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## A REVISION OF THE GENUS *TOWNSENDIA*<sup>1</sup>

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### HISTORY OF THE GENUS

The genus *Townsendia* was first described by William Jackson Hooker in his 'Flora Boreali-Americana' in 1834.<sup>2</sup> It was named in honor of David Townsend of Pennsylvania, an ardent student of botany who contributed substantially to our knowledge of the flora of his native state and especially to the genus *Aster*. Hooker, in establishing the genus *Townsendia*, recognized only one species, *Townsendia sericea*, which he described in detail and carefully illustrated.

Thomas Nuttall,<sup>3</sup> in 1841, added four new species to the genus, namely, *Townsendia incana*, *T. spathulata*, *T. strigosa*, and *T. grandiflora*. The material from which Nuttall described these species was collected by him "on the Black Hills (or eastern chain of the Rocky Mountains) near the banks of the Platte." During the next four decades *T. Parryi* Eaton,<sup>4</sup> *T. condensata* Parry,<sup>5</sup>

<sup>1</sup> An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfilment of the requirements for the degree of Master of Science in the Henry Shaw School of Botany of Washington University.

<sup>2</sup> Hook. Fl. Bor. Am. 2: 16. 1834.

<sup>3</sup> Nutt. Trans. Am. Phil. Soc. N. S. 7: 304. 1841.

<sup>4</sup> Eaton, Am. Nat. 8: 212. 1874.

<sup>5</sup> Parry, Am. Nat. 8: 213. 1874.

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*T. scapigera* Eaton,<sup>6</sup> *T. Rothrockii* Gray,<sup>7</sup> and *T. Wilcoxiana* Wood<sup>8</sup> were described by individual workers, thus making a total of ten known species. In 1880 Dr. Asa Gray<sup>9</sup> published a synopsis of the group to which he added the following species as new: *T. florifer*, *T. Watsoni*, *T. arizonica*, and *T. glabella*. This synopsis formed the basis for Gray's<sup>10</sup> treatment of the group in the 'Synoptical Flora of North America,' in which seventeen species and four varieties of *Townsendia* were recognized. Since 1886 several species have been published and included in the various manuals treating the flora of portions of the western United States; but no revision of the group as a whole has appeared since Dr. Gray's excellent treatment in the 'Synoptical Flora of North America.'

In 1894 Professor Thomas C. Porter revived Richardson's specific name *exscapus* and created the binomial *Townsendia exscapa* (Richards.) Porter,<sup>11</sup> a name which has been current in botanical literature during the last thirty years.

Through the courtesy of Dr. A. W. Hill, Director of the Royal Botanic Gardens, Kew, England, the writer has been privileged to examine portions of the original material on which the genus *Townsendia* was founded. A critical examination of this material shows that the genus was based on two specifically distinct elements, namely, specimens collected by Dr. John Richardson at "Carlton House upon the Saskatchewan," a plant described in 1823 in "Franklin's Journey to the Polar Sea" as *Aster exscapus* Richards,<sup>12</sup> and specimens collected in the "Rocky Mountains" by Thomas Drummond. These two plants differ in the following important details: Richardson's specimen has pubescent, linear-lanceolate flat leaves, which overtop the heads, and the pappus of the ray-flower equals that of the disk-flower; Drummond's specimen has more densely sericeous-pubescent subterete leaves equalling but rarely exceeding the head, and the

<sup>6</sup> Eaton, Bot. King's Exp. 145. 1871.

<sup>7</sup> Gray, Wheeler Rept. 6: 148. 1878.

<sup>8</sup> Wood, Bull. Torr. Bot. Club 6: 163. 1875.

<sup>9</sup> Gray, Proc. Am. Acad. 16: 82. 1880.

<sup>10</sup> Gray, Syn. Fl. N. Am., ed. 2, 1<sup>2</sup>: 166. 1886 and 1888.

<sup>11</sup> Porter, Mem. Torr. Bot. Club. 5: 321. 1894.

<sup>12</sup> Richards. Frankl. Jour. Bot. App. 7, 748. 1823.



pappus of the ray-flower is much shorter than that of the disk-flower. The specimens collected by Drummond accord in every detail with the description and illustration in Hooker's 'Flora Boreali-Americana,' while those collected by Richardson present several discrepancies when compared with Hooker's description and illustration, particularly in the character of the leaf, pubescence and pappus. Hence the Drummond plant is interpreted as the type of *Townsendia sericea* Hooker, and this species therefore must be taken as the type or standard species of the genus *Townsendia*. The Richardson plant, on the other hand, becomes the type of *Townsendia exscapa* (Richards.) Porter.

#### GENERAL MORPHOLOGY

*Roots.*—Most members of the genus *Townsendia* develop rather slender tap-roots. The roots of some of the more caespitose species, however, become very coarse and woody and more or less branched. The slender tap-root with a simple unbranched crown is typical of the genus.

*Stems.*—The stem presents considerable variation in length and in the extent to which it becomes branched. *Townsendia Parryi* and *T. formosa* have simple, erect, scapiform stems, while *T. grandiflora*, *T. texensis*, and *T. strigosa* have numerous ascending branched stems. The stem is usually herbaceous throughout its entire length, but in some species, particularly those of xerophytic regions, the basal portion becomes distinctly ligneous.

*Leaves.*—The leaf outline varies from linear-lanceolate to obovate-spathulate. In *T. Watsoni* and *T. Parryi* both types are present, the stem-leaves being linear-lanceolate and the basal leaves obovate-spathulate. The broader leaves are attenuated at the base into a petiole, while the narrower ones are only obscurely petiolate or sessile. The range in the leaf size is from 0.5 to 6 cm. in length and from 0.2 to 1.0 cm. in width. Entire leaf margins prevail throughout the genus. The surface is usually pubescent, but sometimes it is glabrate, as in *T. glabella*. In *T. spathulata*, on the other hand, the leaves are villose-lanate. However, a strigose pubescence of closely appressed hairs as in *T. eximia* and *T. strigosa* is most prevalent in the genus.



*Inflorescence*.—The heads resemble those of the closely related genus *Aster*. They are usually solitary and terminal and may be borne on naked scapes or peduncles, or in the acaulescent forms sessile among the rosulate leaves. In the branched species the heads are occasionally disposed in clusters of two or three, but the solitary condition is most characteristic.

*Involucre*.—The involucre is broadly campanulate and is composed of two to six series of imbricated bracts. The outline of the bract within the genus is quite variable, ranging from linear-lanceolate to obovate, and from obtuse to acute or acuminate at the apex. A lacerate-ciliate margin prevails throughout the genus. Furthermore, in most species the involucre bracts also have a membranaceous margin. The character of the terminal portion of the bract is important in the natural grouping of species.

*Pappus*.—The plurisetose pappus consists of a single row of rather coarse, slightly flattened bristles. The pappus of the ray-flower is somewhat shorter, or often reduced to a crown of short squamellae. The pappus in *T. formosa* in both ray- and disk-flowers is scarcely more than a vestige of the squamellate crown. *Townsendia eximia* develops a coroniform pappus of coalescent rigid squamellae sometimes bearing two or more prolonged awns. The condition in *T. eximia* is analogous to that of *T. glabella* where the short ray-pappus contains a few elongated setae. The character of the pappus in some species is very constant, while in others it is exceedingly variable.

Intermediate stages in the length of the ray-pappus from a crown of short setae to a condition in which the setae equal those of the disk-flower in length may be found in *T. incana* and *T. florifer*. The variability in the length of the pappus in certain species, particularly in *T. sericea*, has been emphasized by Gray, Meehan,<sup>1</sup> and others. It is evident that the length of the ray-pappus alone cannot be used in the differentiation of species.

Plate 5.

*Corolla and Stamens*.—The corolla of the disk-flower equals the involucre in length while the ray is twice as long. The color of the ray varies within the genus from white through pink to

<sup>1</sup> Meehan, Nat. Flowers II. 1: 189. 1880.



purple but is never yellow. In both ray- and disk-flowers the corolla is deciduous. The stamens are typical of the aster group.

*Pistil.*—The style appendages are lanceolate and have well-developed stigmatic surfaces in both ray- and disk-flowers. Nuttall referred to the ray-flowers of *T. strigosa* and *T. grandiflora* as "infertile or neuter." A ray-flower from Nuttall's type of *T. strigosa* was found to have stigmatic surfaces exactly like those of the disk-flowers, and the ovary contained a well-developed ovule. Flowers were examined from all recorded species, and in all cases the ray-flowers were found to be fertile. Moreover, in those specimens which had reached maturity the ray-achenes were well developed and appeared to be viable.

*Achenes.*—The achenes are ovate or oblong, much compressed, and calloused margined, although those of the ray are sometimes triangular. The hairs on the achene are bidentate or glochidiate-tipped. These two types have the same morphological origin, the bidentate forms being merely a forerunner of the glochidiate type. The nature of these hairs is best seen under the low power of the compound microscope. The type of pubescence is fairly constant within the species and is important in the classification of the group.

#### GEOGRAPHICAL DISTRIBUTION

The genus *Townsendia* is restricted in its distribution to the western half of the North American continent. It extends from western Manitoba and southern Alberta west to the Cascade Mountains in Washington and Oregon, southward to the state of Hidalgo in Mexico. *T. mexicana* is endemic to Mexico. The only other representative of the group occurring in that country is *T. strigosa*, a closely related species which extends from Wyoming and Colorado through New Mexico and Arizona into adjacent Mexico. The genus is best represented in Colorado where ten out of the nineteen species recognized in this paper are found. Material at hand would indicate that three of these are endemic to that state. So far as known, *T. leptotes* occurs only in the Middle and South Park Region, *T. glabella* in southwestern Colorado, while *T. Rothrockii* extends from the north-central part of the state to the Uncompahgre Mountains. Two other species







which seem to be restricted to rather local areas are *T. formosa* of southwestern New Mexico and adjacent Arizona and *T. texensis* of northwestern Texas. The difference between the mountain species *T. sericea* and the plains species *T. exscapa* is very well brought out by material collected in Colorado. The latter has by far the largest distribution of any member of the genus. It extends from western Manitoba and eastern Alberta south through the plains region into Texas, New Mexico, Arizona, and southwestern Colorado. *T. sericea* is found in the Rocky Mountains from Alberta to Colorado and in the Black Hills of South Dakota. Another species which has discontinuous distribution is *T. scapigera* which extends from the Uintah Mountains of Utah to northeastern California and is also found in the region of Santa Fe, New Mexico.

#### ACKNOWLEDGMENTS

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#### ABBREVIATIONS

The specimens cited in this paper are deposited in various herbaria which are indicated by the following abbreviations:

C = National Herbarium of the Victoria Memorial Museum, Ottawa, Canada; F = Herbarium of the Field Museum of Natural History; G = Gray Herbarium of Harvard University; Kew = Royal Botanic Gardens, Kew, England; M = Missouri Botanical Garden Herbarium; NY = New York Botanical Garden Herbarium; Pomona = Herbarium of Pomona College;



Phil = Herbarium of the Academy of Natural Sciences of Philadelphia; R = Rocky Mountain Herbarium; US = United States National Herbarium.

#### TAXONOMY

*Townsendia* Hook. Fl. Bor. Am. 2: 16. 1834; DC. Prodr. 7: 273. 1838; Nutt. Trans. Am. Phil. Soc. N. S. 7: 304. 1841; Torr. & Gray, Fl. N. Am. 2: 185. 1842; Benth. & Hook. Gen. Pl. 2: 268. 1873; Gray, Proc. Am. Acad. 16: 82. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 166. 1884, and ed. 2, 166. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 156. 1885; Engl. & Prantl, Nat. Pflanzenfam. 4<sup>5</sup>: 161. 1890; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 507. 1909; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 691. 1915; Rydb. Fl. Rocky Mts. 873. 1917, and ed. 2, 873. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 553. 1925.

Herbaceous, caulescent or acaulescent, glabrate or pubescent perennials. Leaves alternate, sessile or petioled, linear-lanceolate to obovate-spathulate, entire. Involucre of many imbricated, appressed, lanceolate bracts, usually with lacerate-ciliate membranaceous margins. Heads many-flowered. Ray-flowers numerous, in a single series, pistillate, fertile, rays linear, 2-5-dentate. Disk-flowers tubular, 5-lobed, perfect. Branches of the style lanceolate, acutish, hairy toward the tip. Pappus uniseriate, that of the disk-flower composed of numerous, rather rigid, barbellate-scabrous bristles as long as the corolla; that of the ray-flowers similar or shorter, sometimes squamellate, with a few longer setae intermixed. Achenes of the disk compressed, obovate to oblong; those of the ray sometimes triangular, pubescent with bidentate or glochidiate-tipped hairs, sometimes glabrate.

Type species: *T. sericea* Hook. Fl. Bor. Am. 2: 16, *pl.* 119. 1834, which was based on the collection of Drummond made in the "Rocky Mountains."



## KEY TO THE SPECIES

- A. Bracts of the involucre attenuate-acuminate.
  - B. Stems erect, simple.
    - C. Pappus plurisetose.....1. *T. Parryi*
    - CC. Pappus a crown of minute squammelate setae.....2. *T. formosa*
  - BB. Stems ascending, branched.
    - D. Pappus of ray-flower coroniform-concreted; that of disk-flower similar but with two stout awns.....3. *T. eximia*
    - DD. Pappus in ray-flower a crown of short distinct squamellae; that of disk-flower plurisetose.....4. *T. grandiflora*
- AA. Bracts of the involucre acute or obtuse.
  - E. Leaves glabrous or glabrate.
    - F. Involucral bracts scarious-margined.
      - G. Pappus of ray-flower a crown of short squamellae....5. *T. texensis*
      - GG. Pappus of ray-flower plurisetose.....6. *T. glabella*
    - FF. Involucral bracts not scarious-margined.....7. *T. Rothrockii*
  - EE. Leaves persistently pubescent.
    - H. Achenes glabrous or glabrate.....8. *T. montana*
    - HH. Achenes persistently pubescent.
      - J. Hairs on achenes bidentate.
        - K. Plants cinereous with short hirsute pubescence.
          - L. Involucral bracts linear-lanceolate.
            - M. Leaves all obovate-spathulate.....9. *T. Watsoni*
            - MM. Leaves of stem mostly linear-spathulate.....10. *T. florifer*
            - LL. Involucral bracts broadly lanceolate.....11. *T. scapigera*
          - KK. Plants densely subsericeous, villous.....12. *T. spathulata*
        - JJ. Hairs on achenes glochidiate-tipped.
          - N. Plants with branched ascending stems.
            - O. Involucral bracts in two series, equal.....13. *T. mexicana*
            - OO. Involucral bracts in several series, unequal.....14. *T. strigosa*
          - NN. Plants depressed, caespitose.
            - P. Densely canescent, pubescent.
              - Q. Leaves 1.5-3 cm. long, narrowly spathulate to oblanceolate.....15. *T. incana*
              - QQ. Leaves 1-1.5 cm. long, obovate-spathulate....16. *T. arizonica*
            - PP. Sparsely hirsute pubescent.....17. *T. leptotes*
        - NNN. Plants strictly acaulescent.
          - R. Leaves narrowly oblanceolate, somewhat glabrate, distinctly flattened.....18. *T. exscapa*
          - RR. Leaves linear-lanceolate, densely pubescent, subterete.19. *T. sericea*

1. *T. Parryi* Eaton, Am. Nat. 8: 212. 1874; Gray, Proc. Am. Acad. 16: 82. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 167. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 156. 1885; Howell, Fl. Northwest Am. 306. 1897; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 508. 1909; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.



Stem erect, naked and pedunculiform above, sparingly leafy below, rarely branched, 5–35 cm. high; leaves rosulate, spatulate, often apiculate, tapering into a petiole, 2–5 cm. long, .3–.5 cm. broad; heads solitary, pedunculate or rarely sessile, 3–6 cm. in diameter including the rays; involucre 3–6-seriate; bracts lanceolate, acute, with narrow scarious margins, lacerately ciliate, inner bracts acuminate; rays twice the length of the involucre, blue; pappus the same in ray- and disk-flowers, persistent, pluri-setose, a little longer than the achene; achenes pubescent with bidentate hairs.

Distribution: Rocky Mountains from southwestern Canada to Colorado, west to eastern Oregon.

Specimens examined:

MONTANA: Teton River at the foot of the Rocky Mts., on hard, stony, gravelly plains, May 19, 1854, *Doty* 59 (M); bluffs, Midvale, July 4, 1903, *Umbach* 254 (F); bluffs, Midvale, June 24, 1903, *Umbach* 142 (F); canyon, Helena, July, 1892, *Aiton* (F, No. 90554); Helena, June, 1891, *Kelsey* (F, Nos. 397673 and 397674); Helena, June, 1892, *Starz* (M, No. 713519); mountains about Helena, *Anderson* (M); near Butte, alt. 1846 m., July, 1893, *Mrs. C. H. Moore* (M); rocky canyon, dry ground, Bozeman and vicinity, June 15, 1905, *Blankinship* 301 (F); Gallatin Co., May, 1888, *Tweedy* 228 (F); mountain meadows, alt. 1537 m., Bozeman, June 1, Livingston, June 8, 1906, *Blankinship* 301a (F, M, R); on a clayey gravelly slope in the foothills ten miles east of Monida, Madison Co., June 18, 1899, *A. & E. Nelson* 5425 (M, R); Bridger Mts., June 11, 1897, *Rydberg & Bessey* 5132 (F, R); Belt Mts., July 17, 1886, *Anderson* (F, No. 360840); Little Belt Pass, alt. 2154 m., Aug. 10, 1896, *Flodman* 828 (M); 1888, *Kelsey* (M, No. 783933); July, 1894, *Mrs. Moore* (M).

YELLOWSTONE NATIONAL PARK: Electric Peak, alt. 2923 m., July 26, 1902, *Smith* 16 (F); Mt. Washburn, July 20, 1902, *Smith* (F, No. 121846); Mammoth Hot Springs, June 15, 1902, *Mearns* (F, No. 121848); subalpine, alt. 2923 m., Aug., 1884, *Tweedy* (F, No. 211406); Swan Lake, alt. 2308 m., June, 1885, *Tweedy* 695 (F); rocky hills near Mammoth Hot Springs, alt. 1846 m., July, 1893, *Burglehaus* (M); Mt. Washburn, July, 1912, *Eikenberry* 59 (F).



WYOMING: Wind River Mts., alt. 2764 m., 1873, *Parry 144* (F, M, *co-type*); Gros Ventres Fork, alt. 2000 m., June 10, 1860, *Hayden* (M); slopes at timber-line, Wyoming Range, 15 miles west of Merna, Sublette Co., July 18, 1922, *E. & L. Payson 2762* (M, R); sage-brush slopes 20 miles west of Big Piney, Sublette Co., July 10, 1922, *E. & L. Payson 2632* (M, R); Gros Ventres Fork, alt. 2400 m., June 5, 1860, *Hayden* (M); in the vicinity of Green River Lakes, Sublette Co., alt. 300 m., Aug. 11, 1925, *E. & L. Payson 4642* (R).

COLORADO: dry ridge near Cottonwood Lake, east of Smoot, Lincoln Co., alt. 3169 m., Aug. 2, 1923, *E. & L. Payson 3693* (M).

IDAHO: dry hillside south of Henry Lake, Fremont Co., alt. 1846 m., July 15, 1920, *E. & L. Payson 2026* (M, R); exposed rocky slopes, base to summit of mountains northeast of Henry Lake, Fremont Co., alt. 2830 m., July 11, 1920, *E. & L. Payson 1979* (M, R).

CANADA: "Moose Mts.," Rocky Mts., alt. 2061 m., June 30, 1897, *Macoun* (F, No. 227891); Mount Forget-me-not, July 16, 1897, *Macoun* (F, No. 227661).

OREGON: subalpine ridges of the Wallowa Mts., alt. 2154 m., July 31, 1899, *Cusick 2295* (F, M, R).

2. *T. formosa* Greene, *Leaf. Bot. Obs. & Crit.* 1: 213. 1906; Wootton & Standley, *Contr. U. S. Nat. Herb.* 19: 692. 1915; Nelson in Coulter & Nelson, *Man. Cent. Rocky Mts.*, 508. 1909.

*T. pinetorum* Greene acc. to Nelson in Coulter & Nelson, *Man. Cent. Rocky Mts.*, 508. 1909, in synonymy.

An herbaceous perennial, spreading by short, stout stolons, the sterile ones ending in a rosette of leaves, the others in a stout upright monocephalous stem about 25 cm. in height; stem striate, sparsely pubescent; leaves thin, glabrous except at the callose-ciliate margin, basal leaves obovate-spathulate, 1.5–4 cm. long, .5–1.5 cm. broad, very obtuse, narrowed below into a sessile or subpetiolate base, those of stem oblong-spathulate, sessile, gradually reduced towards the inflorescence; heads large, 4–6 cm. in diameter including the rays; involucre 2–3-seriate; bracts with broad membranaceous margins, minutely lacerate-ciliate, those



of the outer series broadly ovate, those of the inner series linear-lanceolate, distinctly attenuate-acuminate; achenes glabrous.

Plate 2; pl. 5, fig. 19-24.

Distribution: known only from southwestern New Mexico and adjacent Arizona.

Specimens examined:

NEW MEXICO: Mogollon Mountains on or near the west fork of the Gila River, Socorro County, alt. 2615 m., Aug. 8, 1903, *Metcalf* 413 (M, R); around the south end of the Black Range, Sawyer's Peak, Grant Co., alt. 2770 m., Sept. 30, 1904, *Metcalf* 1434 (M, *co-type*); Sacramento Mts., July 28, 1899, *Wooton* (R).

ARIZONA: White Mountains, Aug. 6-15, 1903, *Griffiths* 5340 (M); Bonita Creek, White Mts., July 23, 1912, *Goodding* 1235 (R); Thompsons Ranch, Black River, White Mts., July 13, 1910, *Goodding* 561 (R).

3. *T. eximia* Gray, Mem. Am. Acad. (Pl. Fendl.) N.S. 4: 70. 1849; Walp. Ann. Bot. Syst. 2: 822. 1851-1852; Syn. Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 169. 1886 and 1888; Proc. Am. Acad. 16: 83. 1880; Coulter, Man. Rocky Mt. Region, 156. 1885; Coulter & Nelson, Man. Cent. Rocky Mts. 508. 1909; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

*T. Vreelandii* Rydb. Bull. Torr. Bot. Club 28: 22. 1901; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

Herbaceous perennial, caudex sending up a number of simple or branched stems 15-35 cm. high; leaves spatulate or the upper ones lanceolate, 2-5 cm. long, nearly glabrate; heads terminal, solitary; involucre 3-4-seriate, 1-1.5 cm. broad, 2-3 cm. in diameter; bracts ovate-lanceolate and somewhat cuspidate-acuminate with a narrow membranaceous lacerate-ciliate margin; ray-flowers about 35-40, fertile, blue or purple, with a much-reduced persistent pappus of rigid coroniform-concreted squamellae; pappus of the disk-flowers containing two subulate corneous stout awns which are slightly shorter than the achene; achenes pubescent with glochidiate-tipped hairs, at maturity broadly ovate with a cartilaginous margin. Plate 5, fig. 13-18.

Distribution: mountains of southern Colorado and northern New Mexico.



## Specimens examined:

COLORADO: side of Veta Mt., alt. 2600 m., July 19, 1900, *Vreeland 639* (NY, TYPE of *T. Vreelandii*).

NEW MEXICO: Gallinas Valley above the Hot Springs, Las Vegas, Sept. 12, 1881, *G. Engelmann* (M); Las Vegas, Sept., 1881, *G. Engelmann* (M); dry hills and hillsides, Sandia Mts., Balsam Park, alt. 2500 m., July to Aug., 1914, *Ellis 56* (M); La Glorieta, 1879, *Brandegge* (F, No. 204786); Glorieta, 1881, *Vasey* (F, No. 211503); sides of high mountains up Santa Fe Creek, June 28, 1847, *Fendler 353* (M, *co-type*); Santa Fe, 1891, *Alcott* (M, Nos. 890716 and 890499); Canyoncito, Santa Fe Co., alt. 2210 m., June 18, 1897, *A. A. & E. G. Heller 3726* (M); Albuquerque, Sandia Mts., Sept. 6, 1884, *Jones 4157* (F, R); Harvey's Upper Ranch in Pecos River National Forest, alt. 2985 m., Aug. 1, 1908, *Standley 4621* (M); below Winsors Ranch, in Pecos River National Forest, alt. 2550 m., July 19, 1908, *Standley 4412* (M); Rito de los Frijoles, Aug., 1910, *Robbins 8189*, (R).

4. *T. grandiflora* Nutt. Trans. Am. Phil. Soc. N.S. 7: 306. 1841; Torr. & Gray, Fl. N. Am. 2: 186. 1842; Gray, Mem. Am. Acad. (Pl. Fendl.) N.S. 4: 70. 1849; Proc. Am. Acad. 16: 83. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 167. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 156. 1885; Britton, Man. Fl. Northern States and Canada, 944. 1901; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts., 509. 1909; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 873. 1917, and ed. 2, 873. 1922.

Caulescent, divaricately branched from the base, 5–20 cm. high; leaves linear, sub lanceolate, acute, nearly glabrous, 2–5 cm. long, 0.3–1 cm. broad, two or more of the uppermost usually subtending the head; involucre usually 3-seriate; bracts ovate-lanceolate and rigidly cuspidate-acuminate, with narrow membranaceous lacerate-ciliate margins; heads 1.5–5 cm. in diameter including the rays; pappus of ray-flower reduced to a crown of short squamellae, that of the disk-flower plurisetose, longer than the achene; achenes sparsely pubescent with glochidiate-tipped hairs.



Distribution: eastern South Dakota and Nebraska, west to Wyoming and south to New Mexico; common throughout eastern Colorado.

Specimens examined:

SOUTH DAKOTA: Running Water, Aug. 14, probably 1856, *H. Engelmann* (M); Black Hills on upper Pole Creek, Aug. 1, 1856, *H. Engelmann* (M); Badlands, Cheyenne Valley, Washington Co., July 23, 1911, *Visher 2138* (F).

NEBRASKA: Warbonnet Canyon, alt. 1532 m., June, 1890, *T. A. Williams* (M); Pine Ridge, July 21, 1889, *Webber* (M); Eaglenest Butte, 1853-4, *Hayden* (M).

WYOMING: stony slopes, Laramie Co., June 29, 1901, *Nelson 8312* (M, R); open sandy slopes south of Sibylee, Albany Co., July 3, 1900, *A. Nelson 7373* (M, R); Corlett, June 24, 1907, *Johnston 253* (M).

COLORADO: Douglas Co., 1892, *Walker* (F, No. 376084); Castle Rock, 1889, *Walker* (F, No. 376085); Florence, July 31, 1872, *Brandegee 487* (M); Colorado Springs, July 19, 1872, *Redfield 478* (M); Soldier, June 13, 1899, *Marshall 3138* (F); Garden of the Gods, alt. 2000 m., Aug. 14, 1922, *Brumback & Davis 178* (F); Garden of the Gods, near Colorado City, July 18, 1872, *Porter* (F, No. 318424); Eldorado Springs, alt. 1631 m., June 24, 1917, *Clokey 2810* (F, R); in dry soil, Boulder Canyon, alt. 1692 m., *Young* (F, No. 290193); Colorado Territory, 39-40° lat., alpine and subalpine, 1864, *Parry* (M); Rocky Mts., 40-41° lat., *Vasey 304* (M); infrequent, mesa slopes, Boulder, alt. 1690 m., June 23, 1921, *Hanson C 159* (M); mountains, Larimer Co., alt. 2308 m., June 14, 1896, *Crandall* (M); Una, July 10, 1894, *A. Nelson 385* (M); Platteville, Apr. 17, 1908, *Johnston 492* (M); Horsetooth Gulch, 10 miles southwest of Fort Collins, alt. 1385 m., June 30, 1893, *Baker* (M); Golden, Jefferson Co., July 4, 1915, *Johnston 414 b* (M); foothills near Golden, Castle Rock, July 1, 1885, *Patterson 49* (F, M); foothills near Golden, June 20, 1878, *Jones 284* (F); Gold Hill, Aug. 12, 1875, *Patterson* (F, No. 208980); near Golden City, 1870, *Greene* (F, No. 15363); Fremont Co., near Canyon City, 1873, *Greene* (F, No. 15364); 39-40° lat., alpine and subalpine, 1864, *Parry* (M); Rocky Mts., 40° lat., 1862, *Hall* (F); Rocky Mts., *Hall & Harbour* (F, No. 367351); Rocky Mt.



flora, 39–41° lat., 1862, *Hall & Harbour 289* (F, M); eastern Colorado, *Carleton* (F, No. 353119); southern Colorado, *Brandege* (F, No. 204740); Manitou, Aug. 11, 1884, *Letterman 83* (M).

NEW MEXICO: low prairie between Orate Creek and Rio Colorado, Aug. 21, 1847, *Fendler 533* (M); Moro River Prairie, Aug. 15, 1847, *Fendler 157* (M).

5. *T. texensis* Larsen, n. sp.<sup>1</sup>

Herbaceous perennial; the caudex giving rise to ascending branched stems 6–30 cm. high, leafy throughout; leaves oblanceolate, 1–5 cm. long, 0.2–0.8 cm. broad, apiculate, narrowed at the base into a petiole, sparsely pubescent with closely appressed hairs, occasionally glabrate; heads usually solitary, terminal, sessile or short-pedunculate, 1.5–3 cm. in diameter including the ray; involucre 4–5-seriate, 1–1.5 cm. in diameter; bracts oblanceolate, acute, pink-tipped, membranaceous-margined and lacerate-ciliate; ray-flowers dark blue or purple with a reduced plurisetose pappus scarcely longer than the breadth of the achene; pappus of disk-flowers plurisetose, somewhat shorter than the corolla; achene pubescent with glochidiate-tipped hairs. Plate 3.

Distribution: northwestern Texas.

Specimens examined:

TEXAS: Randall Co., "rocky bluffs of the Red River," Aug. 13, 1900, *Eggert* (M, Nos. 121021, TYPE, 121022, 121023); Canyon, Aug. 13, 1900, *Eggert* (M, No. 720398); Randall Co., "rocky banks of the Red River," Aug. 12, 1900, *Eggert* (M, Nos. 121028 and 121027); rocky bluffs of Paloduro, May 30, 1902, *Reverchon 3320* (M); abundant on barren slopes, branch of Paloduro Canyon, Sept. 12, 1917, *Young* (M, Nos. 831212 and 831677); dry

<sup>1</sup> Herbaceis perennis; caule ramoso, ramis ascendentibus, 6–30 cm. altis, foliaceis; foliis oblanceolatis, 1–5 cm. longis, 0.2–0.8 cm. latis, apiculatis, integris, basi in petiolam sensim angustatis, utrinque dense strigoso-pilosis, rarius glabratibus; capitulis plerumque solitariis, terminalibus, sessilibus vel brevi-pedunculatis, radio incluso 1.5–3 cm. in diametro; involucri campanulatis, 4–5-seriatis, 1–1.5 cm. in diametro; bracteis involucri oblanceolatis, acutis ad apices roseis, marginibus membranaceis lacerato-ciliatisque; floribus femineis ligulatis, ligulis atro-caeruleis vel purpurascentibus, pappi setis multo reductis vix diametro achenii longioribus; floribus disci numerosis, pappi setis multis paululo corollis brevioribus; acheniis glochideo-pubescentibus.—Collected on "rocky bluffs of the Red River," Texas, Aug. 13, 1900, *H. Eggert* (Mo. Bot. Gard. Herb., No. 121021, TYPE).



open ground, calcareous soil, Channing, Hartley Co., June 19, 1918, *E. J. Palmer 14170* (M); calcareous open ground on plains, Canyon, Randall Co., Oct. 13, 1918, *E. J. Palmer 14586* (M); Canyon, Randall Co., June 12, 1917, *E. J. Palmer 12510* (M).

6. *T. glabella* Gray, Proc. Am. Acad. 16: 86. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 158. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 510. 1909; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922.

*T. Bakeri* Greene, Pittonia 4: 157. 1900.

Subacaulescent; caudex thick, woody, bearing tufted leaves; leaves thick, pilose when young, soon becoming glabrous, linear-spathulate, 2-4 cm. long, 0.2-0.5 cm. broad, gradually narrowed into a slender petiole; heads solitary, on naked peduncles 2-5 cm. long; heads 1.5-2.5 cm. in diameter including the rays; involucre 2-3-seriate; bracts of the involucre oblong, with narrow membranous margins finely lacerate-ciliate; ray-flowers blue or purple, setae irregular, varying in length from 1 to 5 mm.; pappus of disk-flowers regular, as long as the corolla; achenes sparsely pubescent with glochidiate-tipped hairs.

Distribution: known only from southwestern Colorado.

Specimens examined:

COLORADO: Pagosa Springs, Aug. 13, 1917, *Payson 1160* (M, R); dry hills, Pagosa Springs, Archuleta Co., alt. 2160 m., June 29, 1921, *Bethel, Willey & Clokey 4340* (F, M, R); hillside near Dix, alt. 2615 m., *Baker, Earle & Tracy 548* (F, M, R); Los Pinos (Bayfield), May 16, 1899, *Baker 727* (F, M, R, TYPE of *T. Bakeri*); mature yellow pine forest, Piedra, June 31, 1924, *Hazel M. Schmoll 1348* (R); open places between pines, Piedra, June 21, 1914, *Hazel M. Schmoll 1212* (R).

7. *T. Rothrockii* Gray, acc. to Rothrock in Wheeler Rept. 6: 148, t. 7. 1878; Gray, Proc. Am. Acad. 16: 85. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 157. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 510. 1909; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922.



Acaulescent; leaves broadly spathulate, approximately 2 cm. long, glabrous, rosulate; heads sessile, approximately 2 cm. in diameter including the rays; involucre 3–4-seriate; bracts oblong or narrowly ovate, purplish, thickish-margined, distinctly ciliate; ray-flowers with a much-reduced pappus; pappus of disk-flowers equalling or exceeding the length of the corolla; achenes sparsely pubescent with glochidiate-tipped hairs.

Distribution: alpine districts of Colorado.

Specimens examined:

COLORADO: loamy places of the foothills, Sheep and Engineer (?) Mts., Uncompahgre River, alt. 3000–3500 m., Aug. 2, 1893, *Purpus* 532 (F); South Park, alt. 4150 m., July, 1873, *Rothrock* 875 (F, TYPE); South Park, Aug., 1873, *Rothrock* (F, No. 304922 in part).

8. *T. montana* Jones, *Zoe* 4: 262. 1893; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. alpigena* Piper, Bull. Torr. Bot. Club 27: 394. 1900.

*T. dejecta* Nelson, Bot. Gaz. 27: 267. 1904; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 510. 1909.

Caespitose from a multicipital caudex; leaves obovate-spathulate, 1–5 cm. long, 0.3–0.5 cm. broad, apiculate, narrowed at the base into a petiole, pubescent in the early stages with appressed strigulose hairs, more or less glabrate; heads 1.5–2.5 cm. in diameter including the rays, sessile or solitary on naked scapes, 1–5 cm. in length; involucre about 3-seriate; bracts of outer series lanceolate, those of the inner series obovate, obtuse, pink-tipped, membranaceous, lacerate-margined; pappus of disk-flowers plurisetose, equalling the length of the corolla, pappus of ray-flowers similar but somewhat shorter; achenes glabrous or glabrate; achenes of ray-flowers occasionally hairy toward the base with a few scattered bidentate hairs.

Distribution: western Wyoming to Oregon, southward into Utah.

Specimens examined:

YELLOWSTONE NATIONAL PARK: Mammoth Hot Springs, July 5, 1902, *Mearns* (F, No. 121847).



WYOMING: Piney Mt., 25 miles west of Big Piney, Sublette Co., Summit, July 12, 1922, *E. & L. Payson 2694* (M, R); calcareous slide rock, Teton Pass Mts., east of Victor, alt. 2831 m., July 22, 1920, *E. & L. Payson 2078* (M, R); mountains near Cottonwood Lake, east of Smoot, Lincoln Co., alt. 3200 m., Aug. 2, 1923, *Payson & Armstrong 3706* (M, R); Sheep Mt. (Ferry Peak), Snake River Range, near Alpine, Lincoln Co., July 11, 1923, *Payson & Armstrong 3474* (M, R); in vicinity of Green River Lakes, Sublette Co., alt. 3169 m., Aug. 5, 1925, *E. & L. Payson 4542* (M).

IDAHO: subalpine slopes of loose calcareous soil, base to summit of mountains northeast of lake, Henry Lake, Fremont Co., alt. 2678 m., July 11, 1920, *E. & L. Payson 1986* (M, R); Mt. Chauvet, July 29, 1897, *Rydberg & Bessey 5131* (F, R).

UTAH: canyon above Tropic, alt. 2154 m., May 29, 1894, *Jones* (Pomona, No. 40754); mountains above Silver Lake, July 30, 1880, *Jones* (Pomona, No. 40756); Alta, above the Flagstaff Mine, Aug. 7, 1879, *Jones* (Pomona, No. 40755, TYPE of *T. montana*); loose stony soil, Uintah Mts., Dyer Mine, July 3, 1902, *Goodding 1238* (R, M, co-type of *T. dejecta*).

OREGON: subalpine ridges of Wallowa Mts., alt. 2015 m., July 31, 1899, *Cusick 2294* (F, M, co-types of *T. alpigena*).

9. *T. Watsoni* Gray, Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. strigosa* Eaton, non. Nutt. Bot. King's Exp. 145. 1871; Gray, Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888.

Caulescent, hirsute with a close appressed pubescence; the caudex sending up a number of branched, sparingly leafy stems; leaves mostly obovate-spathulate, 2–4 cm. long, 0.2–0.8 cm. broad, narrowed into a petiole; heads on short bracteate or naked peduncles, 0.3–1 cm. long, 1–1.5 cm. in diameter including the rays; involucre 2-seriate; bracts oblong-lanceolate, margins membranaceous, lacerate-ciliate; ray-flowers with a reduced pappus of unequal capillary bristles shorter than the diameter of the achene;



pappus of the disk-flower equalling or surpassing the corolla; achenes pubescent with bidentate hairs.

Distribution: southeastern Oregon through Nevada to southwestern Utah.

Specimens examined:

UTAH: Dugway, May 28, 1891, *Jones* (M); Glenwood, alt. 1692 m., May 24, 1875, *Ward 92* (F, M).

NEVADA: 1891, *A. J. Jones* (M).

OREGON: sandy soil near Vale, May, 1896, *Leiberg 2067* (M); common on hills, in the region of Malheur River, June 19, 1898, *Cusick 1935* (F, M).

**10. *T. florifer*** (Hook.) Gray, Proc. Am. Acad. 16: 84. 1880; Syn Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 167. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 157. 1886; Howell, Fl. Northwest Am. 306. 1897; Piper, Contr. U. S. Nat. Herb. 9: 563. 1906; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. strigosa* Gray in Wilkes' Exp. 17: 344. 1874, not Nutt., fide Gray, Proc. Am. Acad. 16: 84. 1880.

*T. florifer* Gray var. *communis* Jones, Proc. Calif. Acad. II. 5: 697. 1895.

*Erigeron* ? *florifer* Hook. Fl. Bor. Am. 2: 20. 1834.

*Aplopappus florifer* Hook. & Arn. Bot. Beechey Voy. 351. 1841, excl. var.  $\beta$ .

*Stenotus florifer* Torr. & Gray, Fl. N. Am. 2: 238. 1842, excl. var.  $\beta$ .

Caulescent, cinereous-hirsute; the caudex sending up a number of simple or branched stems 5–18 cm. high, leafy throughout; leaves linear or the lowest lanceolate-spathulate, acute, mostly apiculate-acuminate; heads 2–3 cm. in diameter including the rays, solitary, terminating the branches; involucre 2–3-seriate; bracts linear-lanceolate and acute, of about equal length, the membranaceous margins lacerate-ciliate; ray-flowers with pappus similar to that of the disk-flowers but varying in length from about the width of the achene to nearly as long as that of the disk-flowers; pappus of disk-flower composed of coarse, white setae which exceed the corolla in length; achenes densely pubescent with bidentate hairs.

Plate 5, figs. 25–28.



Distribution: dry hills and plains, central Washington and Oregon, southeastward through southern Idaho, Utah, to western Wyoming.

Specimens examined:

WYOMING: moist rich bottoms, Gros Ventres Fork, alt. 2000 m., June 10, 1860, *Hayden* (M).

IDAHO: ditch banks along fields, Challis, Custer Co., alt. 1662 m., July 15, 1916, *Macbride & Payson 3225* (M, R); clayey hills, Kings Hill, Elmore Co., alt. 800 m., July 16, 1911, *Nelson & Macbride 1129* (M, R); dry stony hillsides and dry flats, Arco, Blaine Co., alt. 1640 m., July 3, 1916, *Macbride & Payson 3095* (M, R); loose soil, Reynolds Creek, Owyhee Co., alt. 1538 m., July 3, 1911, *Macbride 1017* (M, R); gravelly slopes, New Plymouth, Canyon Co., alt. 680 m., May 21, 1910, *Macbride 90* (M, R); near Nampa, July 1, 1892, *Mulford* (M).

UTAH: Joseph City, Sevier Co., alt. 1692 m., May 13, 1899, *Jones 6379* (M); Marysvale, alt. 1846 m., May 31, 1894, *Jones 5323* (M, F); rim of Great Salt Lake Desert, May 6, 1889, *H. Engelmann* (M); sage-brush slopes, Milford, June 5, 1902, *Gooding 1046* (R).

WASHINGTON: Ritzville, Adams Co., alt. 480 m., June 6, 1893, *Sandberg & Leiberg 169* (F, M); Craigs Ferry, Kittitas Co., July 15, 1903, *Cotton 1361* (M); Columbia River opposite Umatilla, Apr. 20, 1882, *Howell* (F, No. 206944); Columbia River opposite Umatilla, Apr. 29, 1882, *Howell* (M); Wilson Creek, June, 1893, *Sandberg & Leiberg* (M); Yakima region, Cascade Mts., June, 1882, *Brandeggee* (M).

OREGON: near Lexington, Morrow Co., alt. 420 m., May 7, 1894, *Leiberg 34* (F, M); near Umatilla, May 1, 1882, *Howell* (F, No. 396898); on open plains, Cline Falls, Crook Co., May 22, 1905, *Nelson 815* (M, R); dry banks of Deschutes River five miles below Bend, July 30, 1920, *Peck 9708* (M); stony hills west of Silver Creek (and common westward), June 28, 1901, *Cusick 2616* (F, M, R).

11. *T. scapigera* Eaton, Bot. King's Exp. 145. *t. 17.* 1871; Gray, Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888; Rydb. Fl. Rocky Mts. 874.



1917, and ed. 2, 874. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925; Jepson, Man. Fl. Plants California, 1044. 1925.

*Aplopappus florifer* var.  $\beta$  Hook. & Arn. Bot. Beechey Voy. 351. 1841 (fide Gray).

*Stenotus florifer* var.  $\beta$  Torr. & Gray, Fl. N. Am. 2: 238. 1842 (fide Gray).

*T. scapigera* var. *caulescens* Eaton, Bot. King's Exp. 145. 1841; Gray, Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1886, and ed. 2, 168. 1886 and 1888.

*T. scapigera* var. *ambigua* Gray, Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. ambigua* (A. Gray) Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

Herbaceous perennial, canescent with fine appressed pubescence; caudex bearing tufted leaves; leaves narrowly spatulate to obovate, 1–3 cm. long, 0.3–0.8 cm. wide, lamina sometimes emarginate, narrowed into a petiole; flowering scapes 1–5 cm. long, naked or 1–2-bracted, sometimes leafy; heads 2–2.5 cm. in diameter including the rays; involucre 2–3-seriate; bracts oblong-lanceolate, acute, margins lacerate-ciliate; pappus of ray-flower similar to that of the disk but somewhat shorter; pappus of disk-flower plurisetose, exceeding the length of the corolla; achenes pubescent with bidentate hairs.

Distribution: Wyoming to northeastern California; also in New Mexico.

Specimens examined:

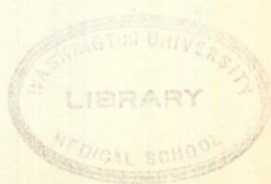
WYOMING: Holm Lodge, about 40 miles west of Cody, Park County, Aug. 26 and 27, 1922, *von Schrenk* (M).

NEW MEXICO: Santa Fe, 1847, *Fendler 351* (Phil.); without definite locality, *Kern* (in part) (Phil.).

UTAH: Rabbit Valley, alt. 2092 m., Aug. 6, 1875, *Ward 523* (U. S., TYPE of *T. scapigera* var. *ambigua*); Deep Creek, June 6, 1891, *Jones* (Pomona, No. 40882).

NEVADA: Monitor Valley, alt. 1538 m., July, 1868, *Watson 519* (US, TYPE of *T. scapigera* var. *caulescens*); eastern Nevada, 1883, *Meehan* (Phil.).

CALIFORNIA: Buffalo Ravine near Surprise Valley, Apr. 1879, *Lemmon 29* (M).





12. *T. spathulata* Nutt. Trans. Am. Phil. Soc. N.S. 7: 305. 1841; Torr. & Gray, Fl. N. Am. 2: 186. 1842; Eaton, Am. Nat. 8: 213. 1874; Gray, Proc. Am. Acad. 16: 86. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 158. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 510. 1909; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922.

*T. condensata* Eaton, Am. Nat. 8: 213. 1874; Gray, Proc. Am. Acad. 16: 83. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 167. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 157. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 519. 1909; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

*T. Parryi* var. *alpina* Gray, Proc. Am. Acad. 16: 83. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 167. 1884, and ed. 2, 167. 1886 and 1888; Coulter, Manual Rocky Mt. Region, 156. 1885.

*T. alpina* (Gray) Rydb. Mem. N. Y. Bot. Gard. 1: 390. 1900; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

Caespitose perennial, 3–5 cm. high; leaves crowded, rosulate, obovate to spathulate, 1–1.5 cm. long, 0.2–0.4 cm. broad, densely subsericeous-villose to villose-lanate; heads sessile or pedunculate, 1–5 cm. in diameter including the rays; involucre usually serrate; bracts pinkish, oblong-lanceolate, those of the inner series with a weak attenuate apex, the narrow margins scarious, lacerate-ciliate; pappus of ray- and disk-flowers similar, composed of slender setae, as long as the corolla of the disk-flower; achenes pubescent with bidentate hairs.

Distribution: alpine and subalpine regions of southwestern Alberta and western Wyoming.

Specimens examined:

YELLOWSTONE NATIONAL PARK: Electric Peak, alt. 2770 m., July 26, 1902, *E. C. Smith* (F).

WYOMING: high alpine ridge between the valleys of the Stinking Water and the Yellowstone, 1873, *Parry 142* (F, M); northwestern Wyoming, 1873, *Parry 145* (F, G, M, TYPE of *T. Parryi* var. *alpina*); high alpine peak, Owl Creek Range, July, 1874, *J. D. Putnam* (G, TYPE of *T. condensata*); "Black Hills of Platte," *Nuttall* (Phil.); shale flats, Bush Ranch, June 10, 1910, *Nelson 7054* (R).



CANADA: High River, Rocky Mts., alt. 2308 m., July, 1884, Dawson (G).

Note: Dr. C. C. Parry says in a note accompanying the type of *T. condensata* Gray: "Single specimen from a high alpine peak, Owl Creek Range, by J. D. Putnam. I take this to be a condensed alpine form of 145." The head of Putnam's specimen is larger than in No. 145 and looks very much as if it were a fasciation of several heads. Otherwise, these specimens are identical. In the specimens cited the heads vary from 1 to 5 cm. in diameter. The presence of intermediates indicates that the size of the head cannot be used as a means of specific demarcation.

13. *T. mexicana* Gray, Mem. Am. Acad. N.S. (Pl. Fendl.) 4: 70. 1849; Walp. Ann. Syst. Bot. 2: 822. 1851-1852; Gray, Proc. Am. Acad. 16: 86. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Hemsley, Biol. Cent.-Am. Bot. 2: 118. 1881.

Caulescent; conspicuously cinereous with strigose pubescence; stems decumbent, simple or branched, 5-17 cm. long, leafy throughout; leaves linear, sometimes linear-spathulate, 1-2.5 cm. long, 0.1-0.2 cm. broad; heads usually solitary on terminal peduncles, 1-2 cm. in diameter including the rays; involucre distinctly 2-seriate; bracts of equal length and all very obtuse, membranous-margined; ray-flowers fertile with a much-reduced pappus; pappus of the disk-flowers equalling the corolla in length; achenes sparsely pubescent with glochidiate-tipped hairs.

Distribution: east central Mexico, southern Coahuila, Zacatecas to Hidalgo.

Specimens examined:

MEXICO:

COAHUILA: Saltillo, March 22, 1877, *Gregg* 327 (M, TYPE); Saltillo, alt. 1650 m., June 5, 1909, *Arsène* 3387 (M); Saltillo, Apr. 1-15, 1880, *Ed. Palmer* 499 (F).

ZACATECAS; near Conception Del Oro, Aug. 11-14, 1904, *Ed. Palmer* 252 (M); vicinity of Cedros, Aug., 1908, *Kirkwood* 110 (F); low places, plains, Cedros, Aug., *Lloyd* 110 (M).

HIDALGO: rocky flats and mountains, Ixmiquilpan, July, 1905, *Purpus* 1345 (M, F); calcareous bluffs near Tula, alt. 2080 m.,



Aug. 6, 1896, *Pringle 6573* (M); dry calcareous rocks near Tula, alt. 2080 m., Sept. 16, 1902, *Pringle 9967* (M, F); calcareous plains near Pachuca, alt. 2350 m., Aug. 2, 1898, *Pringle 7580* (F, R).

14. *T. strigosa* Nutt. Trans. Am. Phil. Soc. N.S. 7: 306. 1841; Torr. & Gray, Fl. N. Am. 2: 186. 1842; Gray, Mem. Am. Acad. N.S. (Pl. Fendl.) 4: 70. 1849, in part; Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Proc. Am. Acad. 16: 86. 1880; Coulter, Man. Rocky Mt. Region, 158. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. Fendleri* Gray, Mem. Am. Acad. N.S. (Pl. Fendl.) 4: 70. 1849; Walp. Ann. Syst. Bot. 2: 822. 1851-1852; Gray, Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Proc. Am. Acad. 16: 86. 1880; Coulter, Man. Rocky Mt. Region, 158. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 874. 1917, and ed. 2, 874. 1922.

Caulescent; cinereous with close strigulose pubescence, the caudex sending up a number of simple or branched stems, 3-25 cm. high, nearly naked below, leafy towards the inflorescence; leaves linear to linear-spathulate, 1-3 cm. long, 0.3-0.6 cm. broad, gradually narrowed into a slender petiole; heads subsessile and solitary or terminating the lateral branches in 1-3-headed clusters; heads about 1.5 cm. in diameter including the rays; involucre 2-4-seriate; bracts oblong-lanceolate, membranaceous-margined and lacerate-ciliate; ray-flowers about 15, rays pink or rose-purple, with a much-reduced pappus; pappus of disk-flowers plurisetose, as long as the corolla; achenes pubescent with glochidiate-tipped hairs. Plate 4.

Distribution: dry sandy soil, southwestern Wyoming to New Mexico and Arizona and adjacent Mexico.

Specimens examined:

WYOMING: dry flats 21 miles west of Green River, June 19, 1923, *Payson & Armstrong 3205* (M, R); Church Buttes, Fort Bridger, July, 1873, *Porter* (M, Phil.); without definite locality, *Parry* (Phil); Green River, May 30, 1897, *Nelson 3031* (M, R).



COLORADO: "R. Mts. Platte," *Nuttall* (Phil., TYPE); Salida, June 19, 1898, *Baker, Earle & Tracy 1016* (M); Texas Cr., Fremont Co., 1874, *Brandeggee 951* (M); Arkansas River near Punched Pass, Sept. 24, 1878, *Jones 767* (M); Huerfano, Aug., 1867, *Parry 93* (M, R); dry slopes, alt. 1662 m., Paradox, Montrose Co., June 17, 1912, *Walker 93* (M); adobe plains of San Juan Valley, July, 1875, *Brandeggee* (M); southern Colorado, *Brandeggee* (Phil.); sands of Huerfano Cr., Sept., 1875, *Brandeggee* (M); McElmo Cr., June 3, 1892, *Eastwood* (F, No. 82217); alkaline hillsides, Naturita, 1662 m., May 19, 1924, *Payson 321* (F, M, R); Arkansas Valley, Sept., 1873, *Wolf 517* (F).

NEW MEXICO: near Espanola, Santa Fe Co., alt. 1723 m., May 17, 1897, *Heller & Heller 3547* (M); Mangas Springs, 18 miles northwest of Silver City, Grant Co., alt. 1323 m., Apr. 12, 1903, *Metcalfe 15* (M, R); Mesilla Valley, Dona Ana Co., alt. 1184 m., Apr. 19, 1907, *Wooton & Standley 3237* (M); sand hills near Mesilla, May 4, 1906, *Standley* (M); gravelly hillsides, Santa Fe, May–July, 1847, *Fendler 350* (M, co-type of *T. Fendleri*); El Paso, Apr., 1852, *Parry* (M); Santa Fe, 1891, *Alcott* (M, No. 890501); sandy banks of the Rio Grande and stony hills, El Paso, March–June, 1851–2, *Wright 1172* (Phil., M); without definite locality, *Kern* (Phil.); gravelly hills, Santa Fe, May, 1847, *Fendler 351* (Phil., M); Aztec, May 4, 1899, *Baker 728* (F, M, R); loamy flats, Hillsboro (N. Percha), Sierra Co., alt. 1692 m., Oct. 28, 1904, *Metcalfe 1510* (F, M); Mesilla Valley, Dona Ana Co., alt. 1154 m., Apr. 2, 1907, *Wooton & Standley* (F, M).

ARIZONA: dry spots in river bottoms, Rio Verde, Fort Whipple, Sept. 6, 1865, *Coues & Palmer 523* (M); sandy soil, Beaver Cr., Sept., 1903, *Purpus 8300* (M); *Smart 92* (F); *Voth 7* (F).

15. *T. incana* Nutt. Trans. Am. Phil. Soc. N.S. 7: 305. 1841; Torr. & Gray, Fl. N. Am. 2: 155. 1842; Walp. Rep. 2: 575. 1843; Gray, Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Proc. Am. Acad. 16: 86. 1880; Coulter, Man. Rocky Mt. Region, 157. 1885; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.



*T. Fremontii* Torr. & Gray, Boston Jour. Nat. Hist. 5: 106. 1845.

*T. incana* var. *ambigua* Jones, Zoe 4: 264. 1893.

*T. incana* var. *prolixa* Jones, Contr. Western Bot. 13: 15. 1910.

Herbaceous perennial, strigulose-cinereous, caespitose; stem usually 3–6 cm. high; leaves spatulate, sometimes apiculate, petiolate, 2–4 cm. long and 0.2–0.5 cm. broad, the uppermost clustered at the base of the heads and seldom surpassing them in length; heads 1–2.5 cm. in diameter including the rays, usually sessile; involucre 2–3-seriate; bracts broadly lanceolate, their scarious margins lacerate-ciliate; pappus of the disk-flower plurisetose, equalling the length of the corolla; pappus of the ray-flower similar to that of the disk-flower but only one-third to one-half as long; achenes pubescent with glochidiate-tipped hairs.

Distribution: Wyoming, south through western Colorado into northwestern New Mexico, west into eastern Arizona and Utah.

Specimens examined:

WYOMING: "Black Hills of the Platte," Nuttall (Phil., TYPE); on a stony flat, Granger, Uinta Co., June 14, 1899, A. & E. Nelson 5403 (M, R); Granger, June 10, 1898, A. Nelson 4622 (M, R); deep hot sands, Alcova, Natrona Co., July 1, 1901, Goodding 166 (M, R).

COLORADO: dry rocky south slope, Norwood Hill, San Miguel Co., alt. 2154 m., Aug. 11, 1912, Walker 448 (M, R); Grand Junction, May, 1891, Eastwood (F, Pomona); Grand Junction, June, 1892, Eastwood (F, Pomona); Grand Junction, Apr. 15, 1891, Jones (Pomona, No. 39662); Grand Junction, alt. 1412 m., June 11, 1901, Baker 105 (M).

NEW MEXICO: Aztec, May 6, 1899, Baker 729 (M, R).

UTAH: stony slopes, Thompson Springs, alt. 1630 m., May–Oct., 1899, Purpus 6765 (M); Thompson Springs, May 7, 1891, Jones (Pomona, No. 39664, TYPE of *T. incana* var. *ambigua*); Richfield, alt. 1692 m., June 5, 1875, Ward 176 (F, M); Lower Crossing, alt. 1384 m., July 2, 1898, Jones (M, No. 121121); Westwater, May 6, 1891, Jones (Pomona, No. 39663); Westwater, alt. 1380 m., June 28, 1898, Jones (Pomona, No. 39629);



Chepeta Well, alt. 1540 m., May 23, 1908, *Jones* (Pomona, No. 39630, TYPE of *T. incana* var. *prolixa*).

ARIZONA: near Oraibi, 1900, *Voth* 19 (F); Hackberry, May 26, 1884, *Jones* 4516 (F, R).

16. *T. arizonica* Gray, Proc. Am. Acad. 16: 85. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 169. 1886 and 1888; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

*T. arizonica* × *incana* Jones, Zoe 2: 248. 1891.

Depressed subcaulescent and multicapital, branching from a perennial root, forming a loose pulvinate tuft 3–4 cm. high, minutely sericeous-canescens; leaves short, obovate-spathulate, 2–3 cm. long, 0.2–0.5 cm. broad, seldom surpassing the foliose-fulcrate heads; heads 1–1.5 cm. in diameter including the rays; involucre 2–3-seriate; bracts lanceolate, obtuse, with narrow, membranaceous lacerate-ciliate margins; pappus of the disk-flower plurisetose, equalling the length of the corolla, that of the ray-flower similar but shorter.

Distribution: southwestern Colorado and Arizona; doubtless also in Utah.

Specimens examined:

COLORADO: Naturita, June 1, 1917, *Payson* 989 (M, R); rocky hillside, Naturita, alt. 1670 m., Apr. 21, 1914, *Payson* 242 (F, M, R); dry arroyo sides, Paradox, Montrose Co., alt. 1666 m., June 17, 1912, *Walker* 90 (M, R); Paradox, Montrose Co., alt. 1354 m., *Walker* 206 (R); Grand Junction, Mesa Co., May 31, 1921, *Osterhout* 6116 (R).

ARIZONA: Buckskin Mts., June 19, 1890, *Jones* (Pomona, No. 39642, TYPE of *T. arizonica* × *incana*); Milford, alt. 1540 m., June 19, 1880, *Jones* 1794 (F, M); Ash Fork, May 13, 1883, *Rusby* 660 (M); "southern Utah, northern Arizona, &," *Palmer* 204 (M).

17. *T. leptotes* (Gray) Osterh. Muhlenbergia 4: 69. 1908; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922.

*T. sericea* var. *leptotes* Gray, Proc. Am. Acad. 16: 85. 1880;



Coulter, Man. Rocky Mt. Region, 157. 1885; Gray, Syn. Fl. N. Am. 1<sup>2</sup>: 169. 1884, and ed. 2, 1886 and 1888.

*T. leptotes* Osterh. Muhlenbergia 4: 69. 1908 (doubtless a typographical error, since the bibliographical citation in synonymy refers to var. *leptotes* Gray).

Acaulescent; leaves pubescent with hirsute appressed hairs, narrowly linear, attenuate at the base, 2–4 cm. long, 0.1–0.2 cm. broad, surpassing the shortly pedunculate or sessile heads; heads about 1.5 cm. in diameter including the rays; involucre 3–4-seriate; bracts broadly linear, their membranaceous margin scarcely wider than the lacerate ciliation; pappus of ray- and disk-flowers similar, plurisetose, setae equalling the length of the corolla of the disk-flower, rarely shorter; achenes only sparsely pubescent with glochidiate-tipped hairs.

Distribution: known only from the Middle Park region of Colorado.

Specimens examined:

COLORADO: Middle Park, coll. of 1864, *Parry* (G, TYPE; M, co-type, No. 121020); "Estes Park," coll. of 1864, *Parry* (F, No. 209717); Kremmling, Grand Co., June 22, 1907, *Osterhout* 3487 (R); Kremmling, Grand Co., May 26, 1915, *Osterhout* 5221 (R).

18. *T. exscapa* (Richards.) Porter, Mem. Torr. Bot. Club 5: 321. 1894, in part, as to name-carrying synonym; Nelson in Coulter & Nelson, Man. Cent. Rocky Mts. 509. 1909, in part, excluding synonym *T. sericea*; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 692. 1915; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922, as to name only; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925, in part, excluding *T. sericea* and *T. mensana*.

*Aster* ? *exscapus* Richards. Frankl. Jour. Bot. App. 7, p. 748. 1823.

*T. sericea* Hook. Fl. Bor. Am. 2: 16. 1834, in part, as to synonym, *Aster exscapus*, and plant of Richardson; DC. Prodr. 7: 273. 1838, in part; Walp. Rep. 2: 575 and 957. 1843, in part, as to *Aster exscapus*; Torr. & Gray, Fl. N. Am. 1: 185, 1842, in part, as to *Aster exscapus* and plant of Richardson; Gray, Proc.



Am. Acad. 16: 85, 1880, in part, as to *Aster exscapus*; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888, in part, as to *Aster exscapus*.

*T. Wilcoxiana* Wood, Bull. Torr. Bot. Club 6: 163. 1875; Gray, Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am., ed. 2, 1<sup>2</sup>: 168. 1886 and 1888; Coulter, Man. Rocky Mt. Region, 157. 1885; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922.

*T. sericea*  $\beta$  *papposa* Gray, Mem. Am. Acad. N. S. (Pl. Fendl.) 4: 70. 1849; Proc. Am. Acad. 16: 84. 1880; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888.

*T. exscapa Wilcoxiana* (Wood) A. Nels. in Coulter & Nelson, Man. Cent. Rocky Mts. 510. 1909.

*T. intermedia* Rydb. in Britton's Manual Fl. N. States and Canada, 944. 1901, and ed. 2, 944. 1905; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 1922; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925.

Depressed, acaulescent, rising from a woody root-stalk; leaves linear-spathulate, 2–5 cm. long and 0.2–0.5 cm. broad, somewhat apiculate, sparsely pubescent with fine appressed hairs, somewhat glabrate; heads large, 2–3 cm. high and 3–5 cm. in diameter including the rays; involucre 4–6-seriate; bracts linear-lanceolate, obtuse, pink-tipped with membranaceous lacerate-ciliate margins; pappus of ray- and disk-flowers similar, plurisetose of elongated setae exceeding the length of the corolla of the disk-flower; achenes pubescent with glochidiate-tipped hairs.

Plate 7, figs. 29–31.

Distribution: plains from southern Alberta and Saskatchewan, south to Texas and west to Arizona; also in southern Colorado.

Specimens examined:

SOUTH DAKOTA: clay-hills, near Hot Springs, May 10, 1924, *McIntosh* 21 (R); hills near Hot Springs, June 2, 1924, *McIntosh* 166 (R).

KANSAS: Trego Co., *Rich* 718 (R, M, ISO-TYPE of *T. intermedia*); Clark Co., *Curtis* (M, No. 121174); arid sterile slopes near Culison, March 31, 1888, *Norris* (M, No. 121175); gravelly hills collected within a radius of five miles of Osborne City, April 16, 1894, *Shear* 2 (M).

OKLAHOMA: vicinity of Camp Supply, Woodward, Apr. 5, 1925, *Wilcox* (F, M); hillside, Alva, Apr. 17, 1913, *Stevens* 216 (M).



TEXAS: infrequent, rocky slopes, alpine, March 22, 1919, *Hanson* (M); rare on high mountains, Limpia, March, 1914, *Allen* 36 (M); calcareous bluffs, Falls Creek, Hood Co., Apr, 1884, *Reverchon* 1533 (F, M).

COLORADO: near foothills, Fort Collins, Apr. 19, 1898, *Crandall* 3132 (F, R); plains, Colorado Springs, May 4, 1878, *Jones* 25 (F); Cheyenne Canyon, May 4, 1891, *Smith* (M, No. 121177); Canyon City, Apr. 1875, *Brandeggee* (M); Rocky Mountain Fl., 39–41° lat., 1862, *Hall & Harbour* 290 (F, No. 456674; M, No. 121176); Los Pinos, May, 1899, *Baker* 730 (F, M, R); vicinity of New Winsor, May 11, 1899, *Osterhout* (R, F, No. 118369); Evans, 1909, *Johnston* 253 A (M); dry hillside, Naturita, *Payson* 326 (M, R).

NEW MEXICO: Raton Mts., Colfax Co., March 23, 1848, *Gordon* 42 (M); sloping hillsides on grassy plains, Santa Fe, Apr.-May, 1847, *Fendler* 349 (M, co-type of *T. sericea*  $\beta$  *papposa*); near Silver City, March 29, 1889, *Greene* (F).

ARIZONA: Flagstaff, May–Oct., 1902, *Purpus* 4 (M); vicinity of Flagstaff, alt. 2154 m., June 2, 1898, *MacDougal* 31 (F, R); Prescott, 1876, *Palmer* (F, No. 208510); Bright Angel, May 18–27, 1903, *Griffiths* 4361 (M); Fort Whipple, May, 1865, *Coues & Palmer* 365 (M); Fort Whipple, Apr. 20, 1865, *Coues & Palmer* 315 (M).

CANADA: at Carlton House, *Richardson* (Kew, TYPE); sand hills, Aweme, Manitoba, May 28, 1900, *Criddle* (M); quite rare at Briggs Creek, Elbow River, Alberta, June 26, 1897, *Macoun* (C); dry slope, Medicine Hat, Alberta, May 9, 1894, *Spreadborough* (C); sandy hills, Aweme, Alberta, May 20, 1905, *Criddle* 900 (M).

19. *T. sericea* Hook. Fl. Bor. Am. 2: 16, pl. 119. 1834, in part, excluding synonym; DC. Prodr. 7: 273. 1838, in part; Nutt. Trans. Am. Phil. Soc. N. S. 7: 304. 1841; Walp. Rep. 2: 575 and 957. 1843, in part, excluding *Aster exscapus*; Torr. & Gray, Fl. N. Am. 2: 185. 1842, excluding *Aster exscapus* and the plant of Richardson; Gray, Proc. Am. Acad. 16: 85. 1880, in part; Syn. Fl. N. Am. 1<sup>2</sup>: 168. 1884, and ed. 2, 168. 1886 and 1888, in part, as to plant from "Rocky Mountains in lat. 54°."

*T. mensana* Jones, Contr. Western Bot. 13, p. 15. 1910.



*T. exscapa* Porter in Mem. Torr. Bot. Club 5: 321. 1894, in part, as to synonym *T. sericea*; Nelson in Coulter & Nelson, Man Cent. Rocky Mts. 509. 1909, in part, as to synonym *T. sericea*; Rydb. Fl. Rocky Mts. 875. 1917, and ed. 2, 875. 1922, in part, as to synonyms; Tidestrom, Contr. U. S. Nat. Herb. 25: 554. 1925, in part, as to *T. sericea* and *T. mensana*.

Depressed, acaulescent, rising from a woody perennial caudex; leaves linear-lanceolate to subterete, 1–4 cm. long, 0.2–0.3 cm. wide, clustered at the base of the sessile heads, canescent with dense closely appressed sericeous pubescence, the older leaves conspicuously exceeding the head; heads 1–1.5 cm. in diameter including the rays; involucre 4–5-seriate; bracts pinkish, linear-lanceolate, acute with narrow membranaceous lacerate-ciliate margins; pappus of the disk-flower plurisetose, equalling the length of the corolla; pappus of the ray-flower variable from reduced squamellae little longer than the breadth of achene to a condition similar to that in the disk-flower; achenes pubescent with glochidiate-tipped hairs. Plate 6; pl. 7, fig. 32–34.

Distribution: Rocky Mountains, Alberta to Colorado and Utah; also in the Black Hills of South Dakota.

Specimens examined:

SOUTH DAKOTA: dry hillside near Pringle, alt. 1508 m., Apr. 19, 1909, *Murdoch 3510* (F).

MONTANA: Helena, 1892, *Newton* (F); Gallatin Co., June, 1888, *Tweedy 20* (F); Custer, Apr. 12, 1890, *Blankinship 147* (M); chiefly on the plains, Helena, May 18, 1887, *Anderson* (M, No. 121170).

WYOMING: Laramie, May 8, 1897, *A. Nelson 2862* (F); Laramie Hills, Apr. 28, 1896, *A. Nelson 1883* (F); Laramie plains, Apr. 12, 1894, *A. Nelson 7* (F, M); Laramie, Albany Co., May, 1899, *A. Nelson 7055* (M, R); March 8, 1860, *Hayden* (M, No. 121166); March 25, 1860, *Hayden* (M, No. 121161); Deer Creek, west of Fort Laramie, Apr. 15, 1860, *Hayden* (M, No. 121160); head of Muddy Creek, May 4, 1860, *Hayden* (M, No. 121167); Shoshone Mts., May, 1907, *Hapeman* (M, No. 867626).

COLORADO: near Boulder, Apr. 1901, *Ramaley 654* (R); Rocky Mts., 39–41° lat., 1862, *Hall & Harbour 290* (F, Nos. 314634 and 17721); Larimer Co., March 30, 1896, *Baker 1250* (F, M); West



Cliff, Custer Co., Apr. 1888, *Cockerell* (F, No. 352961); steep slope of "The Mesa," alt. 2738 m., Apr. 23, 1911, *Murdoch* 4503 (F, M); Georgetown, June, 1873, *Wolf* 416 (F); Middle Park, 1861, *Parry* 35 (F); Denver, May, 1894, *Bethel* (F, No. 91820); dry hills, Mt. Vernon, canyon, Jefferson Co., alt. 1730 m., Apr. 13, 1920, *Clokey* 4338 (F, R); foothills west of Fort Collins, alt. 1692 m., March 3, 1896, *Baker* (M, No. 121168); Gregory Canyon, Boulder, Boulder Co., May 21, 1912, *Vestal* 368 (M); infrequent, upper mesas near Boulder, alt. 1477 m., March 19, 1921, *Hanson* c160 (M); South Park, Aug., 1873, *Rothrock* (F, No. 304922 in part).

UTAH: Theodore, Benches of the Uintas, alt. 2308 m., May 14, 1908, *Jones* (Pomona, No. 40603, TYPE of *T. mensana*).

CANADA: Rocky Mountains, *Drummond* (Kew, TYPE; also C, No. 7710); clay banks, Medicine Hat, Apr. 22, 1894, *Spreadborough & Macoun* (C, M); hillsides, Sweet Grass Hills, July 15, 1895, *Macoun* (C); Fort McLeod, Alberta, coll. of 1888, *Cowdry* (C).

#### SPECIES EXCLUDED

*Townsendia Wrightii* Gray, Bot. Mex. Bound. Surv. p. 78. 1859 = *Aster Wrightii* Gray, Pl. Wright. Part II, p. 75. 1853.

#### LIST OF EXSICCATAE

The distribution numbers are printed in *italics*. The number in parenthesis is the species number used in this revision.

- |  |  |
|--|--|
| Aiton, G. B. (1).  | Brumback, Miss F. M., and Davis, Miss C. A. 178 (4).   |
| Alcott, W. P. (3); (14).   | Burglehaus, F. H. (1).                                 |
| Allen, Miss E. A. 36 (18).   | Carleton, M. H. (4).                                   |
| Anderson, F. W. (1); (19).   | Clokey, I. W. 2810 (4); 4338 (19).                     |
| Arsène, Bro. G. 3387 (13).   | Cockerell, T. D. A. (19).                              |
| Baker, C. F. (4); 727 (6); 728 (14); 105, 729 (15); 730 (18); 1250 (19). | Cotton, J. S. 1361 (10).                               |
| Baker, C. F., Earle, F. S., and Tracy, S. M. 548 (6); 1016 (14).         | Coues, E., and Palmer, E. 523 (14); 315, 365 (18).     |
| Bethel, E. (19).   | Cowdry (19).   |
| Bethel, E., Willey, F. S., and Clokey, I. W. 4340 (6).                   | Crandall, C. S. (4); 3132 (18).                        |
| Blankinship, J. W. 301, 301a (1); 147 (19).                              | Criddle, M. 900 (18).                                  |
| Brandeggee, T. S. (3); 487 (4); (10); 951 (14); (18).                    | Curtis, C. (18).                                       |
|  | Cusick, W. C. 2295 (1); 2294 (8); 1935 (9); 2616 (10). |
|  | Dawson, G. M. (12).                                    |



- Doty, T. 59 (1).  
 Drummond, Thomas (19).  
 Eastwood, Miss A. (14); (15)  
 Eggert, H. (5).  
 Eikenberry, W. L. 59 (1).  
 Ellis, Miss C. C. 56 (3).  
 Engelmann, G. (3).  
 Engelmann, H. (4); (10).  
 Fendler, A. 353 (3); 157, 533 (4); 351 (11); 350, 351 (14); 349 (18).  
 Flodman, J. H. 828 (1).  
 Goodding, L. N. 1238 (8); 166 (15); 1235, 561 (2); 1046 (10).  
 Gordon, A. L. 42 (18).  
 Greene, E. L. (4); (18).  
 Gregg, J. 327 (13).  
 Griffiths, D. 4361 (18); 5340 (2).  
 Hall, E. (4).  
 Hall, E., and Harbour, J. P. 289 (4); 290 (18); 290 (19).  
 Hanson, H. C. c159 (4); (18); c160 (19).  
 Hapeman, H. (19).  
 Hayden, F. V. (1); (4); (19); (10).  
 Heller, A. A., & E. G. 3726 (3); 3547 (14).  
 Howell, T. J. (10).  
 Johnston, E. L. 253, 414b, 492 (4); 253a (18).  
 Jones, A. J. (9).  
 Jones, M. E. 4157 (3); 284 (4); (8); (9); 5323, 6379 (10); (11); 767 (14); 4516 (15); 1794 (16); 25 (18); (19).  
 Kelsey, F. D. (1).  
 Kern, R. H. (11); (14).  
 Kirkwood, J. E. 110 (13).  
 Leiberg, J. B. 2067 (9); 34 (10).  
 Lemmon, J. G. 29 (11).  
 Letterman, G. W. 83 (4).  
 Lloyd, C. G. 110 (13).  
 Macbride, J. F. 90, 1017 (10).  
 Macbride, J. F., and Payson, E. B. 3095, 3225 (10).  
 MacDougal, D. T. 31 (18).  
 Macoun, J. (1); (18); (19).  
 McIntosh, A. C. 21, 166 (18).  
 Marshall, W. F. 3138 (4).  
 Mearns, E. A. (1); (8).  
 Meehan, T. (11).  
 Mell and Knopf (18).  
 Metcalfe, O. B. 413, 1434 (2); 15, 1510 (14).  
 Moore, Mrs. C. H. (1).  
 Mulford, Miss I. (10).  
 Murdoch, J. 3510, 4503 (19).  
 Nelson, A. 385, 7373, 8312 (4); 815 (10); 4622 (15); 7, 1883, 2862, 7055 (19); 7054 (12); 3031 (14).  
 Nelson, A., and E. 5425 (1); 5403 (15).  
 Nelson, A., and Macbride, J. F. 1129 (10).  
 Nelson, E. 815 (10).  
 Newton, G. W. (19).  
 Norris, H. W. (18).  
 Nuttall, T. (12); (14); (15).  
 Osterhout, G. E. 6116 (16); 5221, 3487 (17); (18).  
 Palmer, E. J. 14170, 14586 (5).  
 Palmer, Ed. 252, 499, (13); 204 (16); (18).  
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## EXPLANATION OF PLATE

## PLATE 2

*Townsendia formosa* Greene

New Mexico

From a co-type, *Metcalf* No. 1434, in the Missouri Botanical Garden Herbarium.





LARSEN—REVISION OF THE GENUS TOWNSENDIA



## EXPLANATION OF PLATE

## PLATE 3

*Townsendia texensis* Larsen

Northwestern Texas

From the type specimen, *Eggert*, in the Missouri Botanical Garden Herbarium  
No. 121021.





LARSEN—REVISION OF THE GENUS TOWNSENDIA



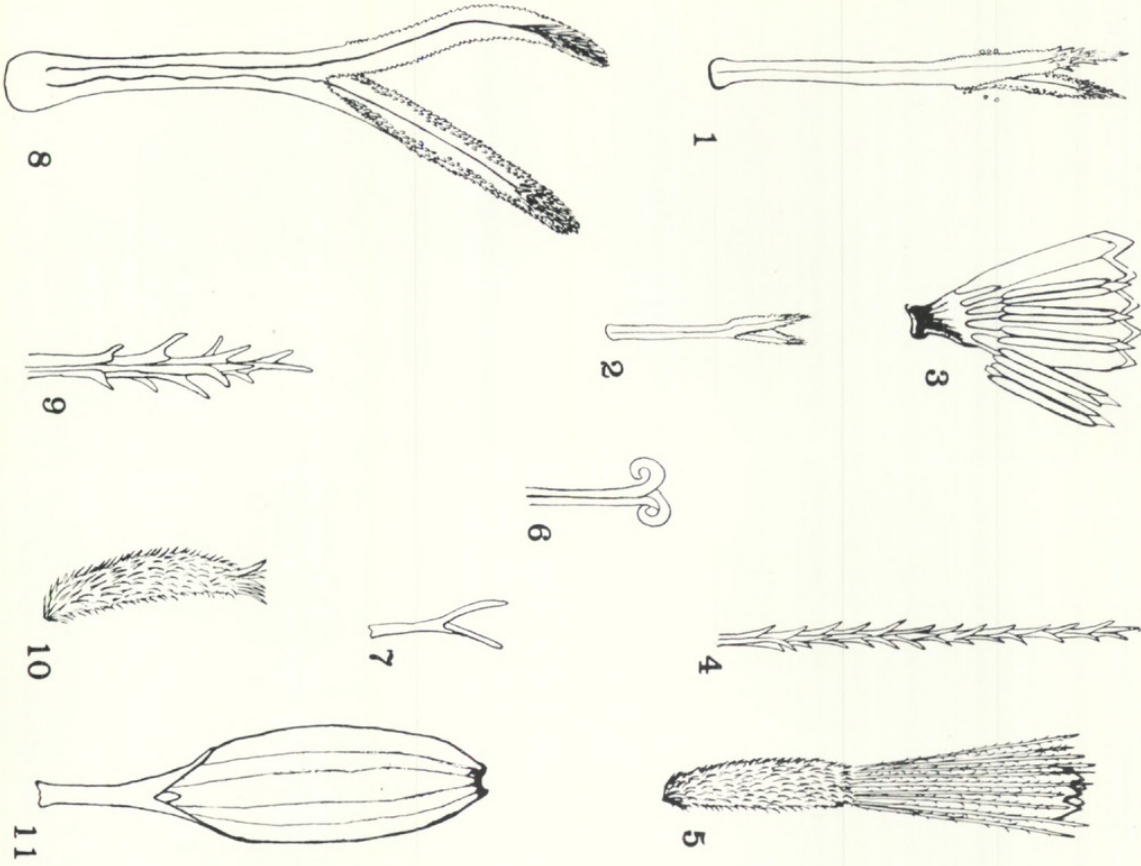
## EXPLANATION OF PLATE

## PLATE 4

*Townsendia strigosa* Nuttall

- Fig. 1. Style-branches of the disk-flower, greatly enlarged.  
Fig. 2. Style-branches of the disk-flower,  $\times 5$ .  
Fig. 3. Corolla of the disk-flower showing the stamens,  $\times 5$ .  
Fig. 4. A seta of the disk-flower, greatly enlarged.  
Fig. 5. Disk-flower,  $\times 5$ .  
Fig. 6. Glochidiate-tipped hair, greatly enlarged.  
Fig. 7. Style-branches of the ray-flower,  $\times 5$ .  
Fig. 8. Style-branches of the ray-flower, greatly enlarged.  
Fig. 9. A seta of the ray-flower, greatly enlarged.  
Fig. 10. Achene of the ray-flower with pappus attached,  $\times 5$ .  
Fig. 11. Corolla of the ray-flower,  $\times 5$ .  
Fig. 12. Photograph of the type specimen in the Herbarium of the Academy of Natural Sciences, Philadelphia.







## EXPLANATION OF PLATE

## PLATE 5

*T. eximia* Gray.

Fig. 13. Ray-flower,  $\times 2\frac{1}{2}$ .

Fig. 14. Pappus of the ray-flower, greatly enlarged.

Fig. 15. Disk-flower, showing a single elongated seta in the pappus,  $\times 2\frac{1}{2}$ .

Fig. 16. Pappus of the disk-flower, greatly enlarged.

Fig. 17. Achene of the disk-flower with the corolla and pappus attached.

Fig. 18. Glochidiate-tipped hair.

*T. formosa* Greene.

Fig. 19. Ray-flower,  $\times 2\frac{1}{2}$ .

Fig. 20. Style-branches of the ray-flower, greatly enlarged.

Fig. 21. Disk-flower,  $\times 2\frac{1}{2}$ .

Fig. 22. Style-branches of the disk-flower,  $\times 5$ .

Fig. 23. Style-branches of the disk-flower, greatly enlarged.

Fig. 24. A seta of the pappus, greatly enlarged.

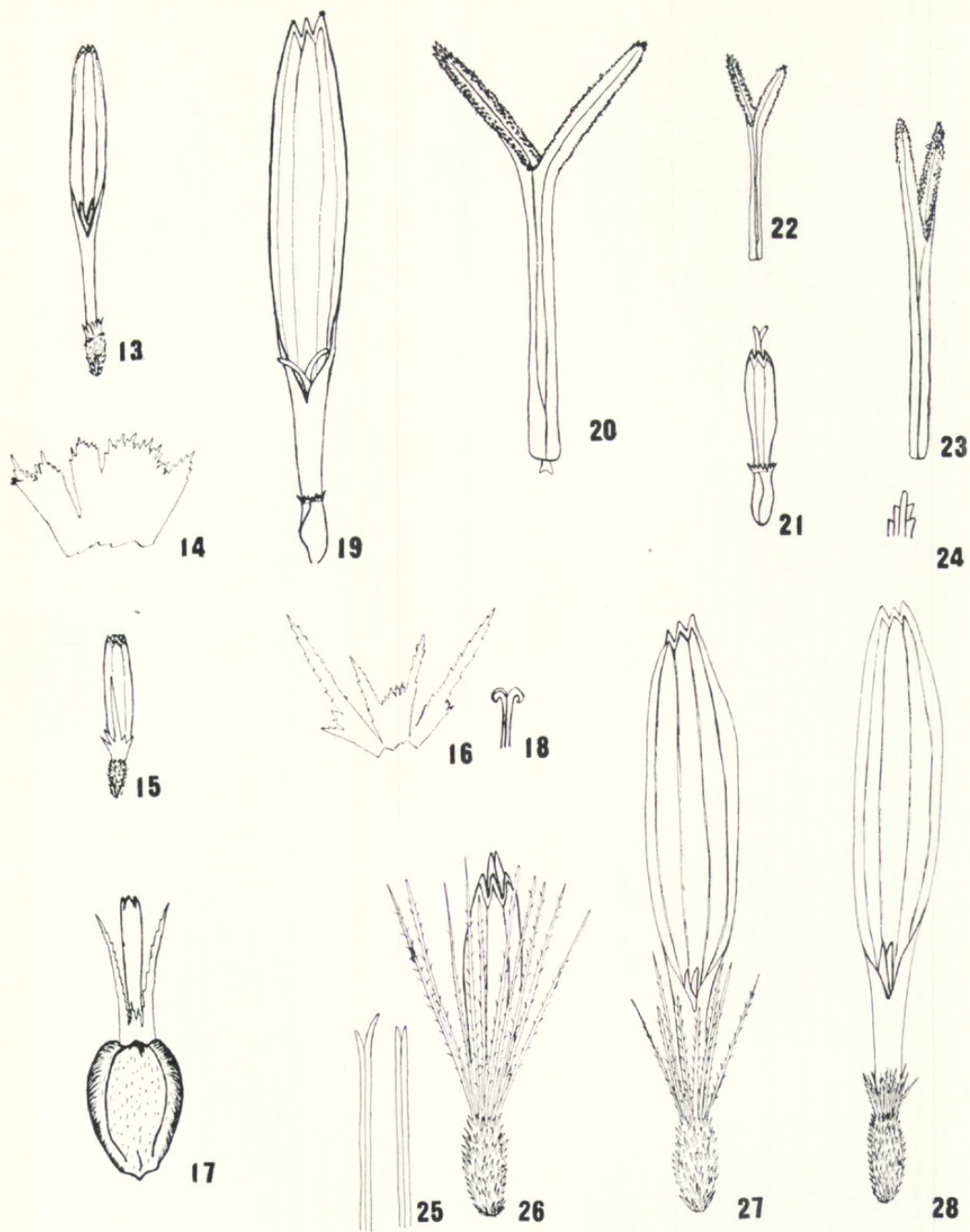
*T. florifer* Gray.

Fig. 25. Bidentate hairs, greatly enlarged.

Fig. 26. Disk-flower,  $\times 5$ .

Figs. 27 and 28. Ray-flowers from the same head showing the variability of the pappus,  $\times 5$ .





LARSEN—REVISION OF THE GENUS *TOWNSENDIA*



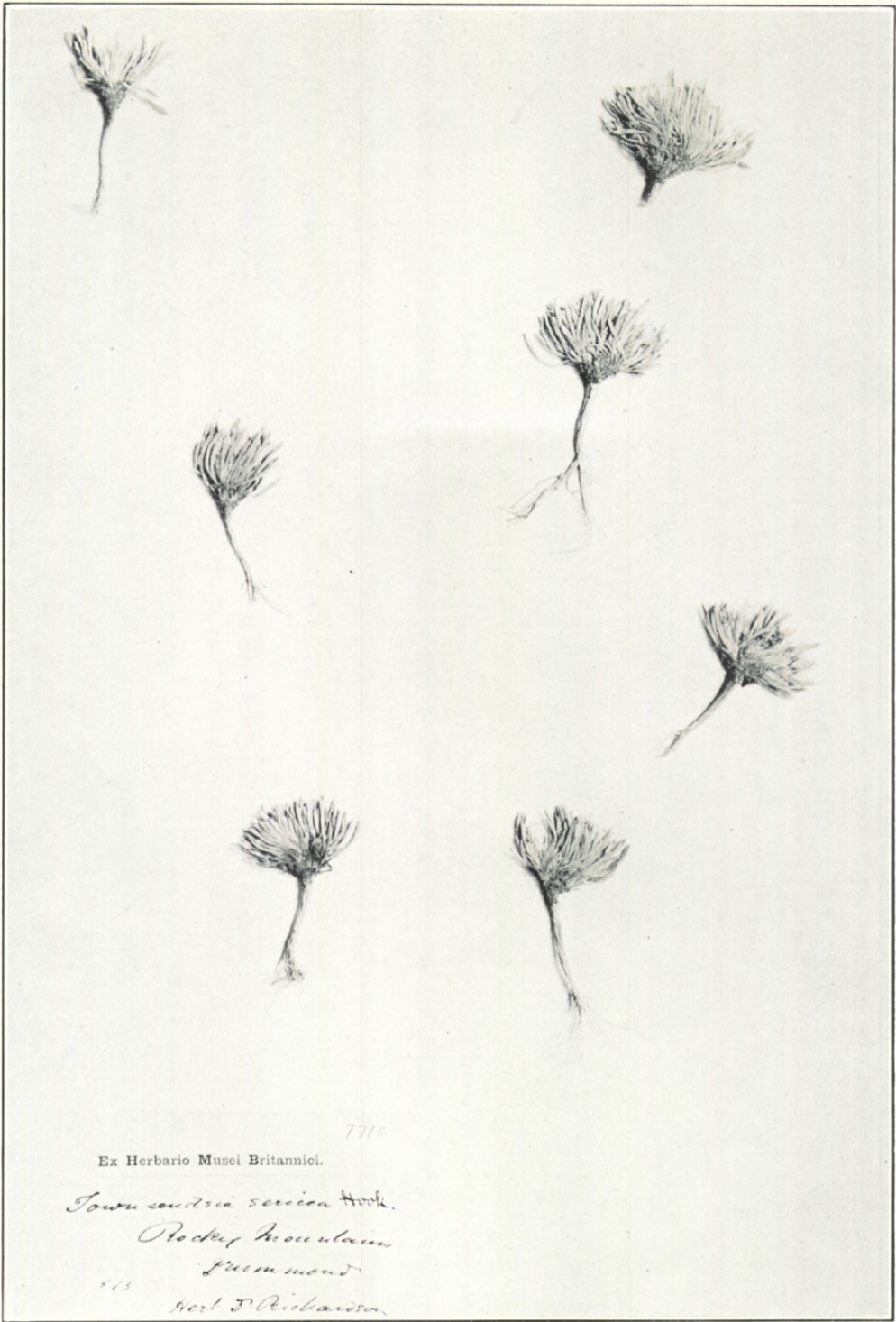
## EXPLANATION OF PLATE

## PLATE 6

*Townsendia sericea* Hook.

From a co-type, *Drummond*, in the National Herbarium of the Victoria Memorial Museum, Ottawa, Canada, No. 7710.





LARSEN—REVISION OF THE GENUS TOWNSENDIA



## EXPLANATION OF PLATE

## PLATE 7

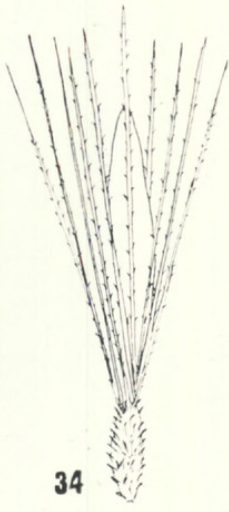
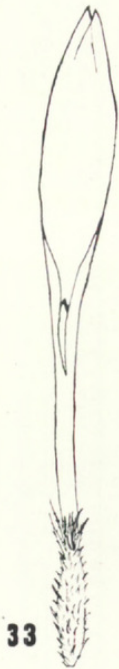
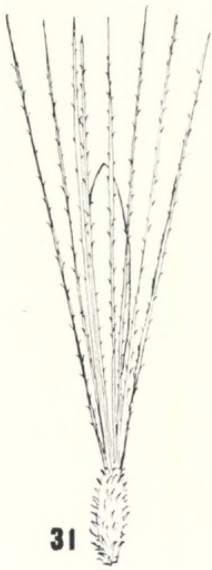
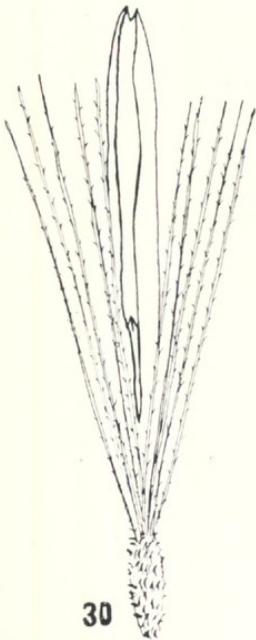
*Townsendia exscapa* (Richards.) Porter.

- Fig. 29. Photograph of type specimen in Kew Herbarium.  
Fig. 30. Ray-flower,  $\times 5$ .  
Fig. 31. Disk-flower,  $\times 5$ .

*Townsendia sericea* Hook.

- Fig. 32. Photograph of type specimen in Kew Herbarium.  
Fig. 33. Ray-flower,  $\times 5$ .  
Fig. 34. Disk-flower,  $\times 5$ .





LARSEN—REVISION OF THE GENUS TOWNSENDIA





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