and Sonora, Mexico. March to June.

12. Cryptantha dumetorum E. L. Greene

*Kryphttia dumetorum* Greene, Pittonia 1: 112. 1887. (*Curran*, half climbing among bushes at Tchachapi Pass, California 1884)

Sprawling annual herb; stems erect, or in age, elongate and scrambling or supported by various shrubs, 1–4(5) dm tall, closely strigose; leaves lanceolate, 1–3(4) cm long, 2–4/8 mm wide, thickish, sparsely appressed hispidulous, conspicuously pubescent on the dorsal surface, less so above; inflorescence open, the spikes solitary or gyneminate, loosely flowered, 5–10 cm long; bracts mostly lacking or occasionally with 1 or 2 near the base; calyx in fruit 2–3 mm long, closely appressed to the flattened rachis, conspicuously asymmetrical, persistent, gibbous at the base on the axial side, the 3 abaxial lobes lanceolate, with thickened hispid midribs, the 2 axial lobes partly united, strigose and deflexed hispid; pedicels lacking; corolla minute, about 1 mm broad; style subequal to nutlets or slightly shorter than the nutlets; gynobase subulate, narrow; nutlets 4, heteromorphous, ovate-lanceolate, to lanceolate, muricate, odd nutlet axial, persistent, 2–3 mm long, the base enlarged and distorting the calyx, scar open and broad, consimilar nutlets 1.5–2 mm long, deciduous, scar closed or very narrow and linear.

Sandy bajadas and hillsides or occasionally in the wash bottoms. Central Mohave Desert of California eastward through southern Nevada into southwestern Utah. April to May.

The Utah collection of this species is from the west shore of Ivins Reservoir, an considerable extension of range from that previously known. The plant probably also occurs in Mohave County, Arizona, but has not been documented.

13. Cryptantha maritima E. L. Greene


Erect annual herbs; stems reddish, ascendingly branched throughout, 1–3(4) dm tall, mostly strigose or occasionally hisprous; leaves linear to lanceolate, acutif, 1–3.5 cm long, 1–3.5 mm wide, sparsely hisprous, coarsely pubescent; inflorescence dense, the spikes solitary or gyneminate 1–7(12) cm long, congested, or glomerate especially when immature; bracts evident, and scattered throughout; calyx in fruit 1–3(3.5) mm long, ovate-obling, ascending, deciduous at length, the segments linear-lanceolate, connivent, the midrib thickish and hisprous, the margins hisprous-villose to villous; pedicels obscure or lacking; corolla minute, 0.5–1 mm broad; style nearly equalling consimilar nutlets; gynobase subulate one-half–two-thirds length of nutlets; nutlets 1–4, heteromorphous, odd nutlet often the only one developing, abaxial, lanceolate, 1–2 mm long, margins rounded, surface smooth and shiny, brownish, scar closed or open at base into a small areola, consimilar nutlets similar, but tuberculate and grayish, early deciduous.

Dry washes and desert bajas. Inyo County and throughout southeastern California to northern Baja California and east to southern Nevada, southwestern Utah, Arizona, and Sonora, Mexico. March to May.

The variety pilosa L. M. Johnston, is distinguished from the typical material by the densely white-villous calyx-segments. The range of pilosa is scattered within the range of the species.


Small annual herbs; stems erect or ascending-spreading, numerous, 0.5–1.5(2) dm tall, finely strigose and coarsely hisprous; leaves ob-lanceolate, 1–3(4) cm long. 1.5–4 mm broad, obtuse, hisprous or hispid in age, moderately pubescent; inflorescence dense, the spikes solitary or occasionally gyneminate 2–9(15) cm long; bracts evident throughout; calyx in fruit 4–7(9) mm long, oblong-ovate, spreading, asymmetrical, the segments lance-linear, connivent, midrib conspicuously thickened and bony, hispid, margins sparsely hisprous or ap-
pressed hispid; pedicels short, 0.5–1.5 mm long; corolla small, 1–1.5 mm broad; style surpassed by odd nutlet, equalling or surpassing consimilar ones; gynobase oblong about 0.7 mm long; nutlets 4, heteromorphous, odd nutlet ovate 2–3 mm long, margins angled, the surface brownish, finely muricate or granulate, persistent, next abaxial calyx-lobe, consimilar nutlets 1.2–1.5 mm long, thick, tuberculate, scar broadly open especially at the base, not forked.

Widely distributed on great variety of soils. Principally on the plains east of the Continental Divide, from Saskatchewan, Canada, south to northern New Mexico and Texas. April to July.

This plant is closely related to C. crassispala (Torr. & Gray) Greene, a more southern and westwardly growing species. The bracted inflorescences serve best to distinguish it from its southern relative.

15. Cryptantha crassispala (Torr. & Gray)
E. L. Greene


*C. crassispala* var. elachantha I. M. Johnston, Wrightia 2: 20. 1959. (R. McVaugh 5040, north end of Quitman Mountains, 8 miles west of Sierra Blanca, Hudspeth County, Texas) = var. elachantha

Erect or spreading annual herbs; stems many, ascendingly branched, 0.5–1.5(2.5) dm tall, hisrute to hispid; leaves oblongate, 1–3(6) cm long, 2–4(6) mm wide, rounded or obtuse, hisrute, postulate, the upper scarcely reduced; inflorescence moderately dense, the spikes solitary or geminate 3–10(15) cm long; bracts lacking or 1 to 2 subtending the lowermost flowers; calyx in fruit 5–7(10) mm long, oblong-ovate, slightly asymmetrical, the segments lance-linear, connivent above, midrib very hard and thickened, hispid-hirsute; pedicels about 0.5–1 mm long; corolla inconspicuous to 5 mm in diameter; style surpassed by odd nutlet, equalling or slightly longer than consimilar ones; gynobase narrowly oblong; nutlets 4, or occasionally less by abortion, heteromorphous, odd nutlet persistent, next abaxial calyx-lobe, ovate, acute, 2–2.5(3) mm long, the surface granulate or spinular-muri- cate, brownish, consimilar nutlets early deciduous, ovate-oblong, 1.2–1.5(2) mm long, tuberculate, scar large, open, occupying most of ventral surface.

Usually dry sandy soils on ridges and in washes. Southern Utah and Arizona, eastward to southwestern Colorado, New Mexico, western Texas, and northern Mexico. March to July.

16. Cryptantha mexicana (Brandeg.) I. M. Johnston


Dense, low, rounded herbs; stems numerous, erect, spreading or ascending, 0.5–2 dm tall, hispid or sparingly strigose-villous; leaves oblong-lanceolate, 2–4(5) cm long, 2–6 mm broad, obtuse, hispid, postulate, the upper only slightly reduced; inflorescence dense, very floriferous, the spikes solitary or geminate, 5–15 cm long; bracts evident throughout; calyx in fruit 3–4 mm long, broadly ovate, the segments lanceolate, connivent, hirsute to hispid villous; pedicels obscure; corolla inconspicuous about 1 mm broad; style barely surpassing nutlets; gynobase pyramidal, shorter than nutlets; nutlets 4, homomorphous, triangular-ovate, 1–1.3 mm long, margins rounded, the surface tan or brownish with white tuberculations, scar triangular, conspicuously excavated.

Exposed slopes and rocky ridges, mostly on limestone or caliche. Southeastern New Mexico, western Texas, and southward into northern Mexico in the state of Nuevo Leon and Coahuila. March to July.

This species is closely allied to *C. albida* (H.B.K.) Johnston. There should be no confusing the two as *C. albida* has a straight erect central axis or stem while this species is much branched from the base and throughout; also the flowering times are very different: *C. mexicana* is early spring and summer, while that of *C. albida* is in July and August.

17. Cryptantha albida (H.B.K.) I. M. Johnston


Erect annual herb; stems single or more commonly several, with numerous loosely ascending branches, the main stem becoming somewhat woody or very stiffened below in age, 1.5–4 dm tall, strigose and sparingly hispid; leaves spathulate to spathulate-linear, usually folded, 2–3 cm long, 2–5 mm broad, acute to obtuse, dorsal surface hirsute, conspicuously pubescent, ventral surface sparsely hirsute to nearly glabrous; inflorescence terminal on the main stem and the numerous branches, the spikes solitary or rarely geminate, 1–6(10) cm long; bracts numerous, small; calyx in fruit 2.5–3 mm long, ovate, the segments lanceolate, connivent, unequal, hispid; pedicels obscure, nearly sessile; corolla inconspicuous, 1.5–2.5 mm broad; style surpassing mature nutlets about 0.5 mm; gynobase pyramidal; nutlets 4, homomorphous, triangular ovate, 1–1.3 mm long, margins rounded, the surface tan or brownish, with low whitish tuberculations, scar triangular, occupying much of ventral face, excavated.

Slopes, canyons, and ridges of volcanic or limestone origin. Southeastern Arizona, possibly in extreme southern New Mexico. Occurring in Trans-Pecos Texas and south in Mexico in the states of Sonora, western Coahuila, Chihuahua, Durango, and Queretaro, as well as northwestern Argentina.

The species just enters our area in southeastern Cochise County, Arizona, but may be expected in the Guadalupe Mountains of southern New Mexico.


C. horridula E. L. Greene, Pittonia 5: 55. 1902. (Mrs. Curran, Salinas River, California, 1885)


Moderately tall erect annual herbs; stems single or several, 1–10 dm tall, ascendingly few to several branched, hishurse also somewhat strigose; leaves linear to linear-oblanceolate, 1–5(9) cm long, 1–3(4) mm wide, acute, villous-hirsute, inconspicuously pubescent; inflorescence terminating the main stem and branches, the spikes geminate to quinate, 2–15 cm long; bracts lacking; calyx in fruit 2–4 mm long, ovate, deciduous, the segments lanceolate, very connivent, midrib slightly thickened and tawny-hirsute, the margins hispid; pedicels obscure; corolla inconspicuous to conspicuous, 1–7 mm broad; style usually much surpassing the nutlets or rarely slightly shorter than them; gynobase linear subulate; nutlets 4, homomorphous, broadly ovate, 1.5–2.5(3) mm long, lucid or dull, mucrulate or tuberculate, also sometimes granulate, margins acute to rounded, base truncate, scar narrow and nearly closed but at the base broadly forking and with a very small areola.

Dry gravelly bajadas and washes, or mountain slopes. Southern California from the transition zone to arid desert zone and eastward to Nevada and Arizona. April to July.

Two rather well-defined varieties occur within the area of our flora, the typical variety has conspicuous corollas 2–6 mm broad, while variety denticulata (E. L. Greene) Johnston has inconspicuous corollas 1–2 mm broad; otherwise the plants are quite the same. Two other varieties may occur within our area, variety jonesii (Gray) Johnston, and variety clokeyi (Johnston) Jepson.

19. Cryptantha intermedia (A. Gray) E. L. Greene


C. barbigera var. fergusoniae Macbr. Ibid. 59. 1918. (Ferguson 42, Palm Springs, California)

C. intermedia var. jonesii Macbr. Ibid. 59. 1918. (Johnston 1928, Claremont, California)

Erect annual herbs; stems 1–several, erectly branched, 1.5–5 dm tall, very hirsute
with spreading or ascending hairs, also strigose; leaves lanceolate to linear, acute to obtuse, 2–6(7.5) cm long, 1–5(7) mm wide, hirsute or strigose, minutely pubulate; inflorescence open and lax, the spikes geminate to quinate, mostly ternate, 1–15 cm long; bracts lacking; calyx in fruit 2–4–6 mm long, ovate-oblong, ascending, the segments lance-linear, connivent with spreading tips, midrib moderately thickened and very hirsute, margins strigose or hispid villous; pedicels obscure, 0.5 mm long; corolla conspicuous, 3–6(8) mm broad; style subequal to the nutlets, or slightly longer or shorter than them; gynobase linear-sulcate; nutlets usually 4, or somewhat less by abortion, homomorphous, lanceolate to ovate, 1.8–2.3 mm long, surface muricate to tuberculate, grayish or tannish, somewhat granulate also, margins mostly obtuse, scar narrow and linear, or closed but with a small areola at the base.

Dry sandy slopes and hillsides. Northern California to northern Baja California mostly west of the Sierra Nevada Mountains but entering the desert edge along the eastern foothills. March to July.

_Cryptantha intermedia_ is a highly variable species and tends to intergrade quite completely with _C. barbigera_ in our area, and to a lesser extent also with _C. nevadensis_. The larger corolla of _C. intermedia_ will usually separate it from its close relatives.

20. _Cryptantha decipiens_ (M.E. Jones) Heller


Slender erect annual herbs; stems ascendingly branched throughout, 1–4(5) dm tall, strigose rarely sparsely hirsute; leaves mostly basal, reduced upward, linear, 1–4 cm long, 1–3(4) mm broad, obtuse to acutish, strigose and sparsely hispid, sparsely but evidently pubulate; inflorescence open, the spikes geminate or occasionally ternate or solitary, slender, usually densely flowered, 3–10(14) cm long; bracts lacking; calyx in fruit 2–5 mm long, ovate to oblong, strictly ascending, asymmetrical, the segments lance-linear, conspicuously connivent with spreading or recurving tips, the midrib moderately thickened and hirsute, margins strigose or weakly hirsute, the abaxial lobe usually slightly the longest; pedicels obscure or lacking; corolla minute to evident, 0.8–3.5 mm broad; style short, much surpassed by nutlets; gynobase short pyramidal; nutlet 1 or rarely 2, next abaxial calyx lobe, ovate-lanceolate, 1.5–2.4 mm long, margins rounded, the surface brownish, muricate to tuberculate, scar narrowly linear, but opening at base to form a small areola.

Sandy, gravelly, or rocky slopes or hillsides, often growing on limestone. Inyo and Kern counties, California, south to northern Mexico, and eastward through southern Nevada to Washington county, Utah, and western Arizona. March to May.

21. _Cryptantha recurvata_ Coville

_C. recurvata_ Coville, Contr. U. S. Natl. Herb. 4: 165. 1893. (Coville & Fausn 713, Surprise Canyon, Panamint Mountains, California)

Sprawling annual herbs; stems slender, ascendingly branched just above the dye-stained root, 1–3 dm tall, strigose rarely hispidulose; leaves remote, oblanceolate or linear-oblanceolate 1–2(3.5) cm long, 1–4(5) mm broad, rounded or obtuse, strigose, inconspicuously pubulate; inflorescence open, the spikes solitary or geminate, slender, 2–10(12) cm long; bracts lacking; calyx in fruit 3–4 mm long, conspicuously asymmetrical, bent and strongly recurved, tardily deciduous, the segments linear, the abaxial the longest, midrib moderately thickened and hirsute, the margins appressed hirsute or strigose; pedicels lacking; corolla minute, shorter than the calyx; style much shorter than nutlet; gynobase short and slender; nutlet 1, persistent, next abaxial calyx-lobe, lanceolate, incurved ca. 2 mm long, the tips attenuate-acute, margins obtuse, the surface dull brownish, granulate or muricate, scar narrowly linear or closed above, below opening into a small basal areola.

Sandy or occasionally gravelly washes or slopes. Southeastern Oregon south to Inyo county, California, in the Panamint Mountains and eastward to San Juan County, Utah, and Mohave County, Arizona. April to June.

22. _Cryptantha echinella_ E. L. Greene


Annual herbs; stems simple below, branched above, with ascending branches,
1–3(4) dm tall, setose or occasionally strigose or hispid; leaves linear to oblong-linear, 1–4(6) cm long, 1–3(4.5) mm broad, obtuse, hispid, pubescent; inflorescence open, the spikes slender, solitary or geminate, 1–5 cm long; bracts evident only near the base; calyx in fruit 4–6 mm long, oblong-ovate, deciduous, spreading, the segments linear-lanceolate, connivent with spreading tips, midrib moderately thickened and hisrate, the margins hispid or strigose; pedicels obscure, about 0.5 mm long; corolla minute, 1–2 mm broad; style slightly surpassed by the nutlets; gynobase narrow, two-thirds as long as nutlets; nutlets 4, homomorphous, ovoid, 2–2.2 mm long, margins rounded, the surface finely muricate or granulate, or verrucose, scar very narrowly linear or closed, broadly forked at the base.

Open dry ridges and slopes in the upper arid transition zone, associated with Juniperus, Pinus, and Artemisia. Sierra Nevada Mountains of California eastward to the Charleston Mountains, Nevada, with an isolated collection in northwestern Colorado, Moffatt County. Weber and Salamun 12612. June to August.

23. Cryptantha barbigera (A. Gray) E. L. Greene


(Parry 171, Washington County, Utah)


Erect annual herbs; stems 1–several, erectly branched, hisrate, 1–4(5) dm tall; leaves oblong to lance-linear, obtuse, 1–5(7) cm long, 3–7(13) mm wide, hisrate, inconspicuously pubescent; inflorescence terminating the main stem and branches, the spikes usually geminate, sometimes solitary or ternate, 2–11(16) cm long; bracts lacking; calyx in fruit 4–8(10) mm long, oblong-lanceolate, ascending, the segments lance-linear, with the tips spreading or recurving, midrib moderately thickened and hisrate, the margins long white-villos; pedicels obscure, 0.5–0.8 mm long; corolla inconspicuous, 1–2 mm broad; style subequal to nutlets or slightly longer; gynobase linear; nutlets 1–4, homomorphous, lanceolate, 1.5–2.5 mm long, margins rounded or slightly angled, the surface verrucose, brownish, scar linear-lanceolate, broadened at the base into a narrowly triangular areola.

Dry slopes, wash bottoms, and hillsides. Very common throughout most of the desert southwest from southeastern California and northern Baja California east through southern Nevada to southwestern Utah, Arizona, and southern New Mexico into Sonora Mexico. February to May.

24. Cryptantha nevadensis Nels. & Kenn.


Erect or ascending annual herbs; stems 1–several, slender, often flexuous, laxly branched, 1–5 dm tall, closely appressed strigose, or rarely sparsely hisrate; leaves linear-oblancoate to linear, acute to obtuse, 1–4 cm long, 1–5(7) mm broad, sparsely appressed hisrate, moderately pustulate; inflorescence lax to somewhat glomerate, spikes geminate or ternate, congested or elongate, 2.5–15 cm long; bracts lacking or occasionally bracted at base; calyx in fruit, 4–10(12) mm long, lanceolate, ascending, the segments linear-lanceolate, connivent with slender recurving tips, midrib thickened and hisrate, margins villous-setose; pedicels obscure about 0.5 mm long; corolla minute, 1–2 mm broad; style subequal to nutlets or a trifle shorter; gynobase linear about three-fourths length of nutlets; nutlets 4, homomorphous, lanceolate, 2–2.9 mm long, the margins obtuse, the surface mostly verrucose or somewhat muricate near the tip, scar narrowly open and linear to nearly closed, but always with a small areola near the base.

Dry bajadas, washes, and open hillsides mainly in the Larrea community. The stems often supported by other vegetation. Southeastern California, northern Baja California, and eastward through Nevada to south-
western Utah and Arizona. March to May.

25. Cryptantha gracilis Osterh.

(Osterhout 2589, Glenwood Springs, Garfield Co., Colorado)


Slender erect annual herbs; stems 1–several, sparsely branched from the base and above, 1–2(4) dm tall, densely short setose; leaves mostly basal, scattered above, linear-oblong, to narrowly oblancoate, 1–3 cm long, 1–2(3) mm wide, rounded or obtuse, setose or weakly hirsid, inconspicuously pubescent; inflorescence open, the spikes solitary or geminate, usually glomerate, 1–2 cm long; bracts lacking; calyx in fruit 2–3 mm long, ovate, spreading, early deciduous, the segments lanceolate, midrib slightly thickened and inconspicuously setose, the margins densely setose-villous, often tawny; pedicels lacking; corolla minute, less than 1 mm broad; style two-thirds to three-fourths length of nutlet; gynobase about half height of nutlet; nutlets 1 or rarely 2 or 3, homomorphous, lanceolate, 1.5–2 mm long, margins mostly rounded, surface smooth and shiny, scar linear very narrowly open at least at the base.

Dry slopes and open areas in the upper Transition Zone. Southern Idaho south through Nevada to Inyo County, California, and east to western Colorado, and northern Arizona. April to July.

*C. gracilis* enters our area from the north, and is found only on some of the higher ranges in the Mohave Desert (Charleston Mountains and the Virgin Mountains). The species never truly grows on the dry desert lowlands.

26. Cryptantha mohavensis E. L. Greene


*C. fallax* E. L. Greene, Pittonia 5: 54. 1902. (E. L. Greene, mountains above Tehachapi, California, 22 June 1899)

Usually erect annual herbs; stems many branched, 1–4 dm tall, short-hispid to hirsut-strigose; leaves linear to linear-lanceolate, 1–4 cm long, 1–3 mm broad, strigose or appressed setose, minutely and densely pubescent, obtuse; inflorescence crowded, the spikes ternate or geminate, usually dense, 2–6 cm long; bracts lacking; calyx in fruit 3–5 mm long, oblong-ovate, ascending, deciduous, the segments lanceolate, connivent, midrib moderately thickened and often sparsely hirsute, margins commonly silky-strigose; pedicels obscure, ca. 0.5 mm long; corolla conspicuous 4–7 mm broad; style evidently surpassing nutlets; gynobase columnar subulate, three-fourths height of nutlet; nutlets 4, homomorphous, lance-ovate to lance-oblong, 2–2.5 mm long, margins angled and obtuse near apex, surface smooth and shiny, rarely granulate, the dorsal side flat or low convex, scar closed above but opening to form a small triangular areola at the base.

Dry sandy soils. Southeastern and southern California from Inyo and Kern counties southward to the San Gabriel Mountains and Sierra Libre. May to June.

The species just enters our flora along the western boundary of the foothills of the Sierra Nevada near Bishop south to the town of Mohave, California.

27. Cryptantha fendleri (A. Gray) Greene


*C. ramulosissima* A. Nels. Erythea 7: 68. 1899. (Nelson 5275, Laramie, Wyoming)


Erect annual herbs; stems solitary with many divaricate or ascending lateral branches, 1–5 dm tall, densely spreading hirsid; leaves narrowly oblancoate, acute to nearly obtuse, 1–5 cm long, (1)2–4 mm broad, hirsid, pubescent on the dorsal surface, much less so above; inflorescence broad, the spikes solitary or geminate 2–13 cm long, loosely flowered; bracts lacking or rarely 1 or 2 near the base; calyx in fruit 3–6(7.5) mm long, oblong-lanceolate, ascending the segments linear to lance-linear, slightly connivent with the tips slightly spreading, midrib thickened and hirsute, margins strigose; pedicels about 0.5 mm long, obscure; corolla inconspicuous, about 1 mm broad; style subequal to or slightly exceeding the nutlets; gynobase subulate, about two-thirds height of nutlets; nutlets 4, or sometimes fewer by abortion, homomorphous, lanceolate, the tips acuminate, 1.5–2 mm long, margins obtuse or
rounded, surface smooth and usually shiny, scar closed or slightly open above, below forming a triangular areola.

Open, exposed, usually sandy sites in the *Artemisia* and *Juniperus* associations, 3,500–7,000 feet elevation. Southeastern Washington and northeastern Oregon east to southern Alberta and Saskatchewan to eastern Nebraska, northern New Mexico, and Arizona. June to August.

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


Perennial herbs; stems many from a multiple caudex. 1.3–4 dm tall, densely long white-hairy at the base, becoming setose and stigose upward; leaves narrowly oblanceolate to nearly linear, acute, 2–9 cm long, 3–8 mm wide, dorsal surface stigose and appressed setose with pubulate hairs, ventral surface almost uniformly stigose, and with the pubules less conspicuous; inflorescence narrow to somewhat open, 0.5–2.5 dm long, conspicuously yellow setose; bracts inconspicuous; pedicels 3–5 mm long in fruit; calyx 8–10 mm long in anthesis, in fruit becoming 9–12 mm long, the segments linear, densely setose, with yellowish hairs; corolla yellow, the tube 9–13 mm long, fornices broad, emarginate, about 1 mm long, crest at base of tube evident or sometimes lacking, limb 8–10 mm wide; heterostyled; nutlets ovate or triangular-ovate, 3.5–4 mm long, 2.5–3 mm wide, usually all four maturing, margins narrowly winged, in contact, both surfaces smooth and glossy, scar straight, closed, elevated margin lacking.

Dry exposed sites on a wide variety of soil types. Southeastern California, eastward through southern Nevada into northern Arizona and southern Utah. April to July.

A tall handsome plant closely related to *C. flava* but having nearly capitate inflorescences and broadly ovate nutlets. The yellow flowers also tend to be lighter in color or a washed out yellow.

29. *Cryptantha confertiflora* (Greene) Payson


*Oreocarya confertiflora* E. L. Greene, Pittonia 3: 112. 1896. (S. B. Parish 1316, Cushenberry Springs on the north side of the San Bernardino Mountains, San Bernardino County, California, 1882)


Perennial herbs; stems 1–7, slender, 1.7–4.3 dm tall, tomentose at base, stigose and setose upward; leaves linear to oblanceolate, 3–12 cm long, 2–10(16) mm wide, acute, dorsal surface densely stigose and appressed setose with pubulate bases, ventral surface uniformly stigose and with few or no pubules; inflorescence subcapitate, 0.3–2 dm long, stigose, and with flattened, twisted, setose hairs; bracts inconspicuous; calyx in anthesis 6–8 mm long, in fruit becoming 10–14 mm long, the segments linear-lanceolate, stigose and spreading setose; corolla yellow, the tube 9–13 mm long, fornices broad, emarginate, about 1 mm long, crest at base of tube evident or sometimes lacking, limb 8–10 mm wide; heterostyled; nutlets ovate or triangular-ovate, 3.5–4 mm long, 2.5–3 mm wide, usually all four maturing, margins narrowly winged, in contact, both surfaces smooth and glossy, scar straight, closed, and lacking an elevated margin.

Dry exposed sites on a wide variety of soil types. Southeastern California, eastward through southern Nevada into northern Arizona and southern Utah. April to July.

A tall handsome plant closely related to *C. flava* but having nearly capitate inflorescences and broadly ovate nutlets. The yellow flowers also tend to be lighter in color or a washed out yellow.

30. *Cryptantha capitata* (Eastw.) I. M. Johnston


Erect perennial herbs; stems weak, 1–several, 1.5–2.7 dm tall, appressed setose; leaves linear or narrowly oblanceolate, 3–8 cm long, 3–5 mm wide, dorsal surface appressed setose-pustulate, ventral surface uniformly stri-
gose and without pustules; *inflorescence* capitate, or with one or two glomerules below the terminal cluster, 0.1–0.4(7) dm long, spreading white-setose; *calyx* 7–9 mm long in anthesis, in fruit becoming 11–16 mm long, the segments linear-lanceolate, conspicuously setose-pustulate; *corolla* white, the tube 9–12 mm long, fornices yellow, emarginate, about 1 mm long, papillose, crests at base of tube conspicuous, 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, knife-like, both surfaces glossy-smooth, scar closed, straight, and without an elevated margin.

Open or exposed somewhat sandy soils in the Transition Zone, 6,500 to 8,500 feet elevation. South central Utah and north central Arizona in the Colorado River drainage basin. April to July.

In our area this species is restricted to the Grand Canyon National Park along the Kaibab and Hermit trails, both on the north and south rims.

31. Cryptantha fulvocanescens (S. Wats.) Payson

Densely caespitose perennials from a strongly lignified taproot; *stems* many from a multiple caudex, 0.8–3 dm tall, white hairy at the base, setose-hirsute upward; *leaves* spatulate or oblanceolate, acute to obtuse, 1.5–7 cm long, 4–12 mm wide, uniformly strigose, pustules mostly confined to the dorsal surface; *inflorescence* narrow or somewhat open at maturity, 0.3–1.9 dm long, white or yellowish setose-hispid; *bracts* inconspicuous; *pedicels* 2–10 mm long; *calyx* 4–6 mm long in anthesis, in fruit becoming 9–13 mm long, the segments linear, densely white or yellowish setose-hispid; *corolla* white, the tube 7–11 mm long, fornices yellow, emarginate or rounded, 0.7–1.3 mm long, crests at base of tube evident or lacking, limb 7–9 mm wide; *style* exceeding mature fruit 3–7 mm; *nutlets* lance-ovate, 3.5–4.5 mm long, 2–3 mm wide, one or two usually maturing, the 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.

Dry, sandy to clay soils on exposed areas in the *Artemisia* or *Juniperus-Pinus* association, 4,000 to 7,500 feet elevation. Central Utah and north central Arizona east to western Colorado and central New Mexico, with an isolated population at White Sands National Monument. April to August.

Two rather distinct varieties occur within our area and may be separated by the following key:

1. Murications on the nutlet rounded; *corolla* 9–13 mm long; *inflorescence* narrow, white setose at maturity; usually growing on sandy soils ................................................................. var. *fulvocanescens*

   Murications on the nutlet with one or two setose projections; *corolla* 7–9 mm long; *inflorescence* broader and usually yellowish setose-hispid at maturity; usually growing on clay soils ...................................................... var. *echinoides* (Jones) Higgins

The variety *echinoides* is limited in our area to north central Arizona and north-eastern New Mexico.

32. Cryptantha oblata (M. E. Jones) Payson
Perennial or biennial herb; stems several, 1–3.5 dm tall, retrorsely setose and spreading hirsute; leaves oblanccolate, acute, 3–10 cm long, 4–14 mm wide, coarsely strigose and setose dorsally with conspicuous pustules, 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 5–7 mm long in anthesis, becoming 8–10 mm long in fruit, the segments linear-lanceolate, densely setose-hirsute; corolla white, tube 7–10 mm long, crests at base of tube lacking, fornices 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.

Sandy or gravelly to rocky hillsides mostly on gypsum soils, 1,000 to 5,000 feet elevation. South central New Mexico south through Trans-Pecos Texas into northern Mexico. March to September.

This species is only one of the many gypsophilous plants that occur in the southeastern part of our area.

33. Cryptantha paysonii (Macbr.) I. M. Johnston


Caespitose perennials; stems erect, stout, (0.5)1.6–2.9 dm tall, strigose and more or less spreading setose; leaves oblanccolate, obtuse to acute, 3–9 cm long, 5–15 mm wide, dorsal surface finely strigose or subtomentose, also setose with pustulate hairs, ventral surface similar but with fewer pustulate hairs; inflorescence subcapitate, consisting of four to six compact cymules, 0.5–1.2 dm long, setose; calyx 7–9 mm long in anthesis, becoming 9–10 mm long in fruit, the segments linear-lanceolate, setose; corolla white to yellowish tinged, the tube 12–14 mm long, crests at base of tube lacking, fornices yellow, rounded, densely papillose, 0.5–1 mm long, limb 10–13 mm wide; 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, lacking an elevated margin.

Gravelly or rocky hillsides mostly on gypsum or limestone soils, 4,000–7,500 feet elevation. Southeastern New Mexico and Trans-Pecos Texas in Culberson County. April to June.

34. Cryptantha paradoxa (A. Nels.) Payson


Small perennial herbs; stems 1–several, slender, 0.4–1.2 dm tall, subtomentose near the base, weakly setose above; leaves oblanccolate to spatulate, usually folded, obtuse, 1.5–4 cm long, 2–4(7) mm 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; bracts inconspicuous; calyx in anthesis 5–6 mm long, in fruit becoming 6–8 mm long, the segments linear-lanceolate, weakly setose; corolla white with a yellow tube 10–12 mm long, crests at base of tube lacking, fornices yellow, broad, slightly emarginate, papillose, 0.5 mm long, limb 10–12 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.

Dry, sandy, gravelly, or clay soils, 4,000 to 7,500 feet elevation. Emery County, Utah, western Colorado, and San Juan County, New Mexico. May to June.

In our area known only from one collection by Duane Atwood 2527, 12 miles west of Shiprock on Hwy 504, 15 May 1970.

35. Cryptantha bakeri (E. L. Greene) Payson

Biennial or short-lived perennials; *stems* stout, 1–3 dm tall, spreading setose-hirsute; *leaves* oblanceolate, obtuse, mostly basal, 3–6 cm long, 5–12 mm wide, dorsal surface strigose and spreading setose, pubescent, ventral surface uniformly strigose and with few or no pubescent hairs; *inflorescence* narrow, 0.6–2.5 dm long, setose-hirsute; *bracts* evident, slightly surpassing the individual cymes; *calyx* in anthesis 3.5–4 mm long, in fruit becoming 6–8 mm long, the segments broadly lanceolate or ovate, conspicuously setose; *corolla* white, the tube 4–6 mm long, crests at base of tube lacking, fornice 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.

Dry sandy or clay soils in *Pinyon-Juniper* community, 4,000 to 8,000 feet elevation. Southeastern Utah, northeastern Arizona in Apache and Navajo counties, and southwestern Colorado. May to August.

A species closely allied with *C. flavoculata* but having a shorter style and corolla, and the nutlet scar tightly closed.

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


*O. shockleyi* Eastw. Bull. Torrey Club 30: 245. 1903. (Shockley 244, Miller Mountain, Esmeralda County, Nevada)

*O. eastwoodiae* Nels. & Kenn. Muhlenbergia 3: 141. 1908. (Kennedy & Goodding 146, Mormon Mountains, Lincoln County, Nevada)

Caespitose perennial herbs; *stems* slender, 1–3 dm tall, strigose and weakly spreading setose with slender bristles; *leaves* linear-oblong to spatulate, obtuse or sometimes acute, 3–11 cm long, 3–15 mm wide, densely strigose and weakly setose, dorsal surface conspicuously pubescent, ventral surface with few pubescent and sometimes silky-strigose; *inflorescence* narrow, or sometimes slightly open and lax, 0.5–3 dm long; *bracts* evident but not conspicuous; *calyx* 5–6 mm long in anthesis, in fruit becoming 8–10 mm long, the segments lanceolate to ovate; *corolla* white or pale yellow, the tube usually yellow, 7–10 mm long, crests at base of tube lacking, fornice yellow, minutely papillate, 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 conspicuous ridges, sometimes nearly foveolate, ventral surface tuberculate, rarely with ridges, scar open, constricted near the middle and surrounded by a high, elevated margin.

On a wide variety of soils mostly in the *Pinyon-Juniper* community, but also occurring in the *Artemisia* and the *Spruce-Fir* communities, 3,000–8,500 feet elevation. East central California eastward through Nevada and Utah into southwestern Wyoming, western Colorado, and northern Arizona. April to July.

37. **Cryptantha tenuis** (Eastw.) Payson


Caespitose perennial herbs; *stems* slender, 1–many, 1.3–2.5 dm tall, strigose and weakly spreading setose; *leaves* linear-spatulate, mostly basal, obtuse, 2–5 cm long, 3–6 mm wide, dorsal surface strigose and weakly spreading setose, evidently pubescent, ventral surface uniformly strigose and without pubescent; *inflorescence* narrow, interrupted, 0.6–1.4 cm long, weakly setose; *bracts* inconspicuous; *calyx* 4.5–6 mm long in anthesis, in fruit becoming 7–9 mm long, the segments linear-lanceolate, white-setose; *corolla* white, somewhat campanulate, the tube 5.5–7 mm long, crests at base of tube lacking or sometimes evident, fornice yellow, broad, emarginate, papillate, limb 5–8 mm wide; *style* ex-
ceeding 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.

Dry, sandy, or clayey exposed slopes and benches, 2,500 to 5,500 feet elevation. South-eastern Utah in Emery, Grand, Wayne, and San Juan counties. The species undoubtedly also occurs in northeastern Arizona, because several collections from San Juan County, Utah, have been made within less than a mile of the Arizona border and may have been within Arizona; it would be very hard to tell exactly where the boundary is in this remote area. April to July.

38. Cryptantha jamesii (Torr.) Payson


Erect to caespitose perennials; stems 1–many, 1–6 dm tall, glabrous to evidently hirsute; leaves linear to broadly oblanceolate, obtuse to acute, 2–15 cm long, 2–15 mm wide, glabrous to hirsute, usually pubescent dorsally, ventral surface lacking pustules or the pustules very inconspicuous; inflorescence open, the cymules usually elongating, tomentose to setose-hirsute; bracts inconspicuous to very evident; calyx in anthesis 3–4 mm long, in fruit becoming 5–7 mm long, the segments ovate-lanceolate, subtomentose to setose-hirsute or sometime nearly glabrous; corolla white, the tube 2.5–3 mm long, crests at base of tube conspicuous, farnices yellow-light, emarginate, 0.5–1 mm long, limb 5–8 broad; style exceeding mature fruit 1–3 mm; fruit oblate-ovoid; nutlets ovate-lanceolate, 1–4 maturing, 2–2.5 mm long, 1.5–2 mm wide, the margins not in contact, acute, both surfaces smooth and glossy, scar straight, closed, extending from the base to near the apex, elevated margin lacking.

In a wide variety of habitats and on very sandy to extremely gumbo clays, 2,000 to 10,500 feet elevation. Southeastern California eastward through southern Nevada and Utah into Wyoming, South Dakota, southward through the high plains into northern Mexico, also northern Arizona and most of New Mexico. April to October.

*Cryptantha jamesii* is a wide-ranging heteromorphic species with a number of diverse growth forms. These growth forms correlated with soil types and altitudinal differences form the basis for the various varieties.
1. Ventral surface of the leaves glabrous, the petioles not ciliate margined, or tufted at the base of the plant; in our area limited to northeastern Arizona and northwestern New Mexico ........................................... var. *pustulosa* (Rydb.) Harrington

   Ventral surface of leaves strigose or setose, the petioles ciliate margined, leaves usually tufted at the base of plant ................................................................. 2

2(1). Stems simple, not branched above the base .................................................. 3

   Stems branched from the base as well as above ............................................. 5

3(2). Stems 1–4.4 dm long, usually twice as long as the basal tuft of leaves; wide spread variety throughout the higher elevations in Arizona and New Mexico of our area ................................................................. var. *multicaulis* (Torr.) Payson

   Stems 0.2–0.9 dm long, usually not exceeding the basal tuft of leaves ............ 4

4(3). Flora bracts exceeding the cymules; stems low, decumbent; mountains of southern California and Nevada ........................................... var. *abortica* (Greene) Payson

   Floral bracts not exceeding the cymules; stems erect or nearly so; common on *Artemisia* flats and in the Pinyon-Juniper community, in our area confined to northern Arizona and New Mexico .......................... var. *setosa* (Jones) Johnst. ex Tidestr.

5(2). Stems decumbent or ascending; plants of the great plains ..................... var. *jamesii*

   Stems erect ................................................. 6

6(5). Leaves linear; cymules 8 cm long or longer, very lax; in our area confined to sand hills in the vicinity of Las Cruces, New Mexico .......... var. *laxa* (Macbr.) Payson

   Leaves oblancoate, cymules usually shorter than 8 cm long and more congested; in our area limited to northern Arizona and northwestern New Mexico on sandy dune areas .................................................... var. *disticha* (Eastw.) Payson

39. **Cryptantha atwoodii** Higgins


   Biennial or short-lived perennial herbs; stems several, arising from the branched caudex, 0.5–3 dm tall, spreading setose with slender somewhat stiffened hairs; leaves oblancoate, folded, obtuse, 1–4 cm long, 2–6 mm wide, setose on both surfaces, conspicuously pustulate on the dorsal side; inflorescence capitate or with several reduced clusters below the terminal cymule, 0.1–1.3 dm long; calyx 3–4 mm long in anthesis, in fruit becoming 5–7 mm long, the segments lanceolate, setose; corolla white, the tube 4–4.5 mm long, crests at base of tube lacking, forns yellow, rounded, 0.5 mm long, limb 5–8 mm broad; style exceeding mature fruit 1.5–3 mm; fruit depressed globose; nutlets ovate, 1.9–2.5 mm long, 1.8–2 mm wide, usually all four maturing, margins acute, not in contact, both surfaces smooth and glossy, opaque, scar straight, closed, extending from the base to near the apex, elevated margin lacking.

   Dry hillsides in shaley soil. A very narrow endemic from Coconino County, Arizona, all collections coming from the area about 7 miles south of the gap along Hwy 89. April to May.

   The area in which this species grows is extremely overgrazed. It was noted that the sheep in the area also utilized this plant for food, although it is not very palatable; also the individual plants are extremely hard to find. *C. atwoodii* is one of those rare endemics that should be protected.

40. **Cryptantha palmeri** (A. Gray) Payson


   (V. L. Cory, s.n., about 2 miles west of Longfellow, Pecos County, Texas, 15 April 1936)

   Biennial or short-lived perennials; stems 1–several, 1.7–4 dm tall, spreading setose or hisrute; leaves linear-lanceolate, acute, 3–10(16) cm long, 4–10 mm wide, strigose and submentose, pustulate hairs con-
spicuous on the dorsal surface, fewer and not evident on the ventral surface; inflorescence broad topped due to the elongation of the cymes in age, 0.3–2.7 dm long, setose; bracts inconspicuous; calyx 4–6 mm long in anthesis, in fruit becoming 7–10 mm long, the segments lanceolate, setose or weakly hispid; corolla white, the tube 4–6 mm long, crests at base of tube lacking, forniceous yellow, rounded, papillose, 0.5–1 mm long, limb 7–9 mm wide; style exceeding mature fruit 2–3.5 mm; nutlets ovate, 2.5–2.8 mm long, 2.2–2.7 mm wide, the margins not in contact, acute, both surfaces of the nutlet smooth and glossy, scar tightly closed and without an elevated margin.

Gravely to rock hillsides on gypsum, 1,000–4,000 feet elevation. Southeastern New Mexico, western Texas, and northern Mexico in the states of Nuevo Leon and Coahuila. April to July.

A Chihuahuan Desert species that just enters our area in southeastern New Mexico. It is found almost exclusively on gypsum or limestone soils.

41. **Cryptantha setosissima** (A. Gray) Payson


Biennial or short-lived robust perennial herbs; stems 1–3, erect, 3–10 dm tall, hisrate; leaves clustered at the base, reduced upward, oblanceolate, 3–13 cm long, 5–15 mm wide, setose, with some finer twisted pubescence beneath, pubulate hairs numerous on both surfaces; inflorescence broad topped due to the elongation of the scorpoid racemes, 1–5 dm long; calyx 4–6 mm long in anthesis, in fruit becoming 9–11 mm long, the segments broadly lanceolate or ovate, setose; corolla white, the tube 3–5 mm long, constricted above the ovary by the conspicuous ring of crests, forniceous yellow, emarginate, about 0.5 mm long, limb 7–9 mm broad; style exceeding mature fruit 1–2 mm; nutlets ovate, 5–6 mm long, 3.5–4.5 mm wide, papyry, 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.

Gravely to sandy soils in the Pinon-Juniper association or the Spruce-Fir association, 6,000 to 11,000 feet elevation. Nye County, Nevada, eastward to central Utah and southeeastward in the mountainous areas of Arizona to Greenlee County.

This is one of the most distinctive species in the entire genus, with its stout, strict, solitary stems, and its broadly winged nutlets.

42. **Cryptantha thyrsiflora** (E. L. Greene) Payson


Short-lived perennials or sometimes biennial; stems stout, 1–several, arising from the base, 1.7–4 dm tall, very hispid; leaves oblanceolate, obtuse, 5–12 cm long, 5–14 mm wide, spreading setose or hispid, pubulate on both surfaces; inflorescence very broad 1–3 cm long, 0.6–2.5 dm wide, setose or hispid; bracts 2–3 cm long, but hidden by the elongate cymes; calyx in anthesis 3–4 mm long, in fruit becoming 6–9 mm long, the segments linear, setose; corolla white, the tube 3–4 mm long, crests at base of tube conspicuous, forniceous 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 2 to 4 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.

Plains, foothills, and mountain slopes, 4,500–9,600 feet elevation. Southeastern Wyoming and western Nebraska, south through the eastern two thirds of Colorado into northeastern New Mexico and the Oklahoma Panhandle. May to September.
This is a very striking and handsome plant, especially when in full flower. The very broad and rounded inflorescence easily separates this species from others in the genus. In our area restricted to the northeastern quarter of New Mexico.

43. Cryptantha osterhoutii (Payson) Payson


Densely caespitose perennials; stems slender, many arising from the densely branched multiple candel, 0.7–1.2 dm tall, strigose and spreading setose; leaves spatulate to oblanceolate, obtuse, 1–3 cm long, 3–8 mm wide, dorsal surface strigose and appressed setose, pubescent, ventral surface strigose, the pustules mostly lacking; inflorescence open, 0.3–0.8 dm long, weakly white-setose; bracts inconspicuous; calyx in anthesis 2.5–4 mm long, in fruit becoming 5–6.5 mm long, the segments lanceolate, strigose and spreading setose; corolla white, the tube 2–3 mm long, crests at base of tube usually evident but poorly developed, fornice yellow, broad, emarginate, papillose, about 0.5 mm long, limb 5–7 mm wide; style exceeding mature fruit 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.

Sandy benches and rocky hillsides, 2,500–6,000 feet elevation. Southeastern Utah, and just into northeastern Arizona and Mesa County, Colorado. May to June.

A striking little plant that reaches its greatest concentration in the Canyonlands National Park area of southeastern Utah.

44. Cryptantha insolita (Macbr.) Payson


Biennial or short-lived perennial from a slender taproot; stems 1–several, 3–4 dm tall, strigose and abundantly setose; leaves spatulate, mostly basal, obtuse, 3–5 cm long, 5–14 mm wide, dorsal surface submentomate and sparsely appressed setose pubescent, ventral surface similar but the setae smaller and fewer, pubescent few and inconspicuous, petioles long-hairy at the base; inflorescence open, 0.7–1.4 dm long, cymes few, much elongating, weakly setose; bracts inconspicuous; calyx in anthesis 3.5–4.5 mm long, in fruit becoming 7–9 mm long, the segments linear-lanceolate, densely hirsute; corolla white, the tube 3–4 mm long, crests at base of tube well developed, fornice 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 rugose, ventral surface tuberculate and somewhat rugulose, scar narrow but open, the margin showing some tendency to become elevated.

Alkaline flats and rolling hills, 1,900–2,500 feet elevation. Known only from the region of Las Vegas, Nevada. April to June.

A rare endemic that may no longer exist because of the urbanization of the area of Las Vegas. The two known collections were labeled Las Vegas, so may have occurred in what is now the city or could possibly exist in outlying regions near the town.

45. Cryptantha virginensis (M. E. Jones) Payson


Biennial herbs; stems 1–several, from a stout taproot, 1.5–3(4) dm tall, setose-hirsute with spreading bristles; leaves oblanceolate to spatulate, obtuse, 3–10(12) cm long, 5–15 mm wide, dorsal surface sparsely setose, pubescent, also with some fine tangled pubescence beneath, ventral surface submentomate and weakly appressed setose, with only a few pubescent hairs; inflorescence a broad thyrsus with the many individual cymes much elongating, 0.5–3 dm long; bracts conspicuous; calyx in anthesis 3–4 mm long, in fruit becoming 7–11 mm long, the segments linear-lanceolate, hirsute; corolla white, the tube 3–4 mm long, crests at base of tube conspicuous, fornice yellow, emargi-
nate, papilllose, about 1 mm long, limb 7-9 mm wide; style exceeding mature fruit 1-1.5 mm; nutlets ovate, 3.3-4.5 mm long, 2.4-2.6 mm broad, usually only one or 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.

Gravelly to clay soils mostly in the lower sonoran zone, 2,000-8,000 feet elevation. Southeastern California in Inyo and San Bernardino counties, eastward through southern Nevada into Washington County, Utah, and southward into Mohave and Coconino counties of Arizona. March to July.

Unlike most of the species of Cryptantha, this showy plant has very fragrant flowers.

46. Cryptantha hoffmannii I. M. Johnst.


Biennial herbs; stems 1-several, 1.7-3(4) dm tall, conspicuously hirsute; leaves spatulate, crowded at the base, reduced upward, 2-5 cm long, 5-12 mm wide, spreading setose-hirsute, pubescent on both surfaces, but more so dorsally; inflorescence broad topped, interrupted, 1-2.8 dm long; bracts evident but not inconspicuous; calyx in anthesis 3-5 mm long, in fruit becoming 5-8 mm long, the segments lanceolate, hirsute-hispid; corolla white, the tube 3-4 mm long, crests at base of tube evident, fornices yellow, rounded, 0.5 mm long, papilllose, 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, 2-4 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, with an elevated margin.

Gravelly soils in the Pinyon-Juniper association to the upper transition zone, 7,000-9,000 feet elevation. Southeastern California in Inyo County and just across the border into Nevada, mostly confined to the area of Westguard Pass. June to July.

48. Cryptantha abata I. M. Johnston


Long-lived perennial caespitose herbs; stems many, 0.5-1.8 dm tall, strigose and weakly setose; leaves ob lanceolate to spatulate, obtuse, strigose, setose, and sub tomentose, the petioles ciliate margined; inflorescence narrow, short, 0.2-0.8 dm long; calyx in anthesis 2.5-4 mm long, 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 in contact, obtuse to acute, dorsal surface carinate, tuberculate, muricate and sometimes with low inconspicuous ridges, ventral surface deeply and irregularly rugose, scar open, triangular, surrounded by a slightly elevated margin.

Sandy to gravelly soils in the Artemisia and Pinyon-Juniper association, 4,000-9,000 feet elevation. Extreme eastern Nevada, south and western Utah, and Mohave County, Arizona. April to July.

Cryptantha abata is a tufted, often mat forming plant. It is extremely rare in our flora but becomes very common at moderate elevations in Garfield and Piute counties, Utah.

49. Cryptantha humilis (A. Gray) Payson


Short-lived perennial herbs; stems many, 0.5-3 dm tall, strigose to spreading setose-hirsute; leaves ob lanceolate to spatulate, 1-6 cm long, 2-12 cm wide, strigose, setose, or sub tomentose, pubescent on both surfaces; inflorescence narrowly cylindrical to open and lax, 0.2-1.8 cm long, tomentose to conspicuously setose; bracts inconspicuous; calyx in anthesis 2.5-4.5 mm long, in fruit becom-
ing 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 obso- lete, fornices yellow, more or less papillose, rounded, about 0.5 mm long, limb 7–10 mm broad; style shorter than to exceeding mature fruit 2.5 mm; nutlets lanceolate to ovate-lan ceolate, 3–4.5 mm long, 1.8–3.2 mm wide, 1 to 4 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.

Mostly sandy or gravelly slopes, road cuts, and talus slopes of the higher mountains, 3,500–12,000 feet elevation. Sierra Nevada of California eastward to southeastern Oregon, southern Idaho to western Colorado and extreme northwestern Arizona. April to August.

Cryptantha humilis is a common member of the Great Basin flora, but enters our area only in southern Nevada and extreme northwestern Arizona. There are 5 varieties in the species complex, with only variety ovina (Payson) Higgins entering our area.

14. Plagiobothrys F. & M.

Annual or perennial herbs; stems prostrate to erect, weak to somewhat robust, usually with slender appressed hairs, but at times setose though not pungently so; lower leaves opposite, alternate, or rosulate and crowded; flowers borne in slender racemes or spikes, occasionally glomerate, frequently bracted; calyx cleft to near the base, sometimes ac crescent; corolla white, the tube short and included in the calyx, the fornices usually prominent and often yellow; stamens included, the filaments short; nutlets 4, or 1–3 by abortion, erect or incurved, roughened or rarely smooth, tending to be keeled on the back, and with a well-developed ventral keel extending from the tip to the middle or to the base, scar usually elevated and caruncle-like, mostly small, lateral to basal, placed at the base of the ventral keel; gyno base short and broad.

About 65 species native to western North America and South America with about 3 outlying species in Australia. (Name from the Greek, plagios, placed sideways, and bothros, pit or excavation, referring to the position of the nutlet scar.)

References


1. Leaves all alternate, scar lateral, near middle of nutlet
2. Leaves opposite at least below; scar lateral, oblique or basal
3. Caruncle of nutlet elongate, extending along crest of the ventral keel; nutlets trigonous
4. Caruncle round or nearly so, at or below end of ventral keel
5. Corolla 4–7 mm broad; nutlets irregularly rugose
6. Corolla 1–2.5 mm broad; nutlets conspicuously tessellate
7. Caruncle weakly developed, borne at tip of a short or conspicuous stipe; lowest leaves not in a rosette
8. Caruncle well developed, sessile on the nutlet; lowest leaves mostly in a rosette
9. Stipe of nutlet elongate, about equalling the body in length; nutlets commonly united in pairs, plants of south and west Arizona
10. Stipe of nutlet very short; nutlets distinct; plants mostly Californian

1. P. kingii
2. P. jonesii
3. P. pringlei
4. P. collinus
6(4). Calyx circumsissile in fruit, less than 4 mm long; lobes usually connivent over fruit; nutlets usually only 1 or 2 .................................................. 7
– Calyx not circumsissile, or, if so, the strongly accrescent calyx over 4 mm long; calyx lobes erect or spreading; nutlets usually 4 .................................................. 8
7(6). Inflorescence a long, simple bracted raceme; nutlets highly incurved in lateral view, 1–2.5 mm long; corolla 2–3 mm broad ......................................... 5. *P. arizonicus*
– Inflorescence forked, bracted only at base if at all; nutlets low and flattened in lateral view 2–3 mm long; corolla 3–99 mm broad .............................. . *P. nothofulius*
8(6). Transverse dorsal crests of nutlets very narrow and sharp, enclosing polygonal granulate areolas ................................................. 7. *P. canescens*
– Transverse dorsal crests of nutlets very low and broad, separated only by low lineate ridges .............................................................. 8. *P. tenellus*
9(1). Stems strigose or appressed hispidulous .................................................. 10
– Stems with distinctly spreading hairs; Mohave Desert of California ..............
.......................................................... 12. *P. parishii*
10(9). Scar nearly basal; calyx lobes becoming elongate and thickened, tending all to be directed toward the same side of the fruit; plants mostly prostrate .......................................................... 9. *P. leptocladius*
– Scar lateral or basilateral, calyx lobes neither elongate nor much thickened, symmetrically disposed; plants prostrate to ascending or erect .......................................................... 11
11(10). Nutlets ovate to lanceolate; the evident scar mostly lateral but occasionally basilateral; plants west of continental divide ........................................ 10. *P. scouleri*
– Nutlets narrowly lanceolate to lance-linear, scar basilateral, small; plants east of the continental divide .................................................. 11. *P. scopulorum*

1. **Plagiobothrys kingii** (S. Wats.) A. Gray


_Stems_ erect, 1–several, 1–4 dm tall, hirsute, also villous-setose; _leaves_ at base of plant narrowly oblanceolate, the calyce lance-linear, 2–6 cm long, hirsute to hispid, with spreading or ascending bristles; _inflorescence_ cy- mose, the cymes dense in early flower, scorpioid, elongating in fruit and more laxly flowered; _bracts_ evident at least on part of the inflorescence or flowers; _calyx_ 5–6 mm long in fruit, the segments lanceolate, very hirsute-hispid; _corolla_ 4–7 mm broad; _nutlets_ 4, cuneate-ovoid, 2.5–3 mm long, acute and incurved at the apex, dorsal surface with a low median ridge and similar lateral keels on the edges, the whole irregularly rugose with broad papillate areolas; _scar_ elongate, keel- like and medial.

Dry sandy to gravelly bajadas and valleys at 4,000–7,000 feet elevation. Southeastern Oregon, extreme eastern California, Nevada, and extreme western Utah. May to June.

Our plant is variety _kingii_ and just enters the flora in southern Nevada. Variety _harknessii_ (E. L. Greene) Jepson is a more northerly ranging form from northern Nevada and California into southeastern Oregon. The cymes on this phase are more congested and usually do not become as elongate.

2. **Plagiobothrys jonesii** A. Gray


_Stems_ erect, simple, widely branched with spreading or ascending branches, 1–3(4) dm tall, conspicuously hispid and villous-setose, the hairs pubescent; _leaves_ oblanceolate to linear at the base 2–6 cm long, the calyx lanceolate, conspicuously spreading hirsute, the hairs with pubescent bases; _inflorescence_ congested when immature, the scorpioid cymes only slightly elongating at maturity 1.5–4(7) cm long, some of the lower leaves also with axillary flowers; _bracts_ lacking; _calyx_ 6–10 mm long in fruit, the segments lin-
Plagiobothrys jonesii differs from all other members of the genus in that it resembles a Cryptantha in habit and an Amsinckia in nutlet characteristics.

3. Plagiobothrys pringlei E. L. Greene


_Plagiobothrys pringlei_ E. L. Greene, Pittonia 1: 21. 1887. (Dr. Smart, Verde Mesa, Arizona)

_Stems_ several to many, branched from near the base, prostrate or decumbent to nearly erect, slender, 1–4 dm long, spreading setose with fine short hairs; _leaves_ numerous below, gradually reduced above, narrowly oblong to linear, 2–4(6) cm long, 2–5 mm broad, obtuse to acute at apex, appressed striate or canescent to conspicuously setose; _inflorescence_ an elongate spike, floriferous to near the base of the stem; _bracts_ conspicuous, 1–2 cm long; _calyx_ 3–4.5 mm long in fruit, the segments linear-lanceolate, canescent; _corolla_ 2–3 mm broad, inconspicuous; _nutlets_ 4, those near the base of stem commonly joined in pairs, the upper separate, ovate, acute at apex, 1.8–2 mm long, dorsal keel evident near the apex but fading to distinct tuberculations below, the surface also rugulose with short ridges; _scar_ elevated on a prominent stipe at least 1.3 mm long, and usually as long as the nutlet.

On sandy or gravelly desert flats and bajadas. Common in Cochise, Maricopa, Pima, and Pinal counties of Arizona, and northern Sonora, Mexico. March to April.

4. Plagiobothrys collinus (Ph.) L. M. Johnston


(A. Nelson 10232, Prescott, Arizona, moist creek banks, 28 April 1925)

_Stems_ slender, elongate, prostrate or decumbent, 1–4 dm long, hispidulous; _leaves_ oblancoelate, obtusish to acutish, 1–3 cm long, 3–5 mm broad, hirsute; _inflorescence_ an elongate spike, remotely flowered and very slender; _bracts_ lacking above the middle of _inflorescence_; _calyx_ 2.8–3.2 mm long in fruit, the segments linear-lanceolate, hispidulous; _corolla_ 2–2.5 mm broad; _nutlets_ 4, ovoid, 1.5 mm long, dorsal keel thin above, reduced to a mere line and fading out about middle of nutlet, irregularly rugose, also muricate; _scar_ on a short stipe near base of nutlet.

Dry, open flats, mesas, and valleys, ascending to moderate elevations in the foothills. Southern California, northern Baja California, Mexico, eastward to westward Arizona and Sonora, Mexico, and in Chile of South America. February to May.

_P. collinus_ is divided into five rather distinct varieties in western North and South America. The only phase that enters our area is _var. fulvescens_, with its elongate laxly flowered spikes and harsher, more penetrating pubescence.

5. Plagiobothrys arizonicus (A. Gray) E. L. Greene


_Stems_ loosely ascending to erect, usually branched below the middle, 1–4(5) dm tall, hirsute-hispid, also somewhat villous, the basal part of the stem and the root highly charged with a purple dye; _leaves_ linear-oblancoelate, 1.5–5(6) cm long, 2–6(10) mm broad, hirsute, with pubulate hairs, the mid-vein and its branches strong dye stained; _inflorescence_ spikelike, elongate, and remotely flowered, 3–15 cm long; _bracts_ mostly lacking on all flowers but with several scattered along the spikes; _calyx_ 3–3.5 mm long in fruit, lobed to about the middle, circumscissile, the segments convolute and narrowly lanceolate, hirsute and somewhat villous; _corolla_ 2–2.5 mm broad; _nutlets_ 1–4, commonly
2, ovoid, abruptly acute at apex, the dorsal surface with rectangular smooth areolae marked off by narrow tuberculate ridges and rugae; scar median in a sunken area at base of keel.

Dry desert slopes and mesas, often near the base of rocky outcrops, extending to moderate elevations in the mountains 7,000 feet. Western edge of the San Joaquin Valley, California, eastward through southern Nevada to southern Utah, New Mexico, and south into Sonora, Mexico. March to May.

6. Plagiobothrys nothofulvus (A. Gray) A. Gray


_Stems_ 1–several, simple or more often ascendingly branched from the base, 1.5–5(6) dm tall, villous-hispidulous with spreading hairs, base of plant often slightly dye stained; _leaves_ at base ob lanceolate 3–10 cm long, 5–20 mm broad, acute at apex, sparsely villous-setose, cauleine leaves few, linear-lanceolate to lanceolate; _inflorescence_ elongate, loosely flowered, racemes often paired, 5–15(20) cm long; _bracts_ lacking; _calyx_ 2–3 mm long in fruit, lobed to about the middle, circumsissile, the segments narrowly lanceolate, fulvous-hirsute; _corolla_ 6–9 mm broad, showy; _nutlets_ 1 to 4, 2–3 mm long, round-ovoid, abruptly constricted to an acute apex, loosely rugulose-rotate and somewhat granular tuberculate; _scar_ annular, median at the base of the narrow ventral keel.

Open grassy slopes, fields, and roadsides, mostly below 2,500 feet elevation. Southern Washington along the Columbia River, south through Oregon and California on the west slope of the Sierra Nevadas to the Coastal Ranges to northern Baja California, Mexico, occasionally at the desert edge in eastern Kern County, California. March to May.

_Plagiobothrys nothofulvus_ just enters our flora along the extreme western boundary in California.

7. Plagiobothrys canescens Benth.


_P. microcarpa_ E. L. Greene, Pittonia 1: 21. 1887. (Mrs. R. M. Austin, Butte County, California, May 1883)

_P. canescens_ var. _apertus_ E. L. Greene, Pittonia 1: 21. 1887. (E.L. Greene, plains of the upper San Joaquin, 1884)

_Stems_ many, branched from the base, decumbent or prostrate, rarely erect, 1–4(6) dm long, villous or finely hispidulous; _leaves_ linear to linear-ob lanceolate, 1.5–5 cm long, 2–7 mm broad, the cauline well developed; _inflorescence_ elongate and loosely flowered in age, 5–25 cm long; _bracts_ conspicuous and well developed, 1–2 cm long; _calyx_ in fruit 4–6 mm long, the segments lanceolate, densely rufous-villous-tomentose; _corolla_ 2.7–3.5 mm broad; _nutlets_ mostly 4, round-ovoid, abruptly constricted to the narrow acute apex, strongly incurved, obscurely tuberculate, but with conspicuous transverse rugae forming rectangular papillate intervals; _scar_ median, annular, slightly raised.

Gravelly to clayey slopes, plains, and grassy hillsides, also alkaline flats, mostly below 4,500 feet elevation. Nearly throughout the length of California, mostly west of the Sierra Nevada, entering the Mohave Desert in Inyo, Kern, and San Bernardino counties. March to May.

8. Plagiobothrys tenellus (Nutt.) A. Gray

Idaho)

_Stems_ 1–several, slender, erect or ascending, 1–3 dm tall, soft-villous; _leaves_ mostly basal, rosettellike, lance-oblanceolate to lance-elliptic, 1–4 cm long, 2–8 mm broad, sessile, cauleine leaves few, ovate to lanceolate, shorter than the basal ones; _inflorescence_ open, loosely flowered, tending to elongate in age, slender, 4–15 cm long; _bracts_ evident only near the base; _calyx_ in fruit 3–5 mm long, the segments ovate-lanceolate, short villous, whitish or fulvous; _corolla_ 2–3 mm broad; _nutlets_ usually 4, 1.5–2.5 mm long, thick cruciform, usually light colored, sharply ridged dorsally and on the edges, tuberculate on the ridges, smooth and shiny between the ridges; _scar_ small, set just below middle of nutlet at end of keel.

Grassy, sandy, or gravelly slopes, hillsides, and dry open areas below 5,000 feet elevation. Common from California to British Columbia and Idaho, becoming rather rare in Utah and Nevada, and with several highly
scattered locations in Graham, Gila, Maricopa, Pinal, and Pima counties of Arizona. March to June.

9. **Plagiobothrys leptocladus** (E. L. Greene) I. M. Johnston


_Stems_ prostrate, 1–3(7) dm long, somewhat succulent, sparsely strigose to subglabrous; _leaves_ linear or linear-oblongolate, 3–8 cm long, 2–5 mm broad, 1 or more pair near the base opposite, dorsal surface sparsely strigose-pustulate, subglabrous above; _inflorescence_ spikelike, elongate, loosely flowered to near base of plant, the spikes somewhat unilateral; _bracts_ evident at least below; _calyx_ very accrescent, in fruit becoming 4–8 mm long, the segments linear, slightly thickened and succulent, all tending to be directed toward the same side of the fruit; _corolla_ minute, 1–2 mm broad; _nutlets_ 1–4, lanceolate, 1.5–2.5 mm long, dorsal surface rugose-tuberculate, granulate, or penicillate-hairy, ventral surface angulate, keeled the entire length; _scar_ basal or nearly so, not surrounded by a ridge.

Moist depressions of clay flats, usually in alkaline soils. Oregon south to northern Baja California, Mexico, eastward to western Wyoming and northern Utah, entering the desert edge in Kern and San Bernardino counties of California. April to July.

In northern Utah _P. leptocladus_ often forms prostrate mats a meter or more in diameter from a single plant, but this is relatively rare throughout most of its range.

10. **Plagiobothrys scouleri** (H. & A.) I. M. Johnston


_Stems_ prostrate or ascending, several to many, 2–1.5 dm long, strigose; _leaves_ essentially all cauline, linear, 1.5–6.5 cm long, 2–5 mm broad, the lowermost opposite, the others alternate, sparsely to densely strigose; _inflorescence_ and elongate, loosely flowered raceme or spike that is floriferous to near base of plant; _bracts_ evident at least below; _calyx_ 2–3.5 mm long in fruit, the segments linear-lanceolate, hispidulous; _corolla_ inconspicuous, 2–4 mm broad; _nutlets_ usually 4, ovate, to lance-ovate, 1.5–2 mm long, rugose and tuberculate to nearly smooth, with or without penicillate bristles; _scar_ small lateral to basilateral.

Moist areas along roadides, open mountain meadow depressions and along slow-moving stream banks, 4,000–10,500 feet elevation. Alaska, south through British Columbia and Saskatchewan, to California, Arizona, and New Mexico, May to August.

_P. scouleri_ is a highly variable and complex species, probably due to the fact that many incipient species are in the process of being evolved. The species and its varieties are centered somewhat to the northwest of our flora; however two varieties, which are separated by the following key, enter our area.

1. Nutlets smooth, glossy; stems and leaves sparsely strigose to glabrous; southern Nevada in Clark County in our flora .................................. var. _cusickii_ (Greene) Higgins

- Nutlets rugulose or tuberculate, dull, often penicillate bristly; stems and leaves abundantly strigose or hispidulous, Arizona and New Mexico in our flora .......... .................................................. var. _penicillatus_ (Greene) Cronquist
11. Plagiobothrys scopulorum (E. L. Greene)

I. M. Johnston


Stems mostly ascending but occasionally prostrate, 5–25 cm tall, branched from near the base, strigose; leaves linear, strigose, 1–5 cm long, 1–4 mm broad; inflorescence loosely flowered, floriferous to near base of plant; bracts evident, mostly near the base; calyx 2.5–3.5 mm long in fruit, the segments lance-linear, not accrescent, strigose-hispidulous; corolla inconspicuous, 1–2 mm broad; nutlets 4, 1.5–2 mm long, lanceolate, rugulose and tuberculate, the ridges rather inconspicuous; scar basilateral to nearly basal, small.

Moist areas at road sides and depressions in the prairie sod to moderate elevations in the mountains. Mostly east of the Continental Divide from Saskatchewan south through much of the northern prairie to Nebraska, the Dakotas, and northern New Mexico. July to September.

The fruit of *P. scopulorum* is very similar to that of *P. leptoclados*, but the habit, indument, and calyx are entirely different, and more like that of *P. scouleri*. These differences correlated with geography distinguished this plant as being at least somewhat different.

12. Plagiobothrys parishii I. M. Johnston


Stems diffusely branched from near the base, erect or ascending, 0.5–3 dm tall, his- sute with short, stout, spreading bristles; leaves linear or the upper oblong, hispidulous and with punctures on the dorsal surface, 1–5 cm long, 2–4 mm wide; inflorescence in age becoming loose and slender, 3–10 cm long; bracts few, near the base; calyx 2–3 mm long in fruit, early deciduous, the segments oblong to lanceolate, hispidulous; corolla 3–5(6) mm broad, white with a yellow throat; nutlets ovate to lance-ovoid, more or less slightly heteromorphic with the axil nutlet slightly larger, plumper, and with a triangular-ovate scar, the others with a sublinear scar, apex on both nutlets acute, dorsal surface keeled at apex only, strongly rugose with transverse ridges.

Wet alkaline soil around desert springs, 2,500–4,500 feet elevation. Southeastern California in Inyo, Mono, and San Bernardino counties. April to June.

*Plagiobothrys parishii* is a rather narrow endemic of the Mohave Desert, having been collected in a few scattered stations, but is quite common about Rabbit Springs in San Bernardino County.

15. Mertensia Roth.

Plants perennial herbs from fleshy fusi- form, rhizomelike or cormlike roots; stems erect or ascending, glabrous to somewhat pubescent 3–17 dm tall, unbranched below the inflorescence; leaves entire, linear to cordate, sessile or petiolate, alternate; inflorescence lax or congested, ebracteate, unilateral, modified scorpioid cyme, or becoming panicked in age; calyx 5-parted, occasionally campanulate, often accrescent; corolla tubular, campanulate, with or rarely without fornsces in the throat, blue, occasionally white or pink; filaments attached below the throat; anthers exserted or included; style shorter or longer than the corolla; ovary 2 celled; nutlets 4, or by abortion fewer, attached laterally to the gynobase at or below the middle, generally rugose.

A genus of about 35 species of Eurasia and North America, mainly in the western half. (Named for F. C. Mertens, 1764–1831, German botanist.)

References


1. Plants relatively tall and robust (4–15 dm tall when fully developed), with evident lateral veins in the cauline leaves; flowering in late spring and summer ...... 2
   – Plants smaller, seldom as much as 4 dm tall, usually without evident lateral veins in the cauline leaves; blooming as soon as snow and temperature permit ...

2(1). Leaves strigillose on the upper surface; calyx-lobes acute .............. 1. M. franciscana
   – Leaves glabrous or somewhat papillos at above, not hairy; calyx-lobes rather obtuse, ciliate on the margins .......... 2. M. ciliata

3(1). Filaments narrower and much shorter than the anthers, the base of the anthers not elevated beyond the fornices; alpine plants ........................................ 3. M. alpina
   – Filaments longer and more conspicuous, broad and flattened; base of anthers elevated well above the fornices; plants alpine or not ............. 4

4(3). Nutlets without an elevated margin or border; plants not of Arizona ..........
   – Nutlets with the margin elevated, forming a definite border; plants of northern Arizona .......................................................... 5. M. macdougalii

1. Mertensia franciscana A. A. Heller
   – *M. pratensis* A. A. Heller Ibid. 550. 1899. (Heller & Heller 3641, Santa Fe Canyon, 9 miles east of Santa Fe, 2 June 1897)
   
   **Stems** erect or ascending (1)3–10 dm tall, glabrous; leaves at base oblong-elliptic to elliptic 6–20 cm long, 1–3.5(4.5) cm broad, base acute-attenuate to subcordate, apex acuminate to acute, upper surface, very short strigillose, lower surface glabrous; petioles longer or shorter than the blade, cauline leaves elliptic to lance-ovate, 4–14 cm long, 1–3(6) cm broad, becoming sessile toward the inflorescence; inflorescence paniculate; bracts lacking; calyx 2.5–5 mm long, the segments linear to lanceolate, acute, divided nearly to the base, glabrous or pubescent on the back, conspicuously ciliate on the margins; pedicels 1–20 mm long, strigose; corolla tube 5–9 mm long, glabrous or pubescent within, limb 4–9 mm broad, moderately expanded, fornices prominent, usually pubescent; anthers 2.5–3 mm long, longer than the filaments; style 9–20 mm long; nutlets rugose and papillate.

   Stream banks, moist meadows, and openings in pine forests, 6,000–11,000 feet elevation. Eastern Nevada and Arizona, eastward to Colorado and New Mexico. June to August.

   This is by far the most common bluebell in our area, it is very common throughout the mountainous areas of New Mexico and Arizona.

2. Mertensia ciliata (Torr.) G. Don
   
   **Stems** many from the branched caudex, 1.5–15 dm tall, glabrous; leaves variable, at the base of the plant oblong to ovate or lance-subcordate, 4–15 cm long, 2–6(10) cm broad, ciliate on the margins, glabrous or papillate on the surfaces, petioles longer or shorter than the blades, cauline leaves lanceolate to ovate, acute, acuminate or obtuse at apex, attenuate to subcordate at base, mostly sessile; inflorescence paniculate; bracts lacking; calyx 1.5–3 mm long, the segments oblong to nearly lanceolate, obtuse or rounded at the apex, not acrcccrescent, glabrous on the back, the margins ciliate; pedicels 1–10 mm long, glabrous or with a few strigose hairs; corolla tube 4–6(8) mm long, the limb 4–10(15) mm broad, moderately expanded, fornices evident, glabrous to pubescent; anthers 1–2.5 mm long, as long as or shorter and narrower than the expanded part
of the filaments; style about as long as corolla or exceeding it; nutlets rugose or papillate. N = 12, 24.

Stream banks, wet meadows, and moist hillsides up to 12,000 feet elevation. Mountains of Montana and eastern Oregon, south-eastward to Utah, Wyoming, Colorado, and northern New Mexico. July to September.

Mertensia ciliata resembles M. franciscana in general aspect but is easily separated from the latter by its glabrous leaves and stems and the small obtuse calyx segments. This plant only enters our flora in the higher elevations in northern New Mexico.

3. Mertensia alpina (Torr.) G. Don


**Stems** 1–numerous, glabrous, erect or ascending, 0.5–2(3) dm tall; leaves at base of plant linear-lanceolate to oblone or elliptic, 1–5(7) cm long, 0.7–1.5(2) cm broad, strigose above, glabrous beneath, the winged petiole shorter than the blade, cauleine leaves lanceolate to elliptic, sessile, 1–6 cm long, 0.3–1.8 cm broad; inflorescence compact, or slightly panicked in age; bracts lacking; calyx 2–3(5) mm long in fruit, divided to near the base, the segments linear-lanceolate to oblong, obtuse to acute at the apex, ciliate; pedicels 1–10 mm long, strigose to glabrous; corolla tube 3–6(11) mm long, glabrous within, limb widely spreading (5)7–10(11) mm wide; fornice prominent, nearly closing the throat; anthers about 1–1.3 mm long, usually longer than the filaments, inserted in the tube and not projecting beyond it; style short, about equaling the calyx; nutlets rugose, about 2 mm long.

Above timberline, in the high mountains on open dry meadows and slopes. Southwestern Montana and adjacent Idaho, south to Colorado and northern New Mexico. July and August.

4. Mertensia lanceolata (Pursh) A. DC.


**Stems** 1–many, 1–4.5 dm tall, erect or ascending, canescent to glabrous; leaves at base of plant ovate to elliptic or ob lanceolate, 1.5–14 cm long, 0.3–3.5 cm broad, glabrous to densely canescent on both surfaces, sessile or with the petioles longer than the blade, cauleine leaves only moderately reduced toward the inflorescence, mostly sessile; inflorescence congested to loosely panicleate, especially in age; bracts only near the base; calyx 2–5(8) mm long in fruit, divided to below the middle and mostly to near the base, the segments lanceolate to ovate-triangular, glabrous to strigose; pedicels 1–15 mm long, strigose to glabrous; corolla tube 3–7 mm long, with a ring of dense hairs near the base, the limb 3–9 mm broad, moderately expanded; fornice conspicuous, glabrous to pubescent; anthers 1–2 mm long, well exserted from the tube; style shorter or longer than the corolla tube; nutlets 2–3 mm long, rugose.

Moderately moist to dry open slopes and ridges in the mountains, 6,000–11,000 feet elevation. Saskatchewan, Montana, and North Dakota, south through Colorado, Utah, and Wyoming into northern New Mexico.
June to September.

Mertensia lanceolata is a poorly defined species. Mertensia bakeri and M. viridis seem to be only ecotypes of the larger, more widespread M. lanceolata. There are no clearly defined morphological differences that can be correlated with geography to aid in the separation of species. There may be enough variation in this heterogeneous mixture, here called lanceolata to warrant a variety or two, but none are here proposed.

5. Mertensia mac dougalii A. A. Heller


Stems ascending, 1–several, 0.8–2.5 dm tall, glabrous; leaves at base oblong-oval to obovate, petiolate, 2–5 cm long, 1–2.8(4) cm broad, glabrous, punctulate, the cauline leaves, sessile, obovate-lanceolate to ovate, 2–4 cm long, 0.5–2 cm broad; inflorescence a modified dense scorpoid cyme, not much elongating in age; bracts lacking; calyx in anthesis 5–6 mm long, in fruit becoming 7–10 mm long, divided to below the middle, the segments lance-oblanceolate, ciliate; pedicels 1–10 mm long, glabrous; corolla tube 8–9 mm long, glabrous within, the limb 5–6 mm broad, moderately expanded; for nices conspicuous, glabrous; anthers 2.5–3 mm long, subequal to the filaments; style usually exceeding the corolla; nutlets rugose, inner surface slightly concave, the margin forming a collar.

Moist rich soil at medium elevations, 6,000–9,000 feet. Coconino and Yavapai counties, Arizona.


Depressed-pulvinate perennial plants; stems 2–10 cm tall, or sometimes acaul escent; leaves small, usually densely hairy, crowded on the numerous short shoots or a base of the elongate stem; inflorescence a false raceme or spike terminating the short stem, naked or leafy bracteate; pedicels erect; calyx eleft nearly to the base; corolla blue, rarely white, often with a yellow eye, salverform, with a short, narrow tube; for nices well developed; filaments attached well down in the corolla tube; anthers included; ovary 4 lobed; stigma 1; nutlets 1–4, smooth, attached basi laterally to the low stout gyno base, the apex obliquely trun cate, this portion surrounded by an entire or toothed margin.

A genus of about 4 species of Eurasia and western North America. (From the Greek eritrichion, wool and trichos, hair, referring to the woolly pubescence of E. numun, the original species.)

Reference


1. Eritrichium numum (Vill.) Schrad.


Pulvinate-caespitose, long-lived perennials; stems acaul escent or acaul escent with short, slender, erect stems, 0.1–0.7(1) dm tall, villous to densely strigose; leaves oblanceolate to oblong or narrowly ovate, 5–10 mm long, 1–2(3) mm broad, villous to loosely strigose; inflorescence compact when sessile among the leaves or racemelike when borne on a leafy flowering branch, capitate; calyx 1.8–2.3 mm long in fruit, linear, villous or silky strigose; corolla tube short, 2–2.5 mm long, yellowish, the limb blue rarely white 4–8 mm broad; for nices prominent, papillose; nutlets 1–4, glabrous, somewhat asymmetric al, margined, with an entire or toothed margin.

Open rocky slopes, dry meadows, and on tundra at high elevations in the mountains, 10,000–14,000 feet elevation. Irregularly from the Alps of Europe, across Asia to
Alaska and south in the Rocky Mountains to northern New Mexico. June to August.

*Ertrichium* as here considered is a highly variable and widespread circumboreal species, with several varieties. In our flora only variety *elongaturn* occurs and is limited to only the highest mountain peaks in northern New Mexico.

17. **Lappula** Gilib.

Stickseed

Annual or biennial herbs; *stems* ascending or erect; *leaves* alternate, entire, narrow, firm, and veinless; *inflorescence* terminal, the flowers borne in a symподial, branched cyme; *calyx* 5-parted, nearly to the base, accrescent; *pedicels* usually erect, short; *corolla* blue or white, rather inconspicuous, more or less funnelform, with conspicuous fornices; *stamens* included; variously inserted; **style** included; *nutlets* 4, ovoid to oblong, trigonous or flattened, with 1–3 rows of cylindrical, conical or flattened spines or glochidia on the sides, or on the cupulate border, attached to the elongate gynobase only part of their length.

A genus of about 10 species of wide distribution in the northern hemisphere (diminutive of the Latin lappa, a bur.)

Reference


1. Nutlets with 2 rows of slender marginal prickles that are not confluent at base; corolla about 3 mm broad ................................................................. 1. *L. echinata*

– Nutlets with a single row of marginal prickles that are more or less confluent at the base; corolla 2 mm or less broad .................................................. 2. *L. redowskii*

1. **Lappula echinata** Gilib


*Lappula echinata* Gilib. Fl. Lithia. 1: 25. 1781. (Europe)


*Stems* simple to freely branched, 1.5–8 dm tall, villous-hirsute; *leaves* linear to linear-lanceolate or lanceolate, acute or obtuse, narrowed to a sessile base, 2–5 cm long, 2–7 mm broad, hispidulous; *calyx* 2.5–3(4) mm long in fruit, the segments linear, appressed hispidulous; *pedicels* 1–3 mm long, erect; *corolla* bright blue, 2–4 mm broad; *nutlets* 3–4 mm long, sharply verrucose or mucrate dorsally, with 2 marginal rows of long, slender bristles that are distinct to near the base, these sometimes irregularly distributed over the back.

Dry plains, hillsides, road sides and waste places, also cultivated ground. Native to Eurasia, but widespread as a weed in northern United States and Canada. June to August.

*L. echinata* is rare in our flora, known only

from Schultz Pass, Coconino County, Arizona (Whiting 1173B).

2. **Lappula redowskii** (Hornem.) E. L. Greene


Stems usually simple, or with several minor stems arising from the base of the major stem, or bushy branched from the base, 1–5 dm tall, cinereous hispid-villosous; leaves narrowly oblanceolate to spathulate, the basal ones 1.5–5(8) cm long, 3–8 mm broad, rosettelike, the cauline leaves gradually reduced in size upward; inflorescence cymose, the individual racemes terminating the stems and branches; bracts conspicuous, subtending each flower; calyx in fruit 3–5 mm long, the segments linear or linear-lanceolate, strigose; pedicels erect or ascending 1–3 mm long; corolla blue or whitish, 1–2 mm broad; nutlets 2–3 mm long, muricate dorsally, with a single row of nearly distinct prickles, or sometimes with a greatly swollen cupulate border.

A weed in dry, usually disturbed areas along roadsides, abandoned fields and waste places. Eurasia and western North America. March to July.

Lappula redowskii is a widespread and variable species. Many names have been placed on the various forms that occur throughout the range of the species. The most distinct of these forms has been called L. texana, and, if it weren’t for the many intermediate characteristics between it and the typical L. redowskii, it could easily be maintained as a distinct species. It is the many named and nameless forms that occur between these two extremes that have produced the abundant synonymy.


Stickseed

Ascending or erect biennial or perennial herbs; leaves alternate, broad and veiny; flowers in naked or only basally bracteate scorpioid cymes panicularly disposed; calyx cut to the base into spreading ovate to oblong or lanceolate lobes; pedicels slender, recurving in fruit; corolla white or blue, with a short or elongated tube, and an evidently 5–lobed limb, the lobes rounded and connate less than one-third their length; stamens well developed; stamens included, affixed at middle of tube; filaments slender, short; anthers oblong to elliptic; style slender, scarcely if at all surpassing the nutlets; stigma capitate; nutlets 4, erect, ovate to lanceolate, attached ventrally to the pyramidal gynobase by a broad medial or submedial areola, the margin with subulate glochidiate prickles which are frequently confluent at the base, the back smooth or with glochidiate appendages.

A genus containing about 45 species, centering in western North America with outlying species in South America and Eurasia.

References


1. Corolla limb white to ochroleucous to greenish tinged
   — Corolla limb blue or occasionally violet blue or pink

2(1). Intramarginal prickles absent on all nutlets (or rarely present on H. floribunda and then only on less than half the nutlets)
   — Intramarginal prickles present on all nutlets

3(2). Corolla limb inconspicuous, only 1.5–2.5 mm wide, calyx segments ca. 1 mm long
   — Corolla limb white to ochroleucous to greenish tinged
Corolla limb broader, mostly 4–8 mm wide; calyx segments mostly 1.5 mm long or more ................................................................. 4

4(3). Cymes conspicuously bracteate throughout; cauline leaves long ciliate; stems generally stiffly hirsute ................................................. 3. *H. hirsuta*

— Cymes bracteate, if at all, only at the base; cauline leaves not long ciliate; stems with appressed hairs ......................................................... 5

5(4). Fornices curved inward at the tips, about twice as long as broad; principal marginal prickles of all mature nutlets less than 2 mm long; inflorescence open and spreading, the branches few; plants slender ........................................ 4. *H. pincorum*

— Fornices relatively straight, not curving inward at the tip, about as broad as long; principal marginal prickles more than 2 mm long; inflorescence mostly elongate and narrow ........................................ 5. *H. floribunda*

1. **Hackelia ursina** (Greene ex A. Gray) I. M. Johnston


Stems erect, 1–several, sometimes branched near the base, 3–14 dm tall, hispid or hirsute with spreading bristles or often appressed strigose also, especially above; leaves at the base of plant oblanceolate, long petiolate, obtuse, 2.5–14 cm long, 5–15 mm broad, hispid-hirsute, pustulate, the cauline leaves gradually reduced above, oblanceolate to narrowly ovate, broader than the basal ones; inflorescence open and spreading; bracts evident throughout the cymes; calyx 1.5–3.5 mm long in fruit, the segments oblong to lanceolate, hispid; pedicels 1.5–10 mm long; corolla white or tinged with yellow, the tube 1.5–2.5 mm long, the limb 5–11 mm wide; forniceae evident, papillate; style 0.8–1.8 mm long, longer than nutlet; nutlets 2–3 mm long, ovate to lanceolate, intermarginal prickles present or lacking, marginal prickles 7–11 on each side, slightly connate at the base or fused for half their length into a cupulate wing, dorsal surface muricate-hispidulous to nearly smooth.

Gravely creek beds, rocky terraces, canyons, and talus slopes or moist areas, 3,500–8,500 feet elevation, mostly in the oak, juniper, or pinus communities. Southern Arizona, New Mexico, and northern Mexico. May to August.

Our plants of *H. ursina*, as here described, are the only white-flowered species and can be separated into three varieties by the following key:

1. Nutlets 2–2.5 mm long, with marginal prickles 1–2 mm long; flowering July and August; Pinal Mountains, Arizona, and western New Mexico to northern Mexico ................................................................................................. 2

— Nutlets 2.5–3.5 mm long, with marginal prickles 2–3 mm long; flowering in May; rare in Devil’s Canyon, Pinal County, Arizona .......... var. diaboli J. L. Gentry
2(1). Corolla limb 5-7.5 mm broad; pedicels rarely more than 2.5 mm at anthesis; southwestern New Mexico .............................................................. var. ursina

Corolla limb 7.5-10 mm broad; pedicels mostly more than 3 mm at anthesis; Pinal Mountains, Arizona, and northern Mexico .............................................................. var. pustulata (Macbr.) J. L. Gentry

2. Hackelia besseyi (Ryd.) J. L. Gentry


**Stems** erect, solitary, 3-11 dm tall, canescent with stigose or villous-hirsute hairs; *leaves* at base of plant oblancoate, 2-9 cm long, (7)10-17 mm broad, obtuse, stigose to hirsute-hispid, pediculate, cauline leaves gradually reduced above 2-13 cm long, 5-10(12) mm broad; *inflorescence* open and spreading; *bracts* evidently near base of cyme; *calyx* 1-1.5 mm long in fruit, the segments lanceolate; *pedicels* in fruit 3-5 mm long; *corolla* tube 0.8-0.9 mm long, limb 1.5-2.5 mm broad, blue; *fornices* evident, papillate; *style* shorter than nutlet; *nutlets* 2-2.5 mm long, ovate to ovate-lanceolate, intramarginal prickles absent, marginal prickles 8-13 on each side, distinct or slightly connate, a long and short prickle alternating, dorsal surface muricate-hispidulous.

In the foothills, extending to moderate elevations in the mountains, 6,000-9,000 feet, in association with Pinyon-Juniper and Fir-Pine stands. El Paso County, Colorado, south through New Mexico to Trans-Pecos Texas. July to September.

The very small corollas, with ascending lobes, easily distinguish this plant from all other members of *Hackelia* in North America.

3. Hackelia hirsuta (Woot. & Standl.) I. M. Johnst.


**Stems** 1 or few, often bluish tinged at the base, erect, or widely branched from the base and throughout, 1-8 dm tall, spreading hispid below, hirsute to stigose above; *leaves* at base of plant oblancoate, acute, petiolate, withering early, 2-7 cm long, 5-10 mm broad, villous-stigose to hirsute, ciliate on the petioles, moderately pubescent, cauline leaves oblancoate to linear-oblong, 3-10 cm long, 5-12 mm wide, ciliate; *inflorescence* open, widely spreading; *bracts* 3-10 mm long; evident throughout; *calyx* 2-3 mm long in fruit, the segments oblong to lanceolate; *pedicels* 5-10 mm long in fruit; *corolla* blue with a white eye, the tube 1.5-2 mm long, limb 4-8 mm broad; *fornices* evident, papillate; *style* 0.6-1.1 mm long, shorter than nutlet; *nutlets* 2.5-3.5 mm long, ovate-lanceolate, intramarginal prickles absent, marginal prickles 4-7 on each side, slightly connate or distinct at the base, dorsal surface muricate-hispidulous.

On dry, open hillsides or shale roadcuts, in oak canyons or coniferous forests, or rarely moist areas, 6,000-10,000 feet elevation. Endemic to north central New Mexico.

A striking and very distinct species due to the spreading branches and the conspicuously hirsute-hispid stems and leaves.

4. Hackelia pinetorum (Greene ex A. Gray) I. M. Johnst.


*H. pinetorum* var. jonesii I. L. Gentry, Southwestern Naturalist 19(2): 142. 1974 (M. E. Jones, Soldier Canyon, Sierra Madre, Chihuahua, Mexico, 16 September 1903) = var. jonesii

**Stems** 1 or few, erect, 3-8 dm tall, grayish hirsute below, becoming stigose above; *leaves* at base of plant withering early, elliptic to oblong or oblanceolate, obtuse, petiolate, 3-8.5 cm long, 10-20 mm broad, hirsute to hispidulous, cauline leaves reduced upward, 3-12 cm long, 8-25 mm broad; *inflorescence* open and spreading; *bracts* lack-
ing or 1–2 at the base; calyx 1.5–2 mm long in fruit, the segments lanceolate to oblong; pedicels 2–5 mm long in fruit; corolla pale blue, tube 1.3–1.6 mm long, the limb 4–7 mm broad; style not exceeding nutlet; nutlets 2–3 mm long, lanceolate to lance-ovate, intramarginal prickles small, 1–3 or absent, marginal prickles 4–7 on each side, distinct or slightly connate at the base, less than 2 mm long, dorsal surface muricate hispidulous.

Moist, shaded places in Douglas-fir or oak woods or pine woodlands at elevations 6,000–9,000 feet. Coconino County, Arizona, south to southeastern Arizona to southern New Mexico and Trans-Pecos Texas, south into Chihuahua, Sierra Madre, Occidentale, Mexico. June to August.

The northern phase of *H. pinetorum* is the most common and is var. *pinetorum*. The southern element has been called var. *jonesii* and enters our flora only in the Organ Mountains of southern New Mexico. It is distinguished from the typical plant by the absence of intramarginal prickles; however, there is some introgression between the two varieties in the Organ Mountains.

5. **Hackelia floribunda** (Lehm.) I. M. Johnston


Stems stout, erect, 5–12(14) dm tall, reflexed or spreading hirsute or strigose below; leaves at base of plant withering early, oblong to elliptic-oblong, 4–20 cm long, 5–20(25) mm broad, petiolate, apex obtuse to acute, hirsutulous-appressed, cauleine leaves sessile, gradually reduced upward: inflorescence elongate, rather narrow with strongly ascending, many-flowered branches; bracts lacking or 1–2 at base of cymes; calyx in fruit 2–3(3.5) mm long, the segments oblong to lance-oblong, hirsute; pedicels 1–3.5 mm long at anthesis, in fruit becoming 4–7(10) mm long; corolla blue or rarely white, the tube 1–2 mm long, the limb 4–7 mm broad; fruits small, obscurely papillate; style shorter than nutlets; nutlets 3–5 mm long, ovate or ovate-lanceolate, intramarginal prickles lacking or rarely present on a few of the nutlets of the inflorescence, marginal prickles 5–8 on each side, distinct or slightly connate, or sometimes fused for half their length, 1.5–3 mm long, dorsal surface with a faint median ridge, muriculate-hirsutulous.

Moist to moderately dry places in the mountains or foothills, or along stream banks, associated with oak, aspen, and evergreen forests 4,000–10,500 feet elevation. British Columbia, Alberta, and Saskatchewan, south to Nevada, Arizona, and New Mexico. Disjunct to Durango, Mexico, less often in Washington, Oregon, and California. July to August.

There is some variation within *H. floribunda*, such as the fusion of marginal prickles or not, and the presence or absence of intramarginal prickles. These phases in the past have been called *H. leptophylla*; however, they seem to be wholly arbitrary and not worthy of any taxonomic recognition.