

MONOGRAPH OF PSILOSTROPHE¹

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INTRODUCTION AND HISTORY

In this paper there has been an attempt to clarify the confusion in the taxonomy of the genus *Psilostrophe*. It has necessitated a critical study of the morphology and of the geographical distribution of the several entities which comprise this interesting composite of southwestern North America. No novelties have been added in this treatment; rather it consists of a reduction in the number of species hitherto recognized.

Psilostrophe received its name from de Candolle² in the year 1838; the genus was based on specimens collected by Berlandier at San Luis Potosi, Mexico. Three years later Nuttall³ described a new genus, *Riddellia*, from a specimen collected by James on Long's Expedition, but no definite locality was recorded.⁴ *Riddellia* subsequently proved to be synonymous with *Psilostrophe*, but the name was used for the next half century before it lapsed into synonymy. Gray, who did much work on the genus, realized that his *Riddellia arachnoidea* was the same as de Candolle's *Psilostrophe gnaphalodes*.⁵ However, he later wrote:⁶ *Psilostrophe*, "a name which although a year or two earlier in publication [than *Riddellia*] we trust may remain disused, having been accompanied by an insufficient, and, in some important respects, erroneous character." Nevertheless, according to the International Rules of Botanical Nomenclature, the older name, *Psilostrophe*, should be used, although the genus may have been incorrectly described in some minor details. In 1891 it was restored as the valid generic name by Greene.⁷

Gray⁸ in his 'Synoptical Flora of North America' recognized three species and one variety of *Psilostrophe*. In the only paper approaching a monographic study of the genus,⁹ A. Nelson in 1903 included six species and two varieties, but this treatment is inadequate to meet present needs. Since that time the most important treatment of the genus is Rydberg's,¹⁰ where three new species are described, bringing the total number of species to ten, some of which are reduced in this monograph. Type material, or duplicates of types, of most of the species has been examined in this study.

¹ An investigation carried out in the graduate laboratory of the Henry Shaw School of Botany of Washington University, and submitted as a thesis in partial fulfillment of the requirements for the degree of master of science in the Henry Shaw School of Botany of Washington University.

² de Candolle, A. Prodr. 7:261. 1838.

³ Nuttall in Trans. Am. Phil. Soc. II. 7:371. 1841.

⁴ Gray in Mem. Am. Acad. II. 4:94. 1849.

⁵ Gray in Smithson Contr. to Knowl. 3:121. 1852.

⁶ Gray in Proc. Am. Acad. 7:358. 1868.

⁷ Greene, Pittonia 2:176. 1891.

⁸ Gray, Syn. Fl. N. Am. 1²:317. 1884, and ed. 2, 1886.

⁹ Nelson in Proc. Biol. Soc. Wash. 16:21. 1903.

¹⁰ Rydberg in Britton, N. Am. Fl. 34:6. 1914.

MORPHOLOGY

All the species of *Psilostrophe* arise from a ligneous tap root. The stems are generally somewhat striate, from almost glabrous in *P. sparsiflora* through all degrees of villosity to densely pannose in *P. Cooperi*. Gray¹¹ correctly describes the pubescence of the stem of *P. Cooperi* as "canescent with close and matted tomentum." The base of the plant, which is usually woody, is frequently more densely hairy than the upper part of the stem. The color of the stem varies, depending on the amount of pubescence, from green in *P. sparsiflora* and occasionally in *P. tagetina*, to gray, and white in *P. Cooperi*. A slight twisting of the stem may show up somewhat in *P. tagetina* var. *lanata* and is frequently very marked in *P. sparsiflora*.

The lower leaves vary in size up to 15 cm. in length and are usually less than half as broad. All measurements in this paper are from dried specimens. As a general rule, the leaves are less villous than the stems and involucres. In shape, there is a wide degree of variation from obovate to linear. Some of the leaves may be lobed in all of the species except in *P. Cooperi*. The lower leaves are quite frequently lacking on the herbarium specimens.

The upper leaves are alternate, generally entire, sessile, and smaller than the basal leaves. They are also usually less villous than the lower leaves and consequently greener. In shape, they vary from spatulate to linear. The leaves fail to offer much of taxonomic value in delimiting the species.

The involucre is cylindrical to campanulate and composed of one definite series of 4–12 linear-oblong or lanceolate connivent bracts, but which often appear connate because of the dense pubescence. There is an inner indefinite series of 1–7 smaller scarious bracts, and sometimes an outer calyculate bract is present.

The heads are on long peduncles up to 8.0 cm. in length in *P. Cooperi*; or they may be clustered on shorter peduncles; or almost sessile as in *P. gnaphalodes*. The length of the peduncles is of some taxonomic worth in distinguishing *P. gnaphalodes* and *P. villosa* from *P. tagetina*, but this character by itself is of doubtful value because of intergradations.

The ligules, which are always some shade of yellow, become papery in age and persist on the achenes. There is great variation in the length of the ligules even among the same species. Nevertheless, the size often serves as a diagnostic character, for in *P. Bakeri* and *P. Cooperi* the ligules are from 8 to 14 or 16 mm. long, while in *P. villosa* they are only 3 to 5 mm. long. There is also a variation in the number of ligules present, 3–4 in most species, but from 4 to 8 in *P. Bakeri* and *P. Cooperi*. The ligules are 4–7-nerved, and the nerves unite in pairs within the lobes. Most of the species have shallowly 3-lobed ligules, rarely 4–5-lobed, but in *P. villosa* the lobes may extend half the length of the ligule. In some plants there may be found ligules with 3, 4, and 5 lobes on the same plant. The ligules, which are broader than long, are contracted at their base into a tube

¹¹ Gray, Syn. Fl. N. Am. 12:318. 1884, and ed. 2, 1886.

from which the style protrudes. The style-branches of the ray-flowers are elongated, subterete, and more or less acute at the apex.

The number of disk-flowers varies from as few as 5 to as many as 20, the larger number being found in *P. Cooperi* and *P. Bakeri*. The anthers are obtuse at the base, lanceolate, and acute at the tips, and the style branches are truncate-capitellate at the apex in contrast to those of the ray-flowers.

The achenes are small, 1.5–5 mm. long, narrow, terete or obtusely angled, and striate when dried. They are glabrous or provided with only a few short hairs, except in *P. gnaphalodes*, where they are long-villous. The hairs in this species project upward and usually exceed the achene in length. This feature is the only good single character separating *P. gnaphalodes* from *P. villosa* and *P. tagetina* in the areas where their distribution overlaps.

The pappus is made up of 6, occasionally 4 or 5, hyaline scales or squamellae. The squamellae may be entire or denticulate, obtuse or acute, unequal or equal in length, lanceolate to ovate in shape, and from less than one half to more than one half the length of the disk-flowers. In *P. tagetina* the pappus may range from one extreme to the other, and some of the scales may be obtuse while others in the same head may be acutish. In some of the species, such as *P. villosa*, *P. Bakeri*, and *P. gnaphalodes*, the pappus is fairly uniform. By itself it is a very unreliable taxonomic guide in this genus.

Other morphological features that should receive mention are the glands and the pubescence. All parts of the plant are frequently glandular-dotted. The stem of *P. sparsiflora*, which is much less villous than the stems of the other species, is quite often glandular. The tube of the disk-flowers may be dotted with these glands, and in some plants the glands extend onto the achene, and rarely they may be present on the pappus-scales. The ligules show the presence of these glands, particularly on the lower surface, and the leaves may show them in some number.

The pubescence, best described as woolly in most cases, is made up of long, multicellular hairs which frequently terminate in a small gland. The hairs of the achenes of *P. gnaphalodes* are very similar to those of other parts of the plant, but rarely terminate in a gland and are more frequently unicellular. The hairs on the squamellae of this species arise directly from the pappus-scales. The squamellae of other species are composed of elongated cells, the terminal ones ending more or less together, whereas in *P. gnaphalodes* some of the terminal cells give rise to hairs which extend beyond the scale. The pubescence of the stem and leaves tends to disappear with age.

DISCUSSION OF PROBLEMS AND RELATIONSHIPS OF SPECIES

In this study it was seen at once that *P. Cooperi* and *P. Bakeri* could be readily segregated from the other species. Even macroscopically they are seldom to be mistaken for any other species, many of which were labeled either *P. tagetina* or *P. gnaphalodes*. By separating the almost glabrous plants from these, with a

few exceptions, *P. sparsiflora* became evident. The distribution of this species in northern Arizona and southern Utah was of great help.

P. villosa is clear-cut in its northern range, but in Texas it is often difficult to distinguish from *P. tagetina* and *P. gnaphalodes*. However, on the basis of glabrous or villous achenes the plants which appeared alike to the naked eye could be placed in either *P. villosa* or *P. gnaphalodes*.

Those plants which did not fall into the above two species were placed in the "tagetina complex." The diversity of these plants in detailed character is not paralleled in other members of the genus. Nelson¹² noted this and commented, "the difference seems to be vegetative and not congenital." There seems to be no consistent basis for segregating this heterogeneous group except into the two varieties, *P. tagetina* var. *lanata* and *P. tagetina* var. *grandiflora*. Perhaps some future worker will see fit to split the "tagetina complex" into several species, but the writer believes that *P. tagetina* should be treated as a comprehensive specific unit.

The possibility of hybridization is strongly suggested, and on the basis of morphology and geography the following hybrids are conceivable:

P. tagetina x *gnaphalodes*

P. tagetina x *villosa*

P. villosa x *gnaphalodes*

P. tagetina x *sparsiflora*

Cytological studies might go a long way in throwing light on some of the problems of specific relationships. No chromosome counts for any species of this genus have been published, so far as the author is aware, and as he was unable to obtain living specimens he could not supply the information.

It is interesting but rather dangerous treading to try to draw conclusions regarding the phylogeny of *Psilostrophe* and its species. The most interesting speculation is in regard to the age of *P. gnaphalodes* as compared with the other species. If *P. gnaphalodes* is thought of as derived from one of the other species then we may claim to see the actual development of a hair-like pappus from a scale-like one. If, on the other hand, *P. gnaphalodes* is thought of as the archetype we might then use the evidence to show the development of a scale-like pappus from a hairy one. The writer is in sympathy with the former hypothesis, for it is his belief that the progenitor was a species that is now relatively constant in morphological features, a perennial rather than a biennial, and does not tend to hybridize.

The presence of close generic relatives helps very little in this problem, for the nearest genus is *Baileya*, in which a pappus is lacking.

Psilostrophe has been placed in the subtribe Riddellieae of the tribe Helenioideae by Gray¹³ and later botanists.¹⁴ The other two genera of the subtribe Riddellieae

¹² Nelson in Proc. Biol. Soc. Wash. 16:21. 1903.

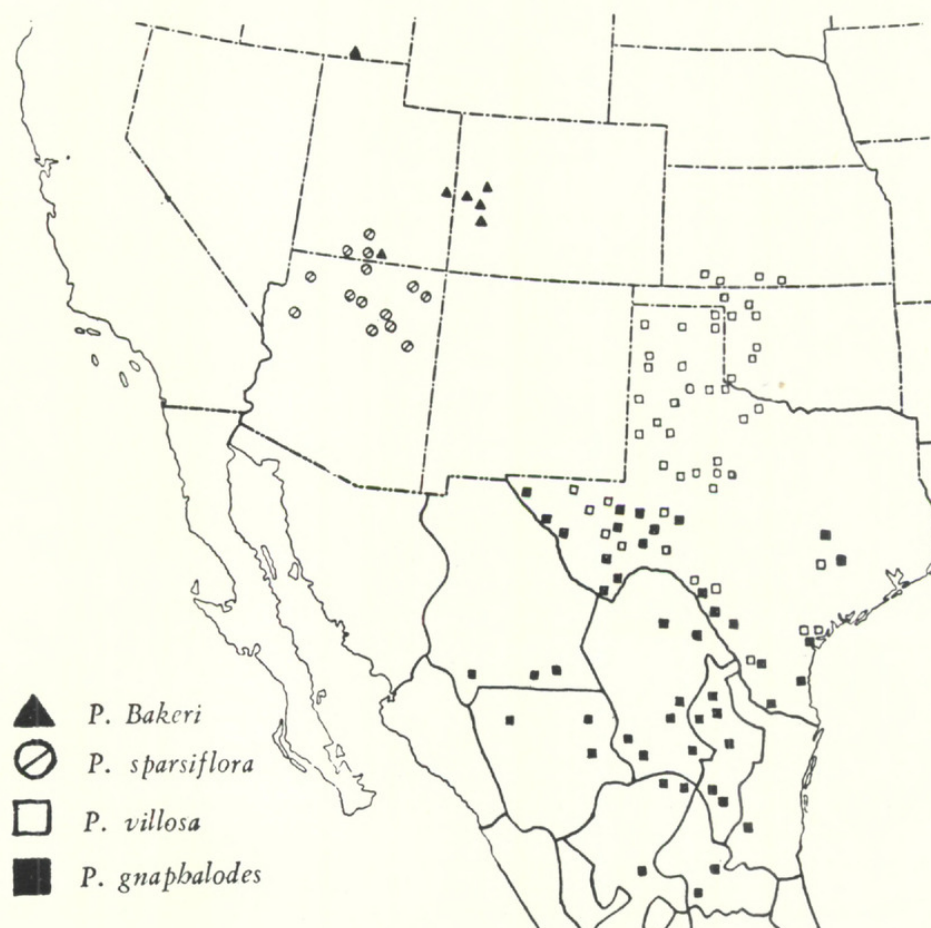
¹³ Gray, Syn. Fl. N. Am. 12:71. 1884, and ed. 2, 1886.

¹⁴ Tribe Helenieae, subtribe Riddellinae. Engler & Prantl, Nat. Pflanzenfam. 4:253. 1890. Tribe Helenieae, subtribe Riddellianae. Rydberg in Britton, N. Am. Fl. 34:6. 1914.

are *Baileya* and *Whitneya*. The latter, a monotypic genus from California, is very distinct from the other two genera because of its opposite leaves, sterile disk-flowers, and absence of pappus. *Baileya*, on the other hand, is very closely allied to *Psilostrophe*; the principal taxonomic distinctions between the two are that *Baileya* lacks a pappus, usually has a greater number of ray and disk-flowers, and has bracts arranged in two more definite series.

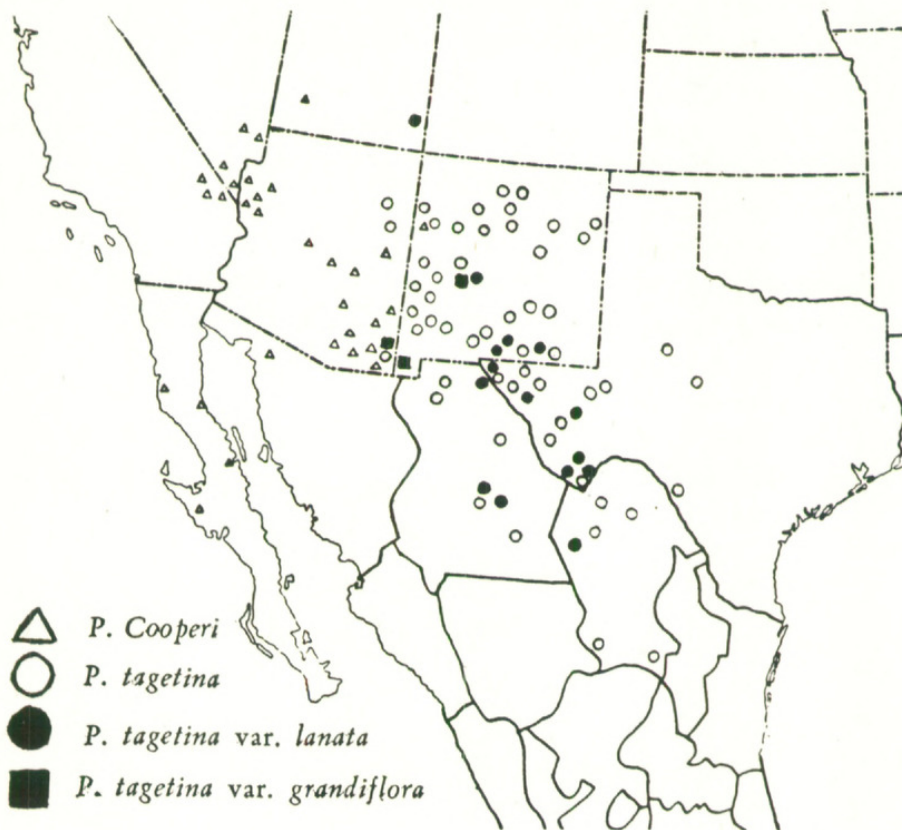
GEOGRAPHICAL DISTRIBUTION

Psilostrophe is confined to southwestern North America, extending from southern Idaho in the north to San Luis Potosi in the south, from Texas in the east to San Bernardino County, California, in the west. The plants are found in ten of the United States and nine Mexican states. The greatest specific concentrations are in western Arizona and western Texas where three species each are found. *P. tagetina* and *P. gnaphalodes* have the widest known distribution of any of the species, while *P. sparsiflora* and *P. Bakeri* have the most restricted distribution. The plants are more or less xerophytic, preferring high, dry, sandy



Map 1. Showing distribution of *Psilostrophe Bakeri*, *P. sparsiflora*, *P. villosa* and *P. gnaphalodes*.

soil as a rule. Maps 1-2 show the distribution of the species and varieties of *Psilostrophe*.



Map 2. Showing distribution of *Psilostrophe Cooperi* and *P. tagetina* and its varieties.

ECONOMIC USES

The economic uses of *Psilostrophe*, as in the case of many Compositae, are very limited. Their chief value is probably as ornamentals. Parks¹⁵ says that *P. gnaphalodes* and *P. tagetina* make excellent border plants. However, *P. gnaphalodes* is poisonous to live stock. Further, he recommends that these two species be grown by nurserymen and made available to gardeners. Gray¹⁶, soon after the genus was described, pointed out that *P. tagetina* should "be very ornamental in cultivation."

P. gnaphalodes and *P. tagetina* are both very attractive plants, particularly var. *grandiflora* of *tagetina*, but both are excelled in beauty by *P. Cooperi*. This tall plant with its large papery rays makes a very striking appearance even on the herbarium sheet. In addition to this species, *P. sparsiflora* and *P. Bakeri* should make exceedingly fine perennials for cultivation.

¹⁵ Parks in Tex. Agr. Exp. Sta. Bull. No. 551, p. 160. 1937.

¹⁶ Gray in Mem. Am. Acad. II. 4:93. 1849.

COMMON NAMES

"Paperflower" is the most common name for this genus. Common names of the various species according to Kelsey and Dayton¹⁷ are as follows: "white-stem paperflower" for *Psilostrophe Cooperi*, "cudweed paperflower" for *P. gnaphadoles*, "greenstem paperflower" for *P. sparsiflora*, and "woolly paperflower" for *P. tagetina*. The last name, of course, could equally well apply to several of the species.

ACKNOWLEDGMENTS

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ABBREVIATIONS

The herbaria cited in this paper are indicated by the following abbreviations:

FM—Chicago Museum of Natural History, formerly Field Museum of Natural History.

G—Gray Herbarium of Harvard University.

MBG—Missouri Botanical Garden.

PA—Philadelphia Academy of Natural Sciences.

T—University of Texas.

US—United States National Herbarium.

TAXONOMY

Psilostrophe DC. Prodr. 7:261. 1838; Greene, Pittonia 2:176. 1891; Britt. & Brown, Ill. Fl. 3:444. 1898, and ed. 2, 3:504. 1913; Britt. Man. 1005. 1901; Greene, Pl. Baker. 3:29. 1901; A. Nels. in Proc. Biol. Soc. Wash. 16:21. 1903; Small, Fl. Southeastern U. S., ed. 2, 1372. 1913; Rydb. in Britt. N. Am. Fl. 34:6. 1914; Jepson, Man. Fl. Pl. Calif. 1133. 1925; Rydb. Fl. Prair. and Plains, 852. 1932.

Riddellia Nutt. in Trans. Am. Phil. Soc. II. 7:371. 1841; Torr. & Gray, Fl. N. Am. 2:362. 1842; Gray in Mem. Am. Acad. II. 4:93. 1849; Gray in Proc. Am. Acad. 7:358. 1868; Benth. & Hook. Gen. Pl. 2:401. 1873; Gray, Syn. Fl. N. Am. 1²:71, 317. 1884, and ed. 2. 1886; Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. 4:253. 1890.

¹⁷ Kelsey & Dayton, Standardized Plant Names, p. 504. 1942.

DESCRIPTION OF THE GENUS

Perennial, rarely biennial, herbs or low shrubs, growing in clumps, from a tap root, 5 to 60 cm. in height; stem branching, pannose, densely villous, or glabrate. Lower leaves petioled, obovate to oblanceolate, entire or occasionally lobed, villous to glabrate, upper leaves alternate, smaller and sessile, spatulate to linear, rarely lobed. Involucre of 4–12 linear-oblong to lanceolate, villous, connivent bracts, and an inner series of 1–7 smaller scarious bracts, rarely an outer calyculate one. Receptacle naked. Inflorescence corymbose. Heads long-peduncled to subsessile. Ray-flowers pistillate, fertile, in a single series of 3–7. Ligules yellow, papery and persistent on the achenes, 3–16 mm. long, slightly 3–5-lobed. Disk-flowers hermaphrodite, fertile, regular. Corolla-tube with cylindric throat and 5 glandular lobes. Anthers obtuse at the base and acute at the apex. Style-branches of the ray-flowers capillary, of disk-flowers truncate at the tips. Achenes small, linear, more or less striate, obtusely angled or terete, glabrous or essentially so, or long-villous. Pappus of 4–6 nerveless hyaline squamellae, lanceolate to oval, acute to obtuse, equal or unequal in length. Leaves, stems, and parts of flower frequently glandular-granuliferous.

Type species: *Psilostrophe gnaphalodes* DC.

KEY TO THE SPECIES AND VARIETIES

- A. Stem white-pannose; shrubby plants; peduncles 3.0–8.0 cm. long..... 1. *P. COOPERI*
- AA. Stem villous to glabrate, gray to green; herbaceous plants; heads subsessile to long-peduncled.
 - B. Achenes and pappus long-villous; heads subsessile or with peduncles mostly less than 0.5 cm.; ligules about 6 mm. long..... 6. *P. GNAPHALODES*
 - BB. Achenes and pappus glabrous or essentially so; heads long-peduncled (subsessile only in *P. villosa*).
 - C. Involucre 7–10 mm. high, 4–6 mm. broad; ligules 4–6, 8–14 mm. long; pappus scales generally ovate, less than half the length of the disk-corolla..... 2. *P. BAKERI*
 - CC. Involucre 4–6 mm. high, 2–4 mm. broad; ligules 3–5, 3–11 mm. long; pappus scales rarely ovate, generally about half the length of the disk-corolla.
 - D. Heads densely clustered, on peduncles mostly less than 0.5 cm.; ligules 3–5 mm. long, deeply lobed..... 5. *P. VILLOSA*
 - DD. Heads loosely clustered, on peduncles mostly longer than 0.5 cm.; ligules 5 mm. or more long, shallowly lobed.
 - E. Plants glabrate to sparingly pilose; stem green, frequently slightly twisted..... 3. *P. SPARSIFLORA*
 - EE. Plants long-villous, rarely glabrate; stem gray to green, not twisted (except in *P. tagetina* var. *lanata*).
 - F. Ligules 5–9 mm. long; peduncles 0.5–2.0 cm. long; upper leaves about 1 cm. long or less..... 4. *P. TAGETINA*
 - FF. Ligules 6–12 mm. long; peduncles 1.0–4.0 cm. long; upper leaves frequently over 1 cm. long.
 - G. Plants densely villous, grayish, about 40 cm. high; basal leaves 5–15 cm. long, frequently lobed; pappus-scales generally acute..... 4a. *P. TAGETINA* var. *LANATA*
 - GG. Plants lightly villous, greenish, about 25 cm. high; basal leaves 3–6 cm. long, mostly entire; pappus-scales generally obtuse..... 4b. *P. TAGETINA* var. *GRANDIFLORA*

1. *Psilostrophe Cooperi* (Gray) Greene, *Pittonia* 2:176. 1891; Kuntze, *Rev. Gen. Pl.* 1:358. 1891; Rydb. in *Britt. N. Am. Fl.* 34:9. 1914; Rydb. *Fl. Rocky Mts.* 939. 1917; Jepson, *Man. Fl. Pl. Calif.* 1133. 1925; Munz, *Man. S. Calif. Bot.* 559. 1939; Blake in *Kearney & Peebles, U. S. Dept. Agr. Misc. Pub.* No. 423, p. 969. 1942 (as *cooperi*).

Riddellia Cooperi Gray in *Proc. Am. Acad.* 7:358. 1868; Gray, *Syn. Fl. N. Am.* 1²:318. 1884, and ed. 2, 1886.

A shrubby perennial with woody caudex; stems white-pannose, less densely so with age, 25 to 50 cm. high; lower leaves entire, linear, pannose to almost glabrate, 1–7 cm. long, seldom more than 2 cm. broad; upper leaves smaller and sessile; heads scattered; peduncles slender, 3.0–8.0 cm. long; involucre woolly, 6–8 mm. long, 4–5 mm. wide; ligules 4–8, 8–16 mm. long, nearly as broad, 3-lobed; disk-flowers 9–20; achenes glabrous; squamellae various, broadly oblong to lanceolate, erose to entire, obtuse to acute, generally from $\frac{1}{4}$ to less than $\frac{1}{2}$ the length of the disk-corollas.

Distribution: New Mexico to California into northwestern Mexico. Altitude: 2000–4000 ft.

ARIZONA.—COCHISE CO.: Benson, *Jones 25940* (MBG); Lowell, *Parish 111* (G, MBG, NY, PA, US). GILA CO.: near Rock and Rye Creeks, *Collom 65* (MBG, NY), near Rye Creek, *479* (MBG); 17 mi. from Roosevelt on road to Payson, *Stone 60* (NY). GRAHAM CO.: Tanque, *Eggleston 19890* (US); Camp Grant, *Palmer 140* (G, MBG); Safford, 30 Sept. 1936, *Tharph* (T). GREENLEE CO.: near Clifton, 1 Nov. 1880, *Greene* (G, NY). MARICOPA CO.: New River Valley, 10 mi. s. of Canyon, *Gillespie 8690* (US). MOJAVE CO.: Kingman, 13 Aug. 1911, *Wootton* (US); southern tip of Cerbat Range, about 5 mi. s. w. of Kingman, *Barkley & Blondeau 4186* (MBG); 5 mi. s. w. of Kingman, *Rose 40083* (MBG); 10 mi. from Kingman on Peach Springs road, *Ferris & Duncan 2228* (NY); between Oatman and Kingman, *Degener 4907* (NY); plain near Oatman, April 1916, *Creighton* (PA); Fort Mojave, coll. of 1861, *Cooper* (G TYPE, US); Yucca, *Jones 3891* (FM, NY, PA, US); 30 mi. s. of Littlefield, *Maguire, Maguire & Maguire 5061* (G, MBG). NAVAJO CO.: Silver Lake, *Toumey 639a* (US). PIMA CO.: Tucson, *Demaree 8031* (MBG), *Fisher 155* (G), 11 Oct. 1894, *Hilzinger* (G, NY), *Lemmon Herbarium 46* (G), *Nelson & Nelson 1519* (G, MBG, NY, PA, US), 10 June 1908, *Sherff* (MBG), *Thorner 402* (MBG, NY, US), 16 April 1892, *Toumey s. n.*, *639b* (US), coll. of 1886, *Vasey* (US), and 1 May 1896, *Zuck* (US); near Tucson, *Peebles, Harrison & Kearney 1279* (US), *Pringle 9845* (NY), *Wiggins 6231* (US); west of Tucson, *Bartram 294* (PA); Picture Rocks, Tucson Mts., *Bartram 295* (US); w. of Tucson Mts., 19 Aug. 1927 and base of Tucson Mts. near Tucson, 24 July 1927, *Graham* (NY); low slopes Tucson Mts., *Bartram 296* (PA); few mi. w. of Carnegie Inst. Desert Lab., foothills of Tucson Mts., *Foster 509* (G); Saguaro Monument, 15 mi. e. of Tucson, *Brass 14330* (G, MBG); Martinez' Ranch, 16 mi. e. of Tucson, *Brass 14263* (G, MBG); between Sells and Tucson, *Gilman 215* (MBG, NY); Covered Wells, *Burnham 291* (FM, NY); Vail, 2 May 1937, *Darrow* (G); Rincon Pass, *Griffiths 2020* (NY); Baboquivari Mts., *Gilman 151* (NY), *Nelson & Nelson 1535* (MBG, NY, US); Tuviaucoc Hill, Tucson, *Harris C1476* (MBG, NY); roadside mine, *Harrison & Kearney 8667* (FM); San Salano, 10 Oct. 1925, *Peebles, Harrison & Kearney* (US); Camp Lowell, *Pringle 13755* (G, MBG, NY, PA). PINAL CO.: Ray, 1 May 1911, *Johnson* (NY). YAVAPAI CO.: Fort Whipple, *Coues & Palmer 254* (G, MBG); Castle Creek, *Toumey 639c* (US); Black Canyon Road near Agua Fria, *Wiegand & Upton 4474* (FM, MBG).

CALIFORNIA.—SAN BERNARDINO CO.: 1 mi. s. of Excelsior Talc Mine, Kingston Mts., Mojave Desert, *Abrams 14104* (G); Providence Mts., 24 May 1902, *Brandegge* (PA); e.

slope of Providence Mts., 29 May 1861, *Cooper* (US); Nipton, June 1915, *Brandege* (G, FM, MBG, NY, US); Kelso, 2 May 1906, *Jones* (MBG, NY, US); Lanfair Valley, e. Mojave Desert, *Munz* 13897 (FM); Seastalk, *Parish* 10264 (G, MBG).

NEVADA.—CLARK CO.: Charleston Mts., Carpenter Canyon, *Anderson* 7749 (NY, US); Valley of Fire, *Clokey* 5952 (MBG, NY, T), *Maguire*, *Maguire* & *Maguire* 5060 (G); Kyle Canyon, *Clokey* 7367 (NY, US); Clark Creek, *Clokey* 7369 (FM, NY, US); Kyle Canyon Fan, *Clokey* 8177 (G, FM, MBG, NY, PA, T); Trout Creek Canyon Wash, *Clokey* & *Anderson* 7368 (G, FM, NY); fan s. of Trout Creek, *Clokey* & *Anderson* 8176 (G, FM, MBG, NY, PA); Virgin River, Bunkerville, *Goodding* 752 (G, MBG); Moapa, *Kennedy* 1127 (NY, US); 8 mi. w. of Goodsprings on road to Kingston, *La Rivers* & *Hancock* 294 (MBG); 1 mi. w. of Riverside, *Maguire* & *Blood* 4498 (FM, MBG); junction of Las Vegas and Head of Callville Wash, 2 mi. n. of airport, *Train* 1804 (NY); junction of Kyle Canyon and Las Vegas Highway, *Train* 1664 (PA). LINCOLN CO.: Searchlight, *Parish* 10285 (NY). NYE CO.: Pahrump Valley, *Coville* & *Funston* 292 (US), *Purpus* 6125 (PA, US).

NEW MEXICO.—MC KINLEY CO.: road near Zuni, *Schott* III 91 (FM).

UTAH.—BEAVER CO.: Beaver, *Palmer* 246 (G, MBG, NY, US).

MEXICO.—LOWER CALIFORNIA: San Luis, 22 April 1889, *Brandege* (G, FM, US); Agua Dulce, *Brandege* (FM); about 32 mi. from Rosario on road to San Augustine, *Ferris* 8553 (US); San Augustine, *Gentry* 4003 (MBG); El Marmol, *Harvey* 518 (US); Los Angeles Bay, Gulf of California, *Palmer* 538 (G, NY, US); coastal terrace along beach 24 mi. s. of Punto Prieta, *Wiggins* 7737 (FM).

SONORA: District of Altar, 7 mi. s. of Sonoyta on road to Quitovac, *Keck* 4147 (G, US).

2. *Psilostrophe Bakeri* Greene, Pl. Baker. 3:29. 1901; Rydb. Fl. Colo. 376. 1906; Coulter & Nels. New Man. Bot. Cent. Rocky Mts. 553. 1909; Rydb. in Britt. N. Am. Fl. 34:8. 1914; Fl. Rocky Mts. 939. 1917, and ed. 2. 1922.

Riddellia tagetina var. *pumila* M. E. Jones in Proc. Calif. Acad. II. 5:700. 1895.

P. pumila A. Nels. in Proc. Biol. Soc. Wash. 16:22. 1903.

A small perennial with woody caudex; stems long-villous, 5–30 cm. high; basal leaves spatulate to obovate, rarely lobed, long-villous, less than 10 cm. long; upper leaves smaller, spatulate to oblanceolate, entire; heads scattered; peduncles 2.0–5.0 cm. long; involucre generally lightly long-villous, 7–10 mm. long, 4–6 mm. wide, bracts apparent; ligules 4–6, 8–14 mm. long, 10 mm. wide, shallowly 3-cleft; disk-flowers 10–18; achenes glabrous; squamellae oval, obtuse, more or less erose, about $\frac{1}{3}$ the length of the disk-corolla.

Distribution: western Colorado to southern Idaho. Altitude: 4500–6500 ft.

COLORADO.—DELTA CO.: 30 June 1892, *Cowen* (NY); Hotchkiss, *Cowen* 276 (US); Surface Creek, *Purpus* 183 (FM); 8 mi. w. of Delta, *Rollins* 1970 (G, NY); 2 mi. s. of Delta, *Rollins* 2141 (G, MBG); 15 mi. w. of Delta, *Rollins* 2155 (G). GARFIELD CO.: Rifle, *Osterhout* 2127 (NY). MESA CO.: Grand Junction, *Baker* 106 (G, MBG), *Jones* 5474 (MBG, NY, US), and 22 May 1895 (US), *Saunders* 405 (NY, US); Palisades, *Crandall* 2995 (NY), May to August 1893, *Long* (G); Whitewater, *Rollins* 1578 (G, MBG). MONTROSE CO.: Montrose, *Baker* 14 (G, MBG, US), *Payson* 658 (G); Uncompagne Mts. near Los Piños, coll. of 1878, *Flint* (NY).

IDAHO.—CASSIA CO.: near Strevell, *Warren* 1416 (US).

UTAH.—KANE CO.: Paria (Pahria) Canyon, *Jones* 5296 in part (MBG). GRAND CO.: near Grand Junction, 15 June 1900, *Stokes* (NY, US).

3. *Psilostrophe sparsiflora* (Gray) A. Nels. in Proc. Biol. Soc. Wash. 16:23. 1903; Rydb. in N. Am. Fl. 34:7. 1914; Rydb. Fl. Rocky Mts. 939. 1917; Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 970. 1942.

Riddellia tagetina var. *sparsiflora* Gray, Syn. Fl. N. Am. 1²:318. 1884, and ed. 2. 1886.

P. tagetina var. *sparsiflora* Greene, Pittonia 2:176. 1891.

P. divaricata Rydb. in Britt. N. Am. Fl. 34:8. 1914, in part.

P. grandiflora Rydb. loc. cit. 8. 1914, in part.

A perennial; stems pilose to glabrate above, often glandular-dotted, frequently twisted, 15–45 cm. high; basal leaves spatulate to linear, seldom lobed, very loosely villous, 5–10 cm. long, rarely wider than 1.5 cm.; upper leaves smaller, linear or linear-oblongate, and sessile; heads generally few in loose corymbs; peduncles slender, 0.5 cm. or longer; involucre lightly woolly, about 5 mm. long, 3 mm. wide; ligules usually 3, 6–8 mm. long and noticeably wider, shallowly 3-lobed; disk-flowers 10 or less; achenes essentially glabrous to glabrous; squamellae unequal, linear-lanceolate, mostly acute, $\frac{1}{2}$ – $\frac{2}{3}$ the length of the disk-corolla.

Distribution: eastern New Mexico and southern Utah to northern Arizona. Altitude: 3000–6000 ft.

ARIZONA.—APACHE CO.: Navajo Reservation, *Vorbies* 56 (G, MBG, NY). COCONINO CO.: Grand Canyon, Aug. 1897, *Allen* (NY), *Eastwood* 3692, 5816 (G), Feb.-May 1885, *Gray* (G), 1 July 1915, *Hitchcock* (US), 51, 77 (US), *Knowlton* 272 (US), *Toumey* 638 (US); Boucher Creek, *Wiegand & Upton* 4475 (FM); Le Conte Plateau, 16–19 Oct. 1906, *Pilsbry* (PA); 2 mi. s. of Grand Canyon, *Degener & Park* 4411 (NY); $\frac{1}{2}$ mi. e. of Grand Canyon National Park, *Ferris* 10213 (G); s. rim of Grand Canyon, 25 mi. n. w. of Cameron, *Carter* 1429 (MBG, NY); near Cameron, *Hanson* A55 (FM, MBG, PA, T); 42 mi. e. of El Tovar on road to Cameron, *Peebles* 13332 (US); Lee's Ferry, Paria [Pahria] Canyon, *Cutler* 3135 (NY, MBG); Coconino Forest at Deadman Ranger Station, *Eggleston* 17187 (MBG); Falls of the Little Colorado River, *Fulton* 7359 (US); 3 mi. n. of the Navajo Bridge, *Rollins & Chambers* 2440 (G); 12 mi. s. w. of Tanner's Crossing, 1 June 1901, *Ward* (NY); O'Leary Peak, *Goldman* 2893 (US); Flagstaff, 5 Aug. 1922, *Hanson* (US), 7–11 Aug. 1915, *Hitchcock* (US), *MacDougal* 229 (G, NY, PA, US), May-Oct. 1901, *Purpus* (MBG, US); near Flagstaff, *Leiberg* 5624 (US); 20 mi. n. of Flagstaff, 16 July 1943, *Huffman* (NY); 10 mi. e. of Jacob Lake, 16 July 1943, *Huffman* (NY); along U. S. Highway #66 between Peach Springs and Hyde Park, *Heller* 15777 (MBG, NY); Cosnino, *Jones* 4038 (NY); below Nagle's Ranch, *Jones* 6050a (US); San Francisco Mts., *Knowlton* 182 (US); w. of Echo Cliffs, *McKelvey* 4454 (G); Wupatki National Monument, *Whiting* 756/892 (US). MOHAVE CO.: n. end of Toroweap Valley, *Cottam* 6589 (MBG); Peach Springs, *Degener* 4900 (NY); 6 mi. w. of Peach Springs, *Kearney & Peebles* 12741 (US); Trumbull, *Palmer* 246 $\frac{1}{2}$ (G, MBG, NY, US); Johnson's Canyon, *Rusby* 657 (FM, MBG, NY, US) and 4734 (MBG, US). NAVAJO CO.: Laguna Canyon, Keet Leil Ruin, *Clute* 24 (G, MBG, NY, US), and 24a (NY); Betatakin, *Eastwood & Howell* 6604 (US); s. of Winslow, *Peebles* 9539 (US).

NEW MEXICO.—COUNTY NOT DETERMINED: Mesa la Vecas, 18 Sept. 1883, *Marsh* (US); no locality given, coll. of 1867, *Parry* (US).

UTAH.—GARFIELD CO.: *Siler* (PA). KANE CO.: Pahria Canyon, *Jones* 5296 in part (MBG, NY, US); 10 mi. s. of Pahria, *Jones* 5291i (US); 2 mi. n. e. of Kanab to Red Canyon, *Stone* 276 (NY); Kanab, coll. of 1872, *Thompson* (G, MBG). COUNTY NOT DETERMINED: *Bishop* (G TYPE, FM); *Vasey* (FM); Cainville, *Jones* 5696e (US).

4. *Psilostrophe tagetina*¹⁸ (Nutt.) Greene, *Pittonia* 2:176. 1891; Britt. & Brown, Ill. Fl. 3:444. 1898 (as "*Tagetinae*"); A. Nels. in Proc. Biol. Soc. Wash. 16:22. 1903; Rydb. Fl. Colo. 376. 1906; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 553. 1909; Rydb. in Britt. N. Am. Fl. 34:8. 1914 (as "*Tagetinae*"); Rydb. Fl. Rocky Mts. 939. 1917 (as "*Tagetinae*"); Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 969. 1942 (as "*tagetinae*").

Riddellia tagetina Nutt. in Trans. Am. Phil. Soc. II. 7:371. 1841 (as "*Tage-tinae*," sphalm.); Torr. & Gray, Fl. N. Am. 2:362. 1842; Torr. in Emory, Notes Mil. Reconnois. p. 143, pl. 5. 1848; Gray in Mem. Am. Acad. II. 4:94. 1849; Gray, Syn. Fl. N. Am. 1²:317. 1884, and ed. 2. 1886.

P. Hartmanii Rydb. in Britt. N. Am. Fl. 34:8. 1914.

P. divaricata Rydb. loc. cit., in part.

A perennial, generally woody at the base; stems densely to lightly villous, occasionally glabrate, 10–50 cm. high; basal leaves ovate to oblanceolate, usually spatulate, entire or pinnately lobed, densely to lightly villous, 2–10 cm. long, less than half as wide; upper leaves linear to oblanceolate, smaller and greener than the basal leaves; heads generally numerous in dense to loose corymbs; peduncles usually 0.5–2.0 cm. long; involucre usually densely woolly, 5–6 mm. long, 3–4 mm. wide; ligules 3–5, 5–9 mm. long, 3 (rarely 4 or 5) shallowly lobed; disk-flowers 6–12; achenes glabrous or with a few short and scattered hairs; squamellae various, lanceolate to lance-elliptic, obtuse to acute, entire to erose, and from $\frac{1}{3}$ to $\frac{2}{3}$ the length of the disk-corolla.

Distribution: western Texas to eastern Arizona into northern Mexico. Altitude: 3000–8000 ft.

ARIZONA.—APACHE CO.: White Mts., Hondo Hill, 28 July 1905, *Wooton* (US); Adamana to "Long H" Ranch, *Griffiths* 5173 (US). COHISE CO.: Chiricahua Mts., Paradise, 4 July 1937, *Darrow* (G); Portal to Paradise, *Eggleston* 10650 (US); desert between the Chiricahuas and the Southern Pacific Railroad, 6 mi. s. of Dos Cabezas, *Stone* 184 (PA); Camp Bowie, *Rothrock* 463 (FM, G, PA, US). GREENLEE CO.: San Francisco Mts. (?), 21 July 1864, *Anderson* (MBG). COUNTY NOT DETERMINED: Moki Reservation and Little Colorado River, *Hough* 115 (US).

NEW MEXICO.—BERNALILLO CO.: 10 mi. w. of Albuquerque, *Rollins & Chambers* 2418 (G). CATRON CO.: Beaverhead, *Eggleston* 20399 (G); Mangas, *Smith* 25 (US), 19 Oct. 1897, *Metcalf* (US); Reserve, 9 July 1906, *Wooton* (G); Mogollon Mts., Gila Hot Springs, 20 Aug. 1900, *Wooton* (US); Tularosa Creek, 8.4 mi. w. of the Continental Divide on the road from Magdalena to Reserve, *Goddard* 810 (MBG). CHAVES CO.: Roswell, *Earle & Earle* 374 (MBG, NY, US); 20 mi. s. of Roswell, 20 Aug. 1900, *Earle & Earle* (NY); Arroyo Ranch near Roswell, *Griffiths* 5741 (MBG). COLFAX CO.: Raton Mts., Aug. 1867, *Bell* (MBG, PA). DONA ANA CO.: s. w. Pyramid Peak, *Fosberg* 53318 (G, MBG, US); w. of Organ Mts., 1 May 1906, *Standley* (MBG); Organ Mts., Van Patten's, 11 June 1906, *Standley* (US); Tortugas Mt., *Standley* 6445 (US); Los Cruces, *Wooton* 6 (G, MBG, NY, US); Mesilla Valley, *Wooton & Standley* 3320 (FM, MBG, NY), 1 June 1906, *Standley* (MBG), May 1906, *Wooton* (T); Mesilla Park, 23 May 1900, *Cockerell* (NY); Doñana, *Wislizenus* 82 (G, MBG); Strauss' Station, *Mearns*

¹⁸ Nuttall's spelling in the original work, "*Tagetinae*," which is grammatically incorrect, is probably a misprint. In letters to the author, Mr. C. A. Weatherby and Dr. S. F. Blake are of the opinion that the spelling "*tagetina*" should be used as was done by Torrey and Gray, loc. cit.

1525 (US); between Strauss and Anapra, *Stearns* 384 (US); Monument #40, Mexican Boundary Line, *Mearns* 253 (US). EDDY CO.: Pecos Valley near Texas line, *Bailey* 746 (US); Dark Canyon, Rocky Arroyo Road, 45 mi. n. w. of Carlsbad, *Grassel* 26 (FM); near Loving, *Standley* 40359 (US); near mouth of South Fork, Guadalupe Mts., *Wilkins* 1790 (PA). GRANT CO.: Wind Canyon, 7-8 mi. n. of Cliff, *Eggleston* 16538 (FM, MBG); near Santa Rita del Cobre, coll. of 1877, *Greene* (FM); plains of the Gila, 2 July 1880, *Greene* (PA); Fierro to Santa Rita, 27 Aug.-12 Sept. 1911, *Holzinger* (MBG, US); Mangas Springs, 18 mi. n. w. of Silver City, *Metcalfe* 124 (G, MBG, NY), and 648 (MBG, NY, US); near Pinos Altos, 26 June 1936, *Stewart* (MBG); Bear Mt., 5 mi. from Silver City, *Wolf* 2623 (G). GUADALUPE CO.: Santa Rosa, *Whitehouse* 7314 (T); 8 mi. s. of Santa Rosa, *Hubricht*, *Shoop* & *Heinze* (MBG). LINCOLN CO.: Lincoln, 31 July 1900, *Earle* & *Earle* (NY); 5 mi. w. of Lincoln, *Hitchcock*, *Rethke* & *van Raads-booven* 4276 (G). MCKINLEY CO.: Fort Defiance, *Friese* (PA); Camp #1, Rio Zuni, 24 Sept. 1851, *Woodhouse* (PA). OTERO CO.: *Archer* 7303 (NY), 7304 (NY, PA); Mescalero, 3 Aug. 1931, *Huber* (PA); Sacramento Mts., Alamo Canyon, 8-10 Oct. 1932, *Pilsbry* (PA); 4 mi. above Tularosa, *Wooton* & *Standley* 3615 (US). QUAY CO.: Nara Vista, *Fisher* 3 (US); Tucumcari, *Fisher* 30 (US). RIO ARRIBA CO.: near El Rito, *Rusby* 175½ (PA). SANTA FE CO.: Galisteo, vicinity of Santa Fe, *Arsène* & *Benedict* 15817 (PA); 10 mi. w. of Santa Fe, *Heller* & *Heller* 3739 (G, MBG, NY, US). SANDOVAL CO.: Jemez Springs, *Nelson* 11671 (G, MBG); Algodones, *Rothrock* 82 (FM). SAN MIGUEL CO.: Las Lagunitas, 14 mi. s. of Las Vegas, *Brandegge* 11794 (MBG). SIERRA CO.: Lake Valley, coll. of 1914, *Beals* (US); road from Kingston to Tierra Blanca, *Eggleston* 16323 (FM, G, NY). SOCORRO CO.: between Nogal Canyon and San Marcial, *Ferris* & *Duncan* 2348 (MBG); Magdalena, *Herrick* 651 (FM); Water Canyon, Magdalena Mts., *Herrick* & *Herrick* 108, 137 (FM). TAOS CO.: Barranca Station, 28 Aug. 1894, *Smith* (PA); near Barranca, 28 Aug. 1894, *Smith* (PA). VALENCIA CO.: Cebolla Springs, *Bailey* 1072 (US); Laguna, *Collins* 11 (PA); e. of Laguna Pueblo on Highway #66, *Nelson* & *Nelson* 2179 (MBG). COUNTY NOT DETERMINED: 66 mi. e. of Albuquerque, 14 July 1943, *Huffman* (NY). NO LOCALITY GIVEN: *Fendler* 461 (FM, G, MBG, NY, PA, US).

TEXAS.—BREWSTER CO.: Panther Springs, *Marsh* 79 (FM); Chisos Mts., *Mueller* 8231 (G, MBG, NY, T), 22-24 Nov. 1922, *Pilsbry* (PA); Willow Creek and Green Gulch Canyons, *Sperry* 250 (US); Lower Green Gulch, *Warnock* 1232 (G); Mesa de Anguila, *Warnock* 726 (US), 13 Aug. 1915, *Young* (MBG, T); Rock Spring Canyon, 24 Aug. 1915, *Young* (T); banks of Rio Grande in Grand Canyon near Castellan, *Palmer* 34216 (NY). CONCHO CO.: Rio Concho, *Thurber* 76 (G, NY). CULBERSON CO.: 9 mi. e. of Van Horn, *Waterfall* 4149 (G); 40 mi. n. e. of Van Horn, *Waterfall* 5008 (G); 1.5 mi. e. of Daughtery, *Waterfall* 5181 (G); Guadalupe Mts., *Bailey* 701 (US), 15 Aug. 1916, *Young* (T), 28 Aug. 1916 (MBG); Pine Springs, *Cory* 17611 (G); Miller Brothers Ranch, *Cory* 2695 (G). EL PASO CO.: coll. of 1858, El Paso, *Dieffen-derfer* (PA), *Fisher* 173 (MBG), *Rose* 1193 (G, US); w. of El Paso, 15 June 1891, *Dewey* (US); n. of El Paso, *Ferris* & *Duncan* 2380 (MBG); 1.5 mi. s. of Newman, *Waterfall* 3940 (G); along Highway #62, between El Paso and Hueco, 6-16 mi. e. of El Paso, *Waterfall* 3888 (G); in Hueco Mts., near Highway #62, *Waterfall* 3928 (G). HUDSPETH CO.: 2 mi. w. of Salt Flats, *Waterfall* 3846 (G); vicinity of Ft. Quitman, *Waterfall* 3994 (G); 3 mi. e. of Sierra Blanca, *Waterfall* 4017 (G); 4 mi. w. of Sierra Blanca, *Ferris* & *Duncan* 2488 (MBG, NY); Ft. Hancock, 23 June 1891, *Evans* (MBG). JEFF DAVIS CO.: near Ft. Davis, *Palmer* 32083 (MBG, PA, T); Ft. Davis, *Blake* (NY); Davis Mts., near Rockpile Ranch, 21 Aug. 1940, *Hinckley* (G). MAVERICK CO.: Eagle Pass, 10 Nov. 1893, *Plank* (NY). MITCHELL CO.: *Goldstein* (PA). PRESIDIO CO.: Marfa, *Eggleston* 17285 (G, NY), *Hinckley* 652 (FM, T); near Marfa, *Drushel* 10499 (PA). REEVES CO.: vicinity of Pecos, *Gillespie* 5263 (G, US). WARD CO.: Barstow, *Earle* & *Tracy* 42 (NY), *Tracy* 8164 (NY, T, US), *Earle* 643 (NY); Pyote, 19 May 1900, *Williams* (US). COUNTY NOT DETERMINED: road between El Paso and Hueco, N. Mex., *Mulford* 111 (MBG, NY); Comanche Plains, 2 Sept. 1853, *Bigelow* (US); along Rio Grande, *Hayes* 469 (FM, NY).

MEXICO.—CHIHUAHUA: Ciudad Juarez, *Pringle* 9954 (G, MBG, NY, US); valley around Juarez, 1912, *Stearns* (MBG); foothills of the Sierra Madre, near Colonia Juarez, *Nelson* 6319 (G, US); Colonia Diaz, *Nelson* 6441 (G, US); Chihuahua, *Le Sueur* 54 (FM, G, T); near Laguna de Guzman, *Hartman* 726 (G); Casas Grandes, *Hartman* 807 (FM, G, NY, PA, US); near Casas Grandes, *Townsend & Barber* 364 (MBG, NY, US); 1 mi. e. of Pozo de Villa on Coahuila boundary, *Johnston* 8183 (G); Sierra San Carlos, *Johnston & Muller* 67 (G); Cañon del Rayo, Sierra del Diablo, *Stewart* 884 (G); 4 km. n. of Fierro, Sierra de Encinillas, *Stewart* 801 (G).

COAHUILA: Muzquiz, 20 mi. n. w. of Hacienda La Babia, *Wynd & Mueller* 432 (G, MBG, NY, US); Municipio de Cuatro Cinegas, Rancho Falcon, Cuesta del Dulce, about 12 mi. w. of Hacienda Berrendo, *Wynd* 723 (G); near Otto, 6 Sept. 1906, *Johnson* (US); base of Picacho del Fuste, *Johnston* 8437 (G); Sierra de las Cruces, Santa Elena Mines, *Johnston & Muller* 1382 (G); n. e. from Tanque Armendais, *Johnston & Muller* 760 (G); Del Carmen Mts., *Marsh* 901 (FM, G); Sierra de Santa Rosa, *Marsh* 1233, 1340, 1522 (G); Sierra del Carmen, *Stewart* 1572 (G); 3 km. s. of El Tule, *Stewart* 544 (G); 2 km. n. of Agritos, *Stewart* 1273 (G); western base of Sierra de los Guajes, 4 km. e. of Rancho Buena Vista, *Stewart* 1485 (G); 8 km. n. w. of Santa Elena, *Stewart* 2161 (G).

STATE NOT DETERMINED: chiefly in the Valley of the Rio Grande below Doñana, *Mexican Boundary Survey* 628 in part (NY, US); near Olla, near the banks of the Rio Grande, *Wislizenus* 36 (MBG); Long's Expedition, *James* (G).

4a. *Psilostrophe tagetina* var. *lanata* A. Nels. in Proc. Biol. Soc. Wash. 16:22. 1903.

P. lanata Anon. in Proc. Biol. Soc. Wash. 16:186 (Index). 1903; Rydb. in Britt. N. Am. Fl. 34:8. 1914.

Densely villous on the caudex, stems generally long-villous, gray, thick, occasionally twisted, mostly 40 cm. high; basal leaves spatulate, frequently lobed, long-villous, 5–15 cm. long; upper leaves linear-oblongate to spatulate, occasionally lobed, 1–7 cm. long; peduncles mostly 1.0–3.0 cm. long; involucre 6–7 mm. long, 3–4 mm. wide; ligules 3–5, 6–12 mm. long; squamellae lance-elliptic to oblong, rarely lanceolate, acute to obtuse; otherwise as in the species.

Distribution: western Texas to southern Utah into northern Mexico.

NEW MEXICO.—EDDY CO.: Guadalupe Mts., South Fork, *Wilkins* 1738 (PA). OTERO CO.: Hueco, 23 Aug. 1911, *Barlow* (FM); no locality given, 7 April–24 May 1902, *Rehn & Viereck* (PA), 21–28 May, *Viereck* (PA). SOCORRO CO.: Magdalena, *Herrick* 643 (US).

TEXAS.—BREWSTER CO.: Boquillas, *Hanson* 608 (MBG, US), and 650 (US); Santa Helena Canyon, Rio Grande, *Innes & Warnock* 501 (G); between Marathon and Persimmon Gap, *McKelvey* 1974 (G), and 1980 (G, US); e. of Chisos Mts., *Sperry* 1709 (G). CULBERSON CO.: Kent, *Tracy & Earle* 42 (G, NY, T, US). EL PASO CO.: *Jones* 3718 (NY, PA, US), *Meebold* 22544 (NY), and coll. of 1881, *Vasey* (G); Fort Bliss, 30 April 1915, *Carlson* (G, NY). HUDSPETH CO.: Sierra Blanca, *Jones* 25943 (MBG).

UTAH.—SAN JUAN CO.: 10 mi. s. of Moab, 4 July 1942, *Huffman* (NY).

MEXICO.—CHIHUAHUA: Valley of the Rio Grande, Paso del Norte, *Pringle* 71 (G, NY, PA, US); hills near Chihuahua, *Pringle* 71½ (MBG, NY); vicinity of Chihuahua, *Palmer* 164 (FM, G, MBG, NY, US); Santa Eulalia, 18 Aug. 1885, *Wilkinson* (US).

COAHUILA: Sierra Mojada Mts., *Jones* 285 (US).

STATE NOT DETERMINED: Valley of the Rio Grande below Doñana, *Mexican Boundary Survey* 629 (US CO-TYPE).

4b. *Psilostrophe tagetina* var. *grandiflora* (Rydb.) Heiser, n. comb.
P. grandiflora Rydb. in Britt. N. Am. Fl. 34:8. 1914, in part.

P. sparsiflora Blake in Kearney & Peebles, U. S. Dept. Agr. Misc. Pub. No. 423, p. 970. 1942, in part.

Stems green, lightly villous, 25 cm. or taller; lower leaves spatulate, generally entire, lightly villous, 3–6 cm. long; upper leaves linear to spatulate, 1–5 cm. long, entire, green; peduncles slender, 1–4 cm. long; involucre 6 mm. long, 3–4 mm. wide; ligules broad, 7–12 mm. long; squamellae lance-elliptic to lance-oblong, obtuse, rarely acutish, $\frac{1}{2}$ or less the length of the disk-corolla; otherwise as in the species.

Distribution: with the species in southeastern Arizona and southwestern New Mexico.

ARIZONA.—COCHISE CO.: Chiricahua Mts., near Cedar Gulch, Paradise, *Blumer 1709* (G, MBG TYPE COLLECTION), and *88* (US); Silver Creek, about Portal, *Eggleston 10945* (G, US); Apache Pass, Sept. 1881, *Lemmon Herbarium* (FM); Fort Bowie, 3–30 Nov. 1906, *Pilsbry* (PA).

NEW MEXICO.—GRANT CO.: Apache Tejo, *Mulford 941* (MBG, NY). HIDALGO CO.: e. side of San Luis Mts., *Mearns 2186* (NY); Animas Creek, *Metcalf 1144* (G, NY, US). SOCORRO CO.: Socorro, May 1881, *Vasey* (US).

5. *Psilostrophe villosa* Rydb. in Britton, Man. 1006. 1901; Britt. & Brown, Ill. Fl. ed. 2, 3:504. 1913; Small, Fl. Southeastern U. S. ed. 2, 1372. 1913; Rydb. in Britt. N. Am. Fl. 34:7. 1914; Rydb. Fl. Prair. & Plains, 852. 1932; Stemen & Meyers, Okla. Fl. 594. 1937.

P. cerifera A. Nels. in Proc. Biol. Soc. Wash. 16:21. 1903.

P. cerifera var. *biennis* A. Nels. loc. cit.

P. biennis Anon. in Proc. Biol. Soc. Wash. 16:186 (Index). 1903.

A biennial or perennial; stems loosely to densely long-villous, 10–60 cm. high; basal leaves spatulate to oblanceolate, entire, or some 3–5-lobed, short-petioled, 5–10 cm. long; upper leaves smaller and sessile, rarely lobed; heads several in a small congested corymb, on peduncles less than 0.5 cm. long, or subsessile; involucre densely woolly, 5 mm. long, 3 mm. wide; ligules 3–4, 3–5 mm. long, 3-lobed about half of their length or sometimes 4-lobed; disk-flowers 5–12, usually 6–8; achenes glabrous or essentially so; squamellae linear-lanceolate, acute, $\frac{1}{2}$ or over the length of the disk-corolla.

Distribution: southern Kansas to Texas and eastern New Mexico. Altitude: 500–5000 ft.

KANSAS.—BARBER CO.: *Hitchcock 741* (G, MBG, NY, US). CLARK CO.: near Sitka, *Palmer 41863* (MBG); on Cimarron, 8 mi. s. of Sitka, *Rydberg & Imler 1120* (NY). COMANCHE CO.: 8 mi. w. of Coldwater, *Rydberg & Imler 716* (MBG, NY). MEADE CO.: Meade, July 1892, *Hitchcock* (MBG), 26 June 1888, *Kellerman* (MBG, NY, PA, US); 7 mi. w. of Meade, *Rydberg & Imler 796a* (NY); near Crooked Creek, *Smyth 140* (NY).

NEW MEXICO.—COUNTY NOT DETERMINED: Upper Canadian, April 1848, *Gordon* (MBG); no locality given, *Heary* (PA), *Wright 1259* (G, NY, PA).

OKLAHOMA.—CUSTER CO.: 2 mi. w. of Weatherford, *Hubricht, Shoop & Heinze B1389* (MBG); 1 mi. w. and 1 mi. s. of Weatherford, *Waterfall 5511* (G); Weatherford, 18 May 1937, *Waterfall* (NY). ELLIS CO.: near Shattuck, *Clifton 3200* (G). HARMON CO.: near Hollis, *Stevens 1052* (G). HARPER CO.: near Horbick's, *Stevens 258½* (G). MAJOR CO.: near Waynoka, *Stevens 593* (G); Glass Mts., *White 141* (MBG, NY), and

164 (MBG). WASHITA CO.: near Rocky, *Stevens* 973 (G). WOODS CO.: near Fairvalley, *Stevens* 715 (G, MBG, NY, US), and 1637 (G).

TEXAS.—BAILEY CO.: Coyote Lake, *Ferris & Duncan* 3459 (MBG); 1 mi. n. w. of Muleshoe, *Cory* 37520 (G). BAYLOR CO.: Seymour, *Reverchon* 505 in part (MBG, US). BREWSTER CO.: Marathon, 14 June 1931, *Tharph* 286 (MBG, NY, T). BRISCOE CO.: Quitaque, 29 April 1934, *Tharph* (NY, T); Floyds Crossing, Tule Creek, *Reed & Demaree* 7636 (US). CALDWELL CO.: Clear Fork, 10 May 1858, *Hayes* (NY). CHILDRESS CO.: 11 mi. n. of Childress, *Innes & Moon* 1004 (G). COKE CO.: 1.5 mi. s. w. of Silver, *Cory* 5322 (G); Fort Chadbourne, 1856, *Swift* (PA). DALLAM CO.: 6 mi. w. of Dallam, *van Gorder* 49 (T). DAWSON CO.: 8 mi. n. of Lamesa, *Innes & Moon* 1061 (G). DONLEY CO.: 5¼ mi. n. w. of Memphis, *Cory* 13478 (G). FISHER CO.: Rotan, April and May 1933, *Brookes* (T). FLOYD CO.: Quitaque-Plainview Road, *Ferris & Duncan* 3371 (MBG). GARZA CO.: near the "Cap Rock", *Ruth* 1283 (US). HALL CO.: Estelline, 8 and 9 July 1903, and 23 May 1904, *Reverchon* (MBG). HEMPHILL CO.: on Canadian, 10 Aug. 1900, *Eggert* (MBG). HOWARD CO.: Big Spring[s], *Bray* 416 (T, US), *Letterman* 25 (MBG, US). HUDSPETH CO.: Salt Basin, 6 Aug. 1916, *Young* (T). HUTCHINSON CO.: July 1934, *Shepard* (T). JEFF DAVIS CO.: Davis Mts., 13 Aug. 1914, *Young* (T). LISCOMB CO.: Liscomb, *Howell* 51, 52 (US). LIVE OAK CO.: *Schulz* 38-39 (FM), 27 June 1941, *Tharph* (T). LUBBOCK CO.: Boll's Ranch, 10 mi. s. e. of Lubbock, *Demaree* 7668 (G, MBG, US); Johnson's Ranch, Lubbock, *Reed* 3408 (US); vicinity of Lubbock, *Reed* 3094 (US); Posey, *Demaree* 7572, 7773 (US). MITCHELL CO.: on Colorado, 8, 9, and 10 June 1900, *Eggert* (MBG); Colorado, *Tracy* 7875 (G, NY, T, US); Loraine, *Finley* 3 (T). NOLAN CO.: Sweetwater, 22 June 1891, *Evans* (MBG), *Palmer* 12472, 13050 (MBG); near Blackwell, *Palmer* 34573 (MBG, PA, US). POTTER CO.: Amarillo Creek, *Reverchon* 3328 (MBG). RANDALL CO.: Palo Duro Canyon, *Ball* 1222, *Cory & Ball* 1709 (US), *Reverchon* 3328A (M); Canyon [City], *Palmer* 12520 (MBG, US), 14049 (MBG), 13 Aug. 1900, *Eggert* (MBG), 5 Aug. 1903, *Reverchon* (MBG). REAGAN CO.: *Cory* 4666 (G); 15 mi. n. w. of Stiles, *Cory* 15195 (G); Best, May 1931, *Graves* (T). REEVES CO.: 3 mi. w. of Pecos, *Waterfall* 4383 (G). SAN PATRICIO CO.: 5 April 1932, *Tharph* (T). TAYLOR CO.: April 1882, *Reverchon* 505 in part (FM, US). TERRELL CO.: near Feodora, *Palmer* 33542 (NY). TERRY CO.: Brownfield, *Reed* 3799 (T). VALVERDE CO.: high bridge of the Pecos, 27-28 April 1903, *Pilsbry* (PA); Del Rio, 22-23 April 1903, *Pilsbry* (PA); near Del Rio, *Palmer* 11088 (MBG, PA, US); Devils River, *Orcutt* 6028 (MBG). WEBB CO.: Toga, 1883, *Holstein* (PA). WICHITA CO.: *Boll* 505 (FM). COUNTY NOT DETERMINED: Fort Smith to Rio Grande, Comanche Plains, *Bigelow* 2 (NY).

6. *Psilostrophe gnaphalodes* DC. Prodr. 7:261. 1838; A. Nels. in Proc. Biol. Soc. Wash. 16:20. 1903; Rydb. in Britt. N. Am. Fl. 34:7. 1914.

Riddellia arachnoidea Gray in Mem. Am. Acad. II. 4:94. 1849; Gray, Syn. Fl. N. Am. 1²:318. 1884, and ed. 2, 1886; Coulter in Contr. U. S. Nat. Herb. 2:226. 1892.

R. gnaphalioides O. Hoffm. in Bull. Herb. Boiss. 3:628. 1895.

A biennial; stems rather densely villous, 10-50 cm. high; basal leaves spatulate to oblanceolate, occasionally lobed, loosely long-villous to pannose, up to 8 cm. long and 2 cm. wide; upper leaves smaller, oblanceolate to linear; heads several in a congested corymb, on peduncles less than 0.5 cm. long to subsessile; involucre densely woolly, 5-6 mm. long, 3 mm. wide; ligules 3-4, 5-7 mm. long, slightly 3-lobed; disk-flowers 8-12; achenes and squamellae of the pappus densely long-villous; squamellae subulate to lanceolate, acute, about ½ the length of the disk-corolla.

Distribution: southern Texas to central Mexico. Altitude: 1000-7000 ft.

TEXAS.—BRAZOS CO.: College Station, 10 June 1891, *Dewey* (US). BREWSTER CO.: Stewart's, *Cory* 2688 (G); 60 mi. s. of Alpine, *Innes & Moon* 1168 (G); near Alpine, *Palmer* 30590a (MBG); Alpine, *Sperry* T346 (US), *Wiegand & Wiegand* 2597 (G); Terlingua, *Reed* 1811 (US); between Terlingua and Marathon, *Schulz* 3001 (FM); Marathon, *von Schrenk* 37, 42 (MBG); s. of Santiago Peak, *Ferris & Duncan* 2757 (MBG); Chisos Mts., *Sperry* 743 (US), 24 Aug. 1915, *Young* (T). CULBERSON CO.: Van Horn Flats, 7 and 10 July 1900, *Eggert* (MBG); 7 mi. n. of Van Horn, *Waterfall* 5125 (G); 9 mi. s. w. of Van Horn, *Waterfall* 4681 (G); s. of Eagle Mt., *Waterfall* 4437 (G). DIMMIT CO.: Carrizo Springs, *Hoaglund* 7303, 7313 (T). EL PASO CO.: e. of El Paso, 21 May 1898, *Bray* (T). HUDSPETH CO.: Indian Hot Springs, *Jones* 36415 (MBG); 6 mi. n. e. of Indian Hot Springs, *Waterfall* 4837 (G). JEFF DAVIS CO.: Limpia, 16 May 1915, *Allen* (T); 2.8 mi. n. of Fort Davis, *Cory* 17685 (G); Davis Mts., between Little and Big Aguja Canyons, *Moore & Steyermark* 3114 (G, MBG, PA, US); n. edge of Davis Mts., 5 mi. e. of Kent, *Rollins & Chambers* 2757 (G); Davis Mts., *Tracy & Earle* 208 (T, US). KENNEDY CO.: 6 Aug. 1925, *Tharp* (T). MAVERICK CO.: Eagle Pass, 25 May 1898, *Bray* (T); 10 mi. e. of Eagle Pass, 9 May 1898, *Bray* (T). MONTGOMERY CO.: Stockton, *Havard* 45 (US), and *Reverchon* 505 in part (MBG). PATRICIO CO.: 5 April 1932, *Tharp* (T). PECOS CO.: on Marathon Road, 11 mi. s. of Fort Stockton, *Cutak* 1, 2 (MBG); Stockton-Sheffield, 3 May 1940, *Tharp* (T); Fort Stockton, 3 Nov. 1913, *Wootton* (US). REEVES CO.: Balmorhea Road, *Tharp* 7311 (T). REAGAN CO.: Best, May 1931, *Groves* (T). STARR CO.: *Drushel* 6280 (MBG); Rio Grande City, *Tharp* 7315 (T). UVALDE CO.: w. of Uvalde, 26 April 1931, *Jones* (MBG). VALVERDE CO.: Langtry, 6 Sept. 1900, *Earle & Earle* (NY), *Orcutt* 6318 (MBG); Devil River, *Earle & Earle* 446 (MBG, US), *Tharp* 3886 (PA); Del Rio, *Fisher* 3219 (FM), *Jones* 25900 (MBG); Comstock, *Palmer* 11055 (MBG, PA, US). WEBB CO.: between San Ignacio and Laredo, *Clover* 1689 (T); Laredo, *Palmer* 11267, and 21 March 1903, *Reverchon* (MBG); Greene, 7 April 1901, *Eggert* (MBG). COUNTY NOT DETERMINED: Del Rio to Cotulla, 40 mi. w. of Cotulla, *Hanson* 701 (NY, US); western Texas to El Paso, *Wright* 380 (G, MBG, US); between Uvalde and Del Rio, *McKelvey* 1894 (G).

MEXICO.—CHIHUAHUA: between San Mateo and Guasarachi, *Goldman* 145 (G, NY, US); Parral, 1914, *Mathews* (MBG); Los Reyes, about 8 mi. s. of Ciudad Jimenez, *White* 2117 (G).

COAHUILA: Saltillo, *Adole* 6349 (US), *Arsène* 3446 (US), *Gregg* 318 (G, PA), *Nelson* 6716 (G, US), *Palmer* 35 (FM, G, MBG, NY, US), *Safford* 1296 (US); Buena Vista, *Gregg* 35 (G), 749 (MBG), *Wislizenus* 303 (MBG); Fraile, 59 kilo. s. of Saltillo, *Stanford*, *Retherford & Northcraft* 257 (MBG, G); road from Monclova to Saltillo, 1 mi. s. of Hipolito, *Johnston* 7238 (G); Hipolito, between Hacienda La Rosa and Hacienda Lechuguilla, *Wynd & Mueller* 59 (G, MBG, NY, US); 6 mi. s. w. of Hipolito, *Mueller* 3012 (G); Monclova, *Nelson* 6154 (G, MBG), *Palmer* 679 (G, PA, US), *Marsh* 1821 (G); Hermanas, *Marsh* 1613 (G); Muzquiz, *Marsh* 523 (FM, G, T), 1050, 1114, 1142 (G); 5 mi. n. of Allende, *Johnston* 7009 (G); De las Neuvas a la Pena, *Berlandier* 2471 (G, PA); 20 mi. w. of Gloria, *Drushel* 9687 (US); Torreon, *Juzepczuk* 683 (US); Correon, *Pittier* 507 (US); Jaral, *Pringle* 9040 (G, NY, US); Jimulco, *Pringle* 216 (G); 11 kilo. n. e. of Jimulco, *Stanford*, *Retherford & Northcraft* 31 (G, MBG); 9 kilo. s. of Parras on Sierras Negras, *Stanford*, *Retherford & Northcraft* 159 (G, MBG); 15 kilo. w. of Concepcion del Oro, *Stanford*, *Retherford & Northcraft* 550 (G, MBG).

DURANGO: near Mapimi, *Gregg* 466 (MBG); near Ojo de San Bernardo, *Gregg* 34 (G), 509 (MBG); near Pedricena, *Juzepczuk* 573 (US).

NUEVO LEON: Monterrey, *Abbon* 6426 (US); coll. of 1828, *Berlandier* (G fragment), *Palmer* 678 (FM, G, MBG, US); s. of Nuevo Laredo on road to Monterrey, *Frye & Frye* 2354 (G, MBG, NY); 17 mi. s. e. of Galeana, *Mexican Biological Expedition of Students of the University of Illinois* 1025 (FM, G, MBG, NY); Galeana, *Chase* 7644 (FM, G); Rancho Resendez, Lampazos, *Edwards* 390 (FM, MBG, T); Sabinas Hidalgo, *Kenoyer* 43 (FM, MBG); 7 mi. s. of Sabinas Hidalgo, *Mueller* 2627 (G); 15 mi. n. of Cienega de Flores, *Shreve* 9428 (G); 15 mi. w. of Icamole, *Safford* 1266a (US); 22 mi. n. w. of Ascension, *Shreve & Tinkham* 9742 (G); along highway passing through Vallecillo,

Langman 1970 (PA); Laredo-Mexico highway, *Langman 2902* (PA); Laredo-Monterrey highway, *Langman 2443* (PA).

SAN LUIS POTOSI: San Luis Potosi, *Berlandier 1336* (FM photograph of TYPE, G); Charcas, *Lundell 5169* (US); near Salado, *Shreve 9356* (G, PA).

SONORA: *Schott* (FM).

TAMAULIPAS: Jaumave, *von Rosynski 305* (NY, US), 328 (FM).

ZACATECAS: 4 mi. s. of Cardona, *Johnston 7378* (G); Caopas, *Lloyd & Kirkwood 3* (MBG, US), 150 (G); near Concepcion del Oro, *Palmer 380* (FM, G, MBG, NY, US); near Calera, *Seler 552* (G).

STATE NOT DETERMINED: Valley of the Rio Grande, below Doñana, *Mexican Boundary Survey 628* in part (US).

LIST OF EXSICCATAE

The numbers in *italics* refer to the collection number, the number in parentheses to the species or variety under which the specimen is cited. The abbreviation *s. n.* indicates that the specimen is without a collector's number.

- Abbon, J. *6426* (6).
 Abrams, L. R. *14104* (1).
 Adole, L. *6349* (6).
 Allen, T. F. *s. n.* (3).
 Allen, —. *s. n.* (6).
 Anderson, Lt. A. *s. n.* (4).
 Anderson, R. C. *7749* (1).
 Archer, W. A. *7303, 7404* (4).
 Arsène, G. *3446* (6).
 Arsène, G. & Benedict. *15817* (4).
 Bailey, V. *701, 746, 1072* (4).
 Baker, C. F. *14, 106* (2).
 Ball, C. R. *1222* (5).
 Barlow, B. *s. n.* (4a).
 Barkley, F. A. & R. Blondeau. *4186* (1).
 Bartram, E. B. *294, 295, 296* (1).
 Beals, I. M. *s. n.* (4).
 Bell, W. A. *s. n.* (4).
 Berlandier, J. L. *s. n.*, *1336, 2471* (6).
 Bigelow, J. M. *s. n.* (4); 2 (5).
 Bishop, Capt. F. *s. n.* (3).
 Blake, S. F. *s. n.* (4).
 Blumer, J. C. *88, 1709* (4b).
 Boll, J. *505* (5).
 Brandegee, K. *s. n.* (1); *11794* (4).
 Brass, L. J. *14263, 14330* (1).
 Bray, W. L. *416* (5); *s. n.* (6).
 Brookes, J. *s. n.* (5).
 Burnham, T. M. *291* (1).
 Carlson, J. I. *s. n.* (4a).
 Carter, A. *1429* (3).
 Chase, V. H. *7644* (6).
 Clifton, R. L. *3200* (5).
 Clokey, I. W. *5952, 7367, 7369, 8177* (1).
 Clokey, I. W. & R. G. Anderson. *7368, 8176* (1).
 Clover, E. U. *1689* (6).
 Clute, W. N. *24, 24a* (3).
 Cockerell, T. D. A. *s. n.* (4).
 Collins, D. W. *11* (4).
 Collom, R. E. *65, 479* (1).
 Cooper, J. W. *s. n.* (1).
 Cory, V. L. *17611, 2695* (4); *4666, 5322, 13478, 15195, 37520* (5); *2688, 17685* (6).
 Cory, V. L. & C. R. Ball. *1709* (5).
 Cottam, W. P. *6589* (3).
 Coues, E. & E. Palmer. *254* (1).
 Coville, F. V. & F. Funston. *292* (1).
 Cowen, J. H. *s. n.*, *276* (2).
 Crandall, C. S. *2995* (2).
 Creighton, H. B. *s. n.* (1).
 Cutak, L. *1, 2* (6).
 Cutler, H. C. *3135* (3).
 Darrow, R. *s. n.* (1); *s. n.* (4).
 Degener, O. *4907* (1); *4900* (3).
 Degener, O. & K. K. Park. *4411* (3).
 Demaree, D. *8031* (1); *7572, 7668, 7773* (5).
 Dewey, L. H. *s. n.* (4); *s. n.* (6).
 Dieffenderfer, F. R. *s. n.* (4).
 Drushel, J. A. *10499* (4); *6280, 9687* (6).
 Earle, F. S. *643* (4).
 Earle, F. S. & E. S. Earle. *s. n.*, *374* (4); *s. n.*, *446* (6).
 Earle, F. S. & S. M. Tracy. *42* (4).
 Eastwood, A. *3692, 5816* (3).
 Eastwood, A. & J. T. Howell. *6604* (3).
 Edwards, M. T. *390* (6).
 Eggert, H. *s. n.* (5); *s. n.* (6).
 Eggleston, W. W. *19890* (1); *17187* (3); *10650, 16323, 16538, 17285, 20399* (4); *10945* (4b).
 Evans, W. *s. n.* (4); *s. n.* (5).
 Fendler, A. *461* (4).
 Ferris, R. S. *8553* (1); *10213* (3).
 Ferris, R. S. & C. D. Duncan. *2228* (1);

- 2348, 2380, 2488 (4); 3371, 3459 (5); 2757 (6).
 Finley, I. O. 3 (5).
 Fisher, G. L. 155 (1); 3, 30, 173 (4); 3219 (6).
 Flint, W. F. s. n. (2).
 Fosberg, F. R. 53318 (4).
 Foster, R. C. 509 (1).
 Friese, —. s. n. (4).
 Frye, T. C. & E. M. Frye. 2354 (6).
 Fulton, H. J. 7359 (3).
 Gentry, H. S. 4003 (1).
 Gillespie, J. W. 8690 (1); 5263 (4).
 Gilman, M. F. 151, 215 (1).
 Goddard, D. R. 810 (4).
 Goldman, E. A. 2893 (3); 145 (6).
 Goldstein, G. W. s. n. (4).
 Goodding, L. N. 752 (1).
 Gordon, A. s. n. (5).
 Gorder, C. van. 49 (5).
 Graham, H. W. s. n. (1).
 Grassel, C. O. 26 (4).
 Graves, H. s. n. (5).
 Gray, A. s. n. (3).
 Greene, E. L. s. n. (1); s. n. (4).
 Gregg, J. 34, 35, 318, 466, 509, 749 (6).
 Griffiths, D. 2020 (1); 5173, 5741 (4).
 Groves, H. s. n. (6).
 Hanson, H. C. s. n., A55 (3); 608, 650 (4a); 701 (6).
 Harris, J. A. C1476 (1).
 Harrison, C. H. & T. H. Kearney. 8667 (1).
 Hartman, C. V. 726, 807 (4).
 Harvey, D. R. 518 (1).
 Havard, V. 45 (6).
 Hayes, S. 469 (4); s. n. (5).
 Heary, —. s. n. (5).
 Heller, A. A. 15777 (3).
 Heller, A. A. & E. G. Heller. 3739 (4).
 Herrick, C. L. 651 (4); 643 (4a).
 Herrick, C. J. & J. Herrick. 108, 137 (4).
 Hilzinger, G. s. n. (1).
 Hinckley, L. C. s. n., 652 (4).
 Hitchcock, A. E. s. n., 51, 71 (3).
 Hitchcock, A. S. s. n. (3); s. n., 741 (5).
 Hitchcock, C. L., R. V. Rethke, & R. Van Raadshooven. 4276 (4).
 Hoaglund, P. 7303, 7313 (6).
 Holstein, G. W. s. n. (5).
 Holzinger, J. M. s. n. (4).
 Hough, W. 115 (4).
 Howell, H. A. 51, 52 (5).
 Huber, W. s. n. (4).
 Hubricht, L., C. Shoop & D. B. Heinze. s. n. (4); B1389 (5).
 Huffmann, W. T. s. n. (3); s. n. (4); s. n. (4a).
 Innes, R. R. & B. Moon. 1004, 1061 (5); 1168 (6).
 Innes, R. R. & B. H. Warnock. 501 (4a).
 James, T. P. s. n. (4).
 Johnson, F. W. s. n. (1); s. n. (4).
 Johnston, I. M. 8183, 8437 (4); 7009, 7238, 7378 (6).
 Johnston, I. M. & C. H. Muller. 67, 760, 1382 (4).
 Jones, M. E. s. n., 3891, 25940 (1); 5474, 5296 in part (2); 4038, 5291i, 6050a, 5296 in part, 5696e (3); 285, 3718, 25943 (4a); s. n., 25900, 36415 (6).
 Juzepczuk, S. 573, 683 (6).
 Kearney, T. H. & R. H. Peebles. 12741 (3).
 Keck, D. D. 4147 (1).
 Kellerman, W. A. s. n. (5).
 Kennedy, P. B. 1127 (1).
 Kenoyer, L. A. 43 (6).
 Knowlton, F. H. 182, 272 (3).
 Langman, I. K. 1970, 2443, 2902 (6).
 La Rivers, I. & N. F. Hancock. 294 (1).
 Leiberg, J. B. 5624 (3).
 Lemmon Herb. 46 (1); s. n. (4b).
 Le Sueur, H. 54 (4).
 Letterman, G. W. 25 (5).
 Lloyd, F. E. & J. E. Kirkwood. 3, 150 (6).
 Long, H. C. s. n. (2).
 Lundell, C. L. 5169 (6).
 MacDougal, D. T. 229 (3).
 McKelvey, S. D. 4454 (3); 1974, 1980 (4a); 1894 (6).
 Maguire, B. & H. L. Blood. 4498 (1).
 Maguire, B., R. Maguire & H. L. Maguire. 5060, 5061 (1).
 Marsh, C. C. s. n. (3).
 Marsh, E. G. 79, 901, 1233, 1340, 1522 (4); 523, 1050, 1114, 1142, 1613, 1821 (6).
 Mathews, E. O. s. n. (6).
 Mearns, E. A. 253, 1525 (4); 2186 (4b).
 Meebold, —. 22544 (4a).
 Metcalfe, J. K. s. n. (4).
 Metcalfe, O. B. 124, 648 (4); 1144 (4b).
 Mexican Biological Expedition of Students of the University of Illinois. 1025 (6).
 Mexican Boundary survey. 628 in part (4); 629 (4a); 628 in part (6).
 Moore, J. A. & J. A. Steyermark. 3114 (6).
 Mueller, C. H. 8231 (4); 2627, 3012 (6).
 Mulford, I. A. 111 (4); 941 (4b).
 Munz, P. A. 13897 (1).

- Nelson, A. 6319, 6441, 11671 (4); 6154, 6716 (6).
 Nelson, A. & R. A. Nelson. 1519, 1535 (1); 2179 (4).
 Orcutt, C. R. 6028 (5); 6318 (6).
 Osterhout, G. E. 2127 (2).
 Palmer, E. 140, 246, 538 (1); 246½ (3); 164 (4a); 35, 380, 678, 679 (6).
 Palmer, E. J. 32083, 34216 (4); 11088, 12472, 12520, 13050, 14040, 33542, 34573, 41863 (5); 11055, 11267, 30590A (6).
 Parish, W. F. 111 (1).
 Parish, S. B. 10264, 10285 (1).
 Parry, C. C. s. n. (3).
 Payson, E. 658 (2).
 Peebles, R. H. 9539, 13332 (3).
 Peebles, R. H., G. H. Harrison & T. H. Kearney. s. n., 1279 (1).
 Pilsbry, H. A. s. n. (3); s. n. (4); s. n. (4b); s. n. (5).
 Pittier, H. 507 (6).
 Plank, E. N. s. n. (4).
 Pringle, C. G. s. n., 9845, 13755 (1); 9954 (4); 71, 71½ (4a); 216, 9040 (6).
 Purpus, C. A. 6125 (1); 183 (2); s. n. (3).
 Reed, E. L. 3094, 3408, 3799 (5); 1811 (6).
 Reed, E. L. & D. Demaree. 7636 (5).
 Rehn, J. A. G. & H. L. Viereck. s. n. (4a).
 Reverchon, J. s. n., 505 in part, 3328, 3328A (5); s. n., 505 in part (6).
 Rollins, R. C. 1578, 1970, 2141, 2155 (2).
 Rollins, R. C. & T. S. Chambers. 2440 (3); 2418 (4); 2757 (6).
 Rose, J. N. 1193 (4).
 Rose, L. S. 40083 (1).
 Rosynski, H. W. von. 305, 328 (6).
 Rothrock, J. T. 82, 463 (4).
 Rusby, H. H. 657, 4734 (3); 175½ (4).
 Ruth, A. 1283 (5).
 Rydberg, P. A. & R. Imler. 716, 796a, 1120 (5).
 Safford, W. E. 1266a, 1296 (6).
 Saunders, D. 405 (2).
 Schott, A. 111 91 (1); s. n. (6).
 Schulz, —. 38-39 (5); 3001 (6).
 Schrenk, H. von. 37, 42 (6).
 Seler, E. 552 (6).
 Shepard, M. s. n. (5).
 Sherff, E. E. s. n. (1).
 Shreve, F. 9356, 9428 (6).
 Shreve, F. & E. R. Tinkham. 9742 (6).
 Siler, A. S. s. n. (3).
 Smith, B. H. s. n. (4).
 Smith, J. G. 25 (4).
 Smyth, B. B. 140 (5).
 Sperry, O. E. 250 (4); 1709 (4a); T346, 743 (6).
 Standley, P. C. s. n., 6445, 40359 (4).
 Stanford, L. R., K. L. Retherford & R. D. Northcraft. 31, 159, 257, 550 (6).
 Stearns, E. s. n., 384 (4).
 Stevens, G. W. 258½, 593, 715, 973, 1052, 1637 (5).
 Stewart, R. M. s. n., 544, 801, 884, 1273, 1485, 1572, 2161 (2).
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