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

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

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

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

18. **C. oxygona** (Gray) Greene. Sparsely branched herb 1–4 dm. tall; stems usually solitary with several well-developed ascending branches from near base, appressed villous-hispid or strigose, often sparsely hispid, leaves linear or lance-linear, 1–4(–6) cm. long, 1–2(–3) mm. broad, strigose or short-hispid, ascending, obtusish, densely and inconspicuously pustulate, upper ones evidently reduced; spikes geminate or ternate, usually short and dense, 1–3(–6) cm. long, naked; corolla conspicuous, limb 4–7 mm. broad; fruiting calyces ovate or oblong-ovate, ascending, 2.5–4 mm. long, deciduous, obscurely biserial, symmetrical, base rounded, pedicel ca. 0.5 mm. long; mature calyx-lobes lanceolate, somewhat connivent above, margin more or less silky-strigose, midrib slightly thickened and frequently sparsely hirsute; nutlets 4, homomorphous; body of nutlets oblong-ovate, 2 or rarely 3 mm. long, only slightly shorter than the calyx-lobes, muricate or tuberculate, back low convex; margin of nutlet narrowly winged or knife-like; groove closed or rarely open, broadly forked below where always opened to form a triangular areola; gynobase columnar-subulate, about ⅔ height of nutlets; style clearly surpassing the nutlets.—Pittonia i. 120 (1887). *Eritrichium oxygonum* Gray, Proc. Am. Acad. xix. 89 (1883). *Krynitzkia oxygona* Gray, Proc. Am. Acad. xx. 277 (1885).

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

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

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

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

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

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

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

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

Var. **cycloptera** (Greene) Macbr. Nutlets homomorphous, all winged.—Contr. Gray Herb. n. s. xlviii. 44 (1916). *Krynitzkia cycloptera* Greene, Bull. Calif. Acad. Sci. i. 207 (1884). *C. cycloptera* Greene, Pittonia i. 120 (1887).

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

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

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

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

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

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

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

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

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

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

Mountains of Colorado and Wyoming. Rarely collected.

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

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