

TAXONOMIC SUMMARY OF *HETEROTHECA* (ASTERACEAE: ASTEREAE): SECT. *CHRYSANTHE*

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ABSTRACT

A taxonomic overview of *Heterotheca* sect *Chrysanthae* includes 49 species. Fourteen new species are described: ***Heterotheca excelsior*** Nesom, **sp. nov.**, ***Heterotheca fulciens*** Nesom, **sp. nov.**, ***Heterotheca hartmanii*** Nesom, **sp. nov.**, ***Heterotheca incensa*** Nesom, **sp. nov.**, ***Heterotheca inflata*** Nesom, **sp. nov.**, ***Heterotheca joshuana*** Nesom, **sp. nov.**, ***Heterotheca komarekiae*** Nesom, **sp. nov.**, ***Heterotheca marcobakeri*** Nesom, **sp. nov.**, ***Heterotheca orovillosa*** Nesom, **sp. nov.**, ***Heterotheca postpetrinis*** Nesom, **sp. nov.**, ***Heterotheca scelionis*** Nesom, **sp. nov.**, ***Heterotheca schneideri*** Nesom, **sp. nov.**, ***Heterotheca utahensis*** Nesom, **sp. nov.**, and ***Heterotheca vespertina*** Nesom, **sp. nov.** Two new combinations validate earlier names for currently recognized species: ***Heterotheca hirsuta*** (Greene) Nesom, **comb. nov.** (replacing *H. barbata* and modifying its definition) and ***Heterotheca hirsutissima*** (Greene) Nesom, **comb. nov.** (replacing *H. horrida*). One replacement name is required: ***Heterotheca paniculata*** Nesom, **nom. nov.** (= *Chrysopsis floribunda* Greene, not *Heterotheca floribunda* Benth.). Nine new combinations validate names at specific rank in *Heterotheca*, drawn from species previously described in *Chrysopsis* and from taxa previously treated at varietal rank within *Heterotheca*: ***Heterotheca angustifolia*** (Rydb.) Nesom, **comb. nov.**, ***Heterotheca ballardii*** (Rydb.) Nesom, **comb. nov.**, ***Heterotheca cinerascens*** (Blake) Nesom, **comb. et stat. nov.**, ***Heterotheca cryptocephala*** (Woot. & Standl.) Nesom, **comb. nov.**, ***Heterotheca harmsiana*** (Semple) Nesom, **comb. et stat. nov.**, ***Heterotheca hispida*** (Hook.) Nesom, **comb. nov.**, ***Heterotheca pedunculata*** (Greene) Nesom, **comb. nov.**, ***Heterotheca resinolens*** (A. Nels.) Nesom, **comb. nov.**, and ***Heterotheca scabrifolia*** (A. Nels.) Nesom, **comb. nov.** A lectotype is designated for *Chrysopsis floribunda* Greene. Details of typification, a county-level distribution map, and at least a diagnostic description are provided for each species.

This study follows the treatment of sects. *Heterotheca* and *Ammodia* (Nesom, Phytoneuron 2019-64: 1–22. 2019), which gives an introduction, Acknowledgements, and Literature Cited for the whole series. A treatment of sect. *Phyllotheca* is in preparation.

Hopes of resolving several taxonomic problems in goldenasters by field and herbarium study in 2020 were nixed by the pandemic — the study is published in its present form to substantiate usage of names in floristic accounts. Modifications and additions probably will be made in the near future.

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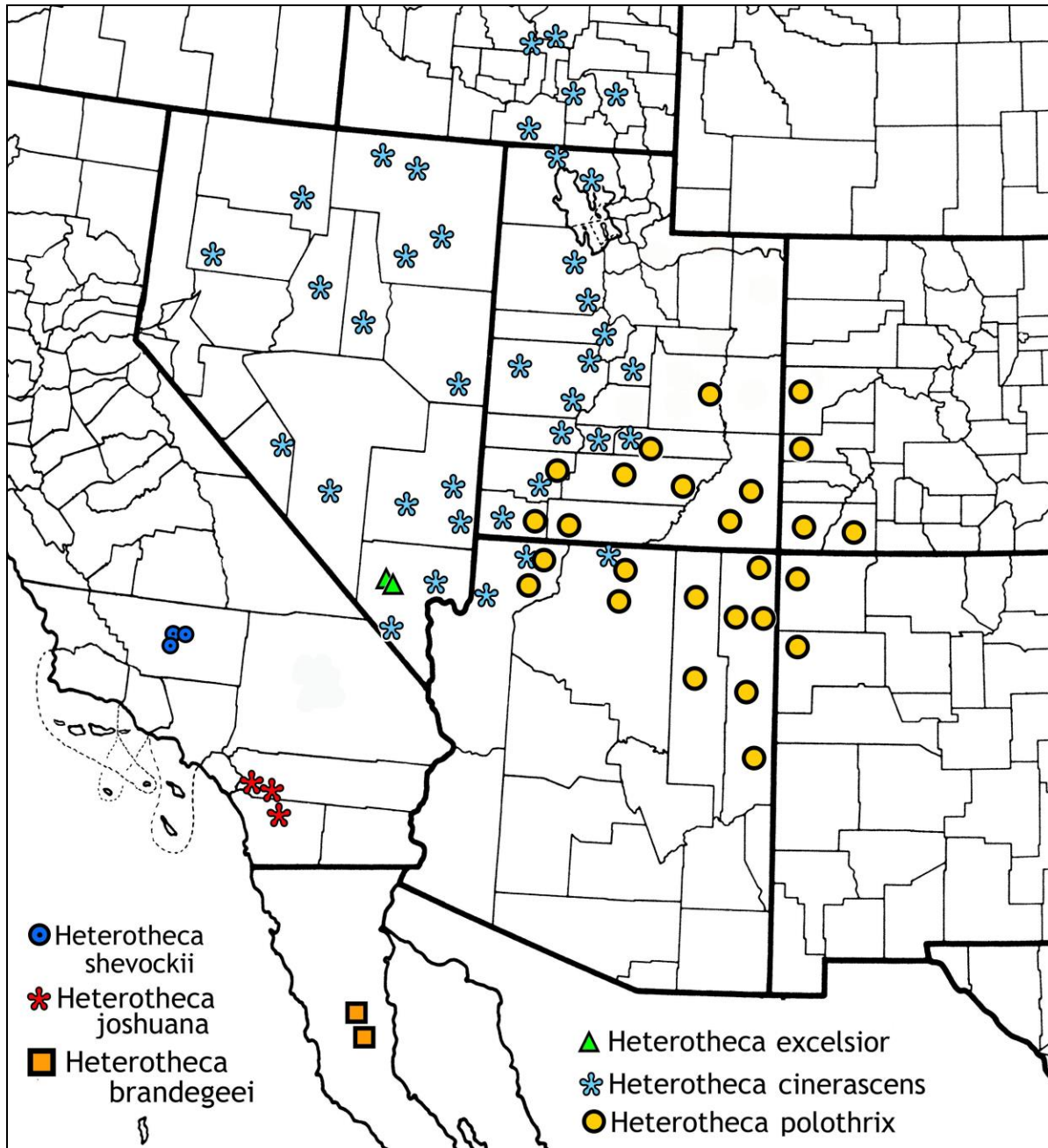
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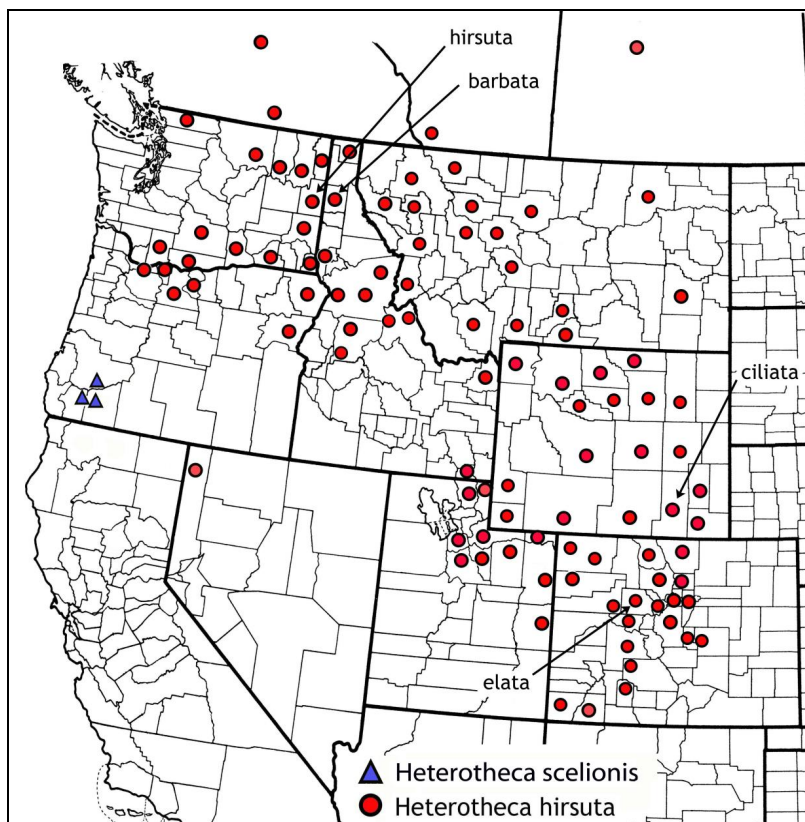
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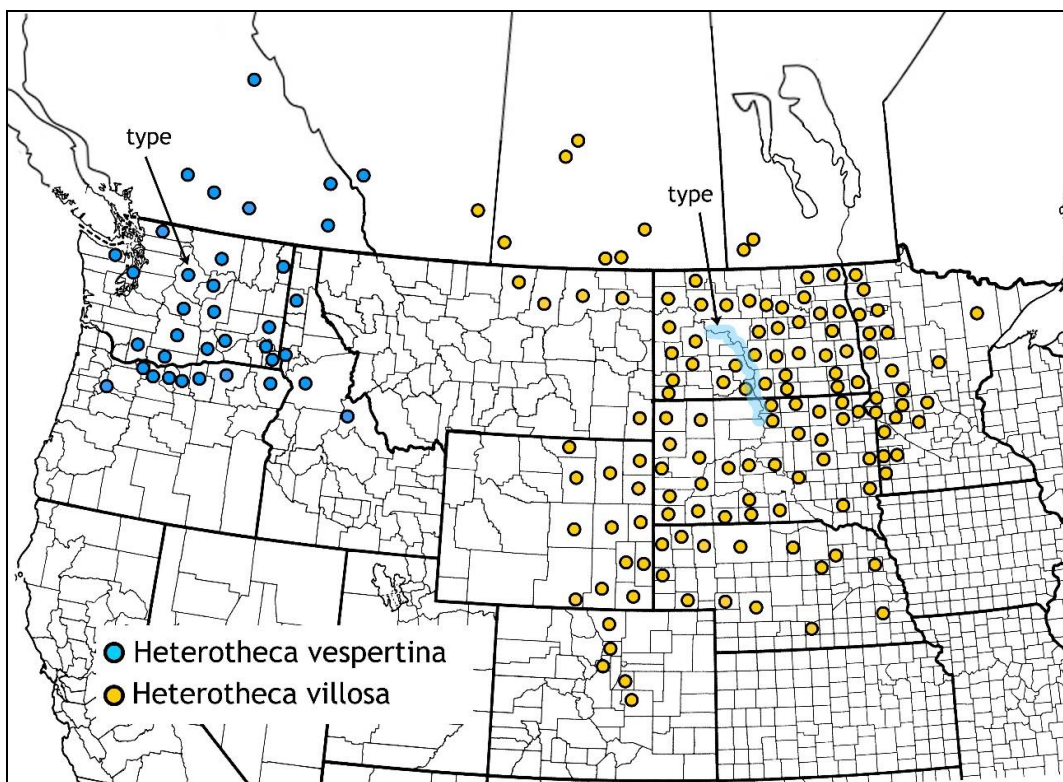
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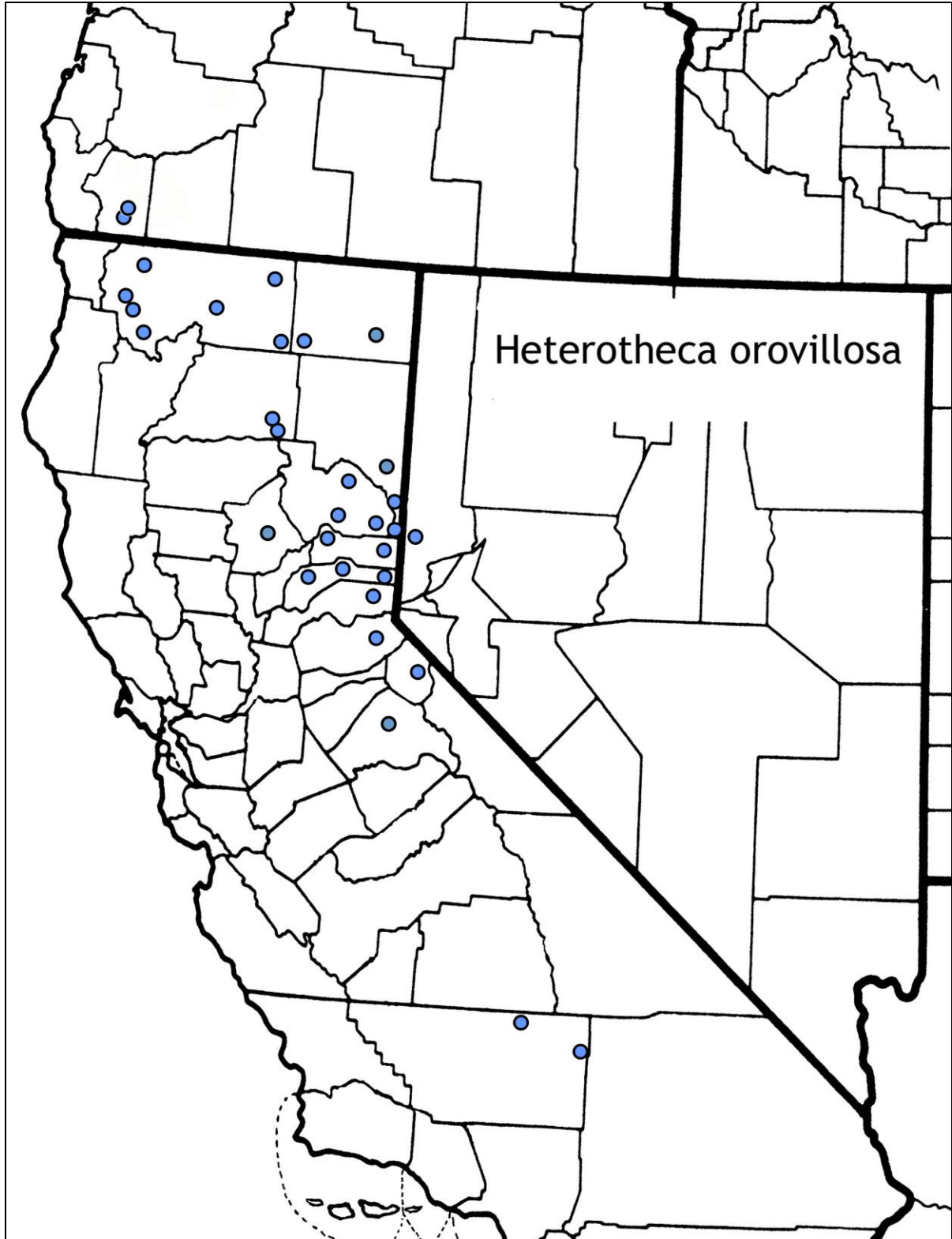
Map 1. Distribution of *Heterotheca* species.



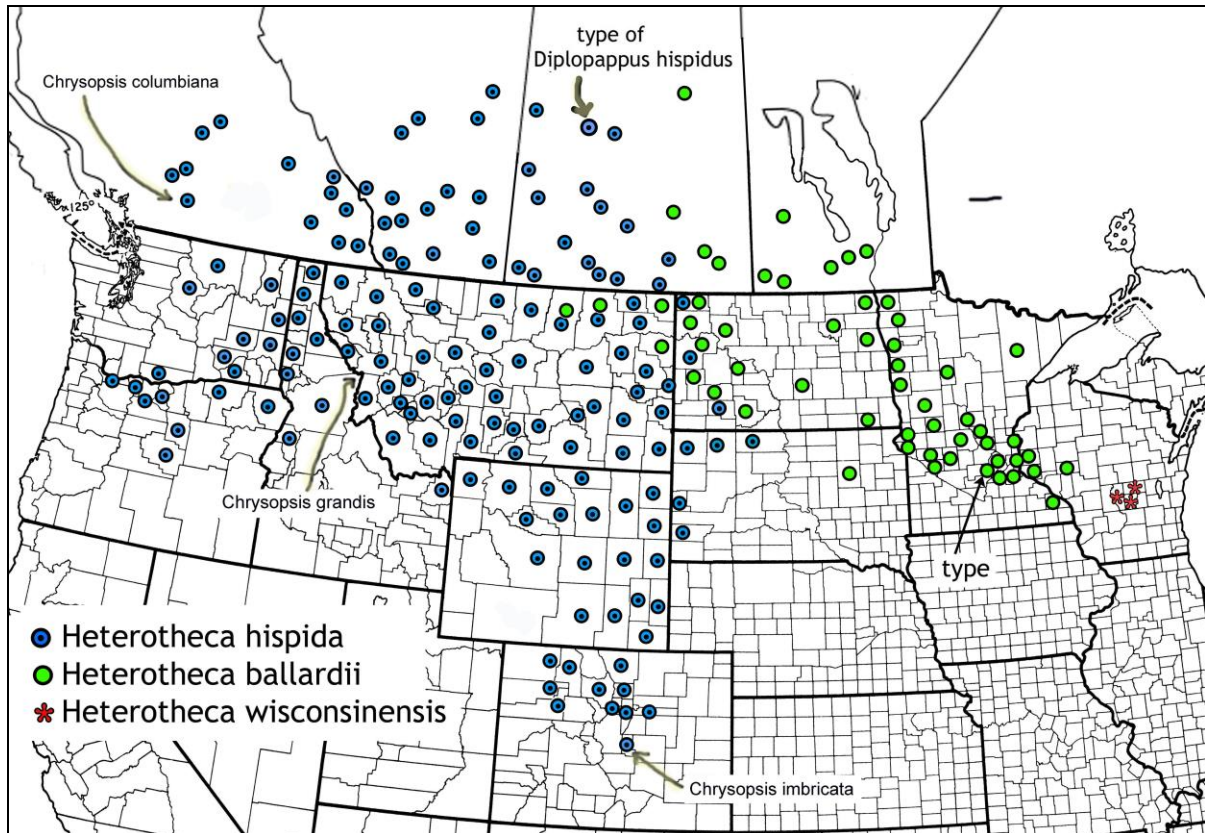
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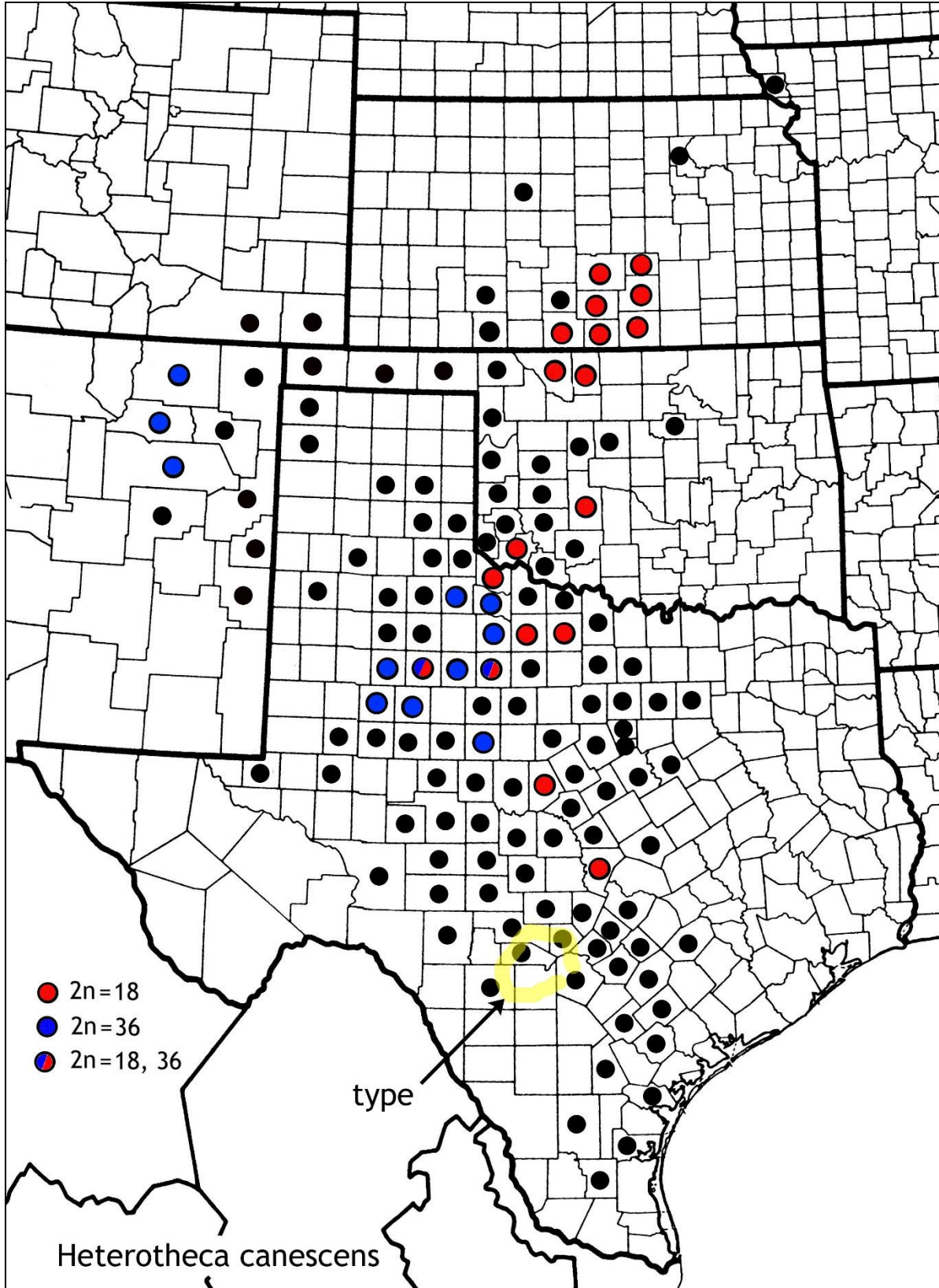
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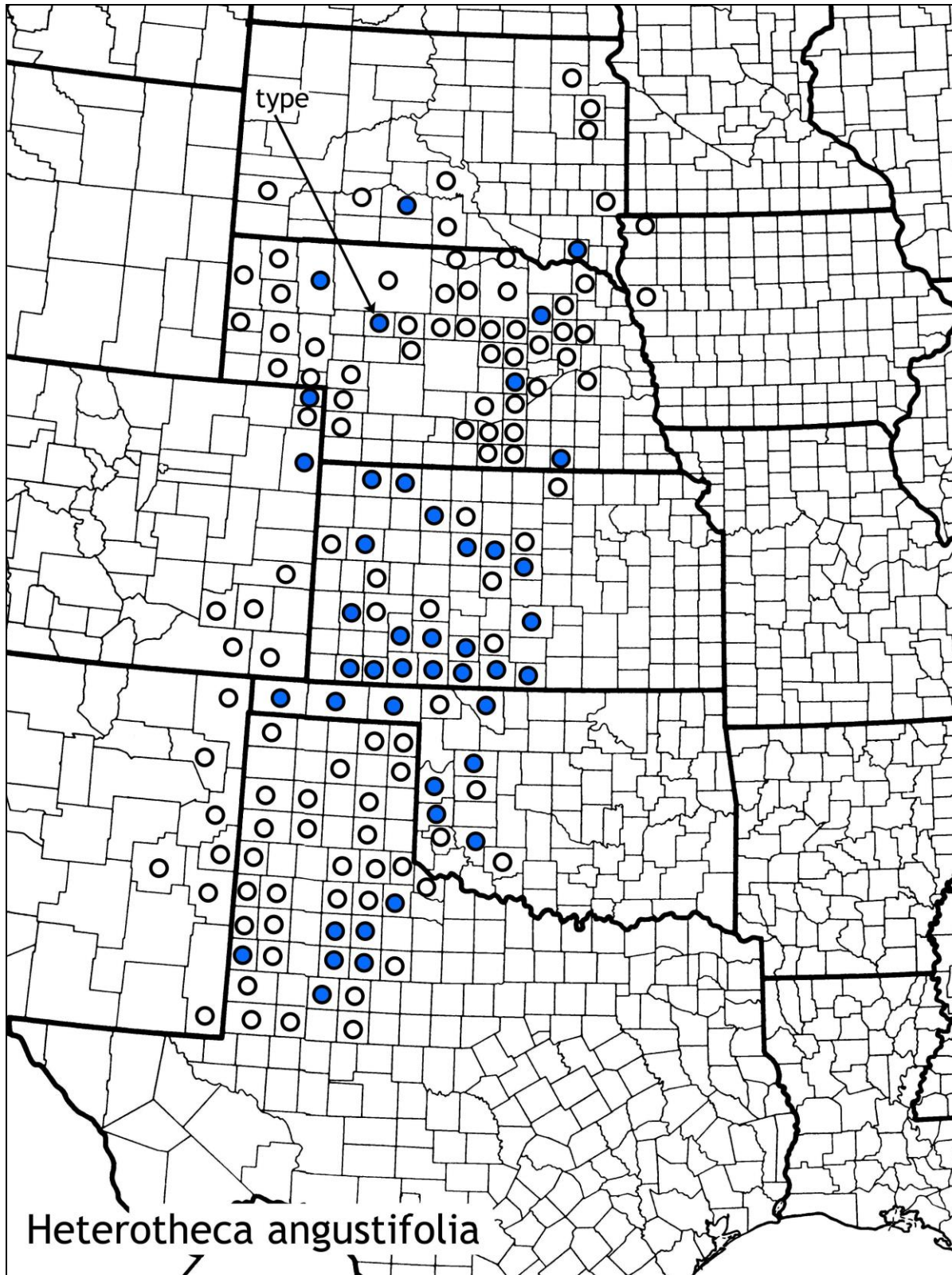
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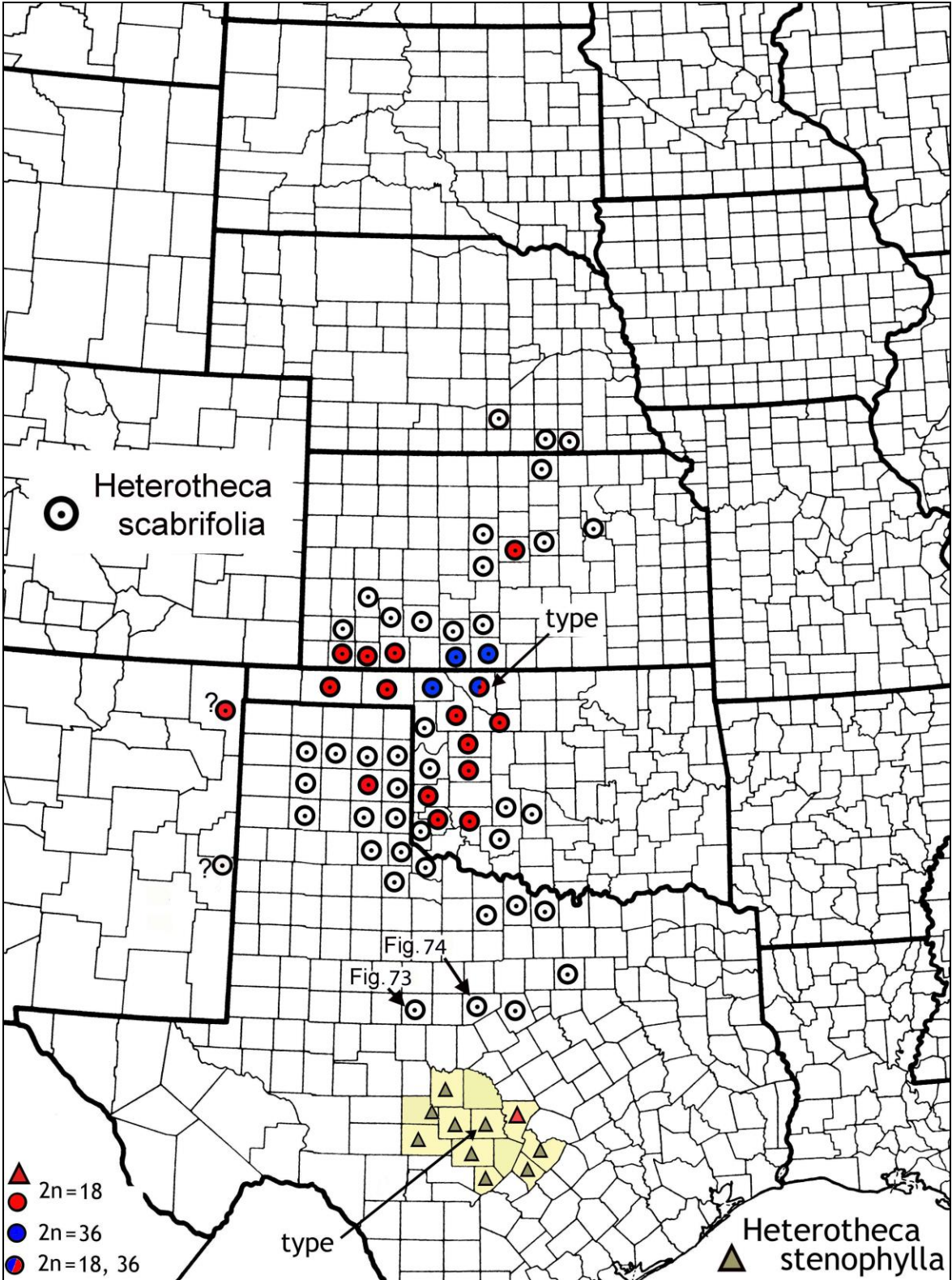
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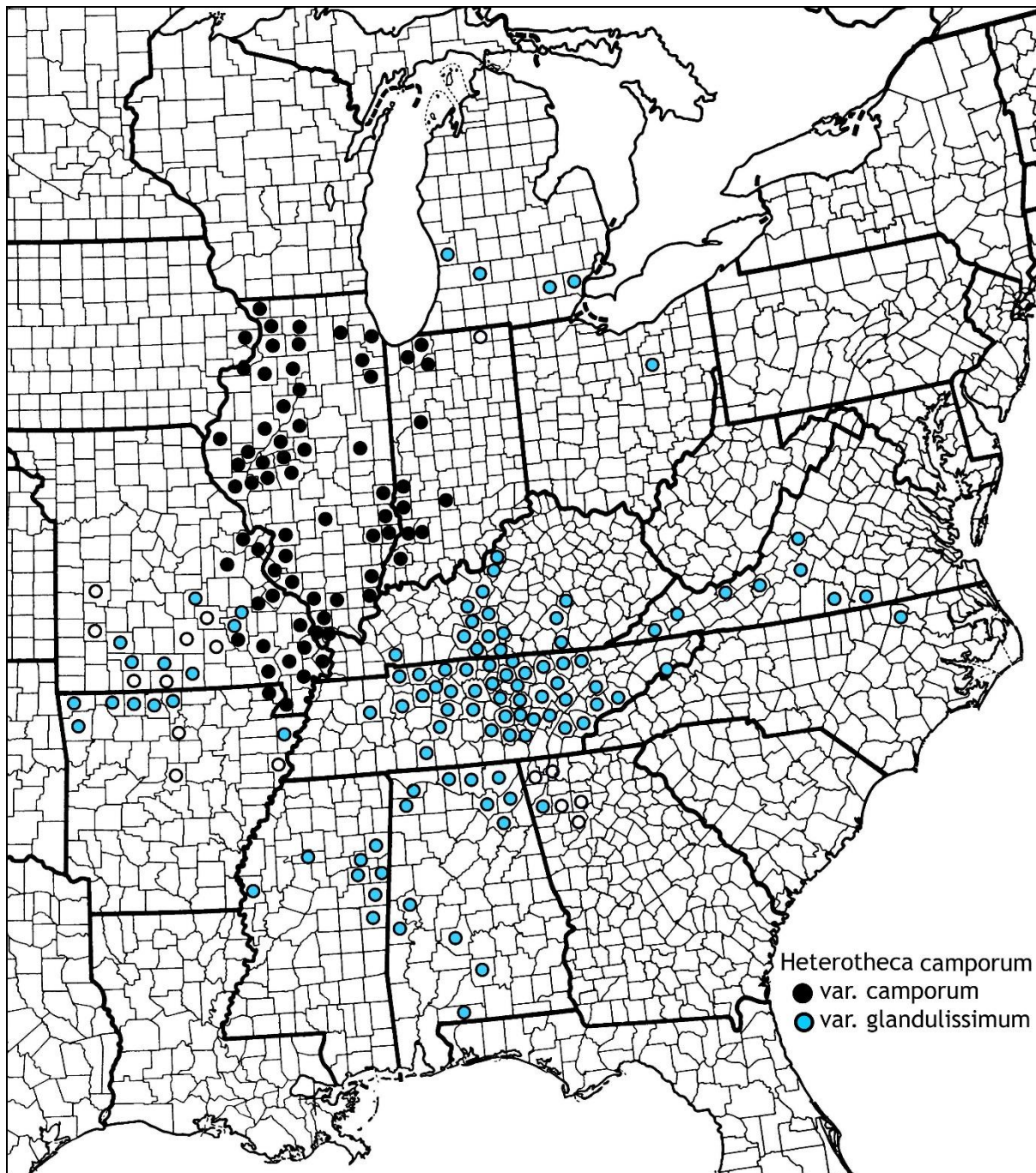
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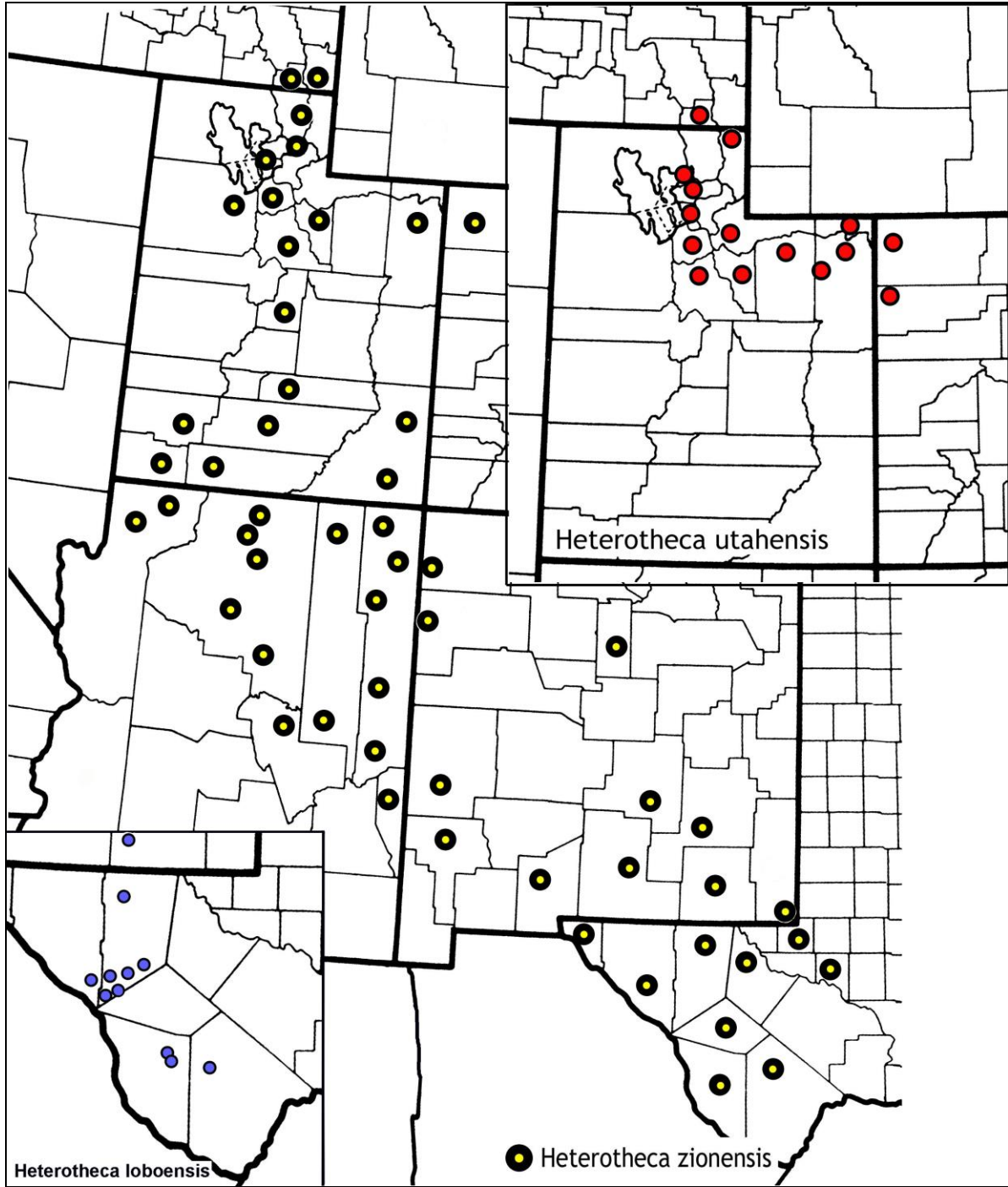
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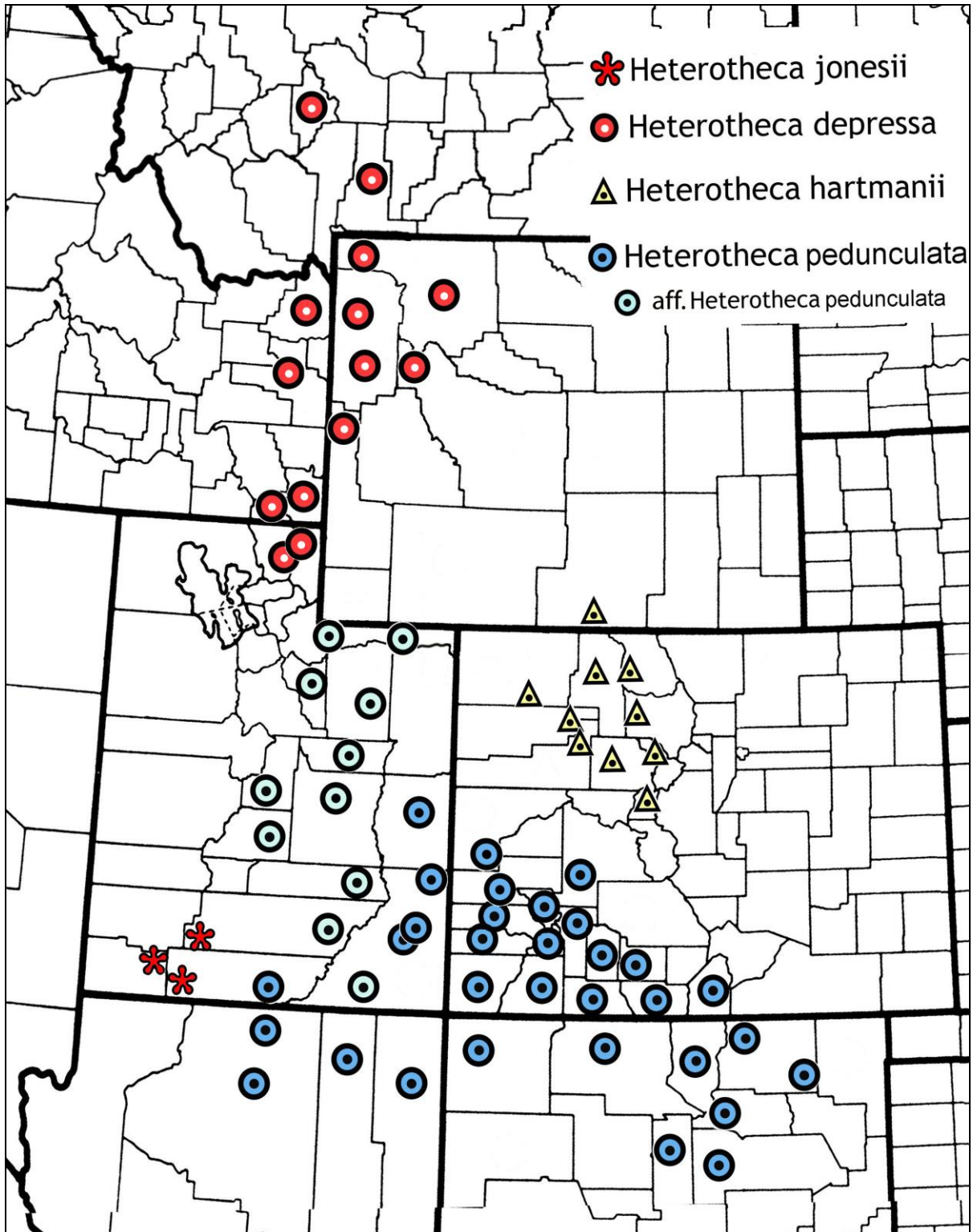
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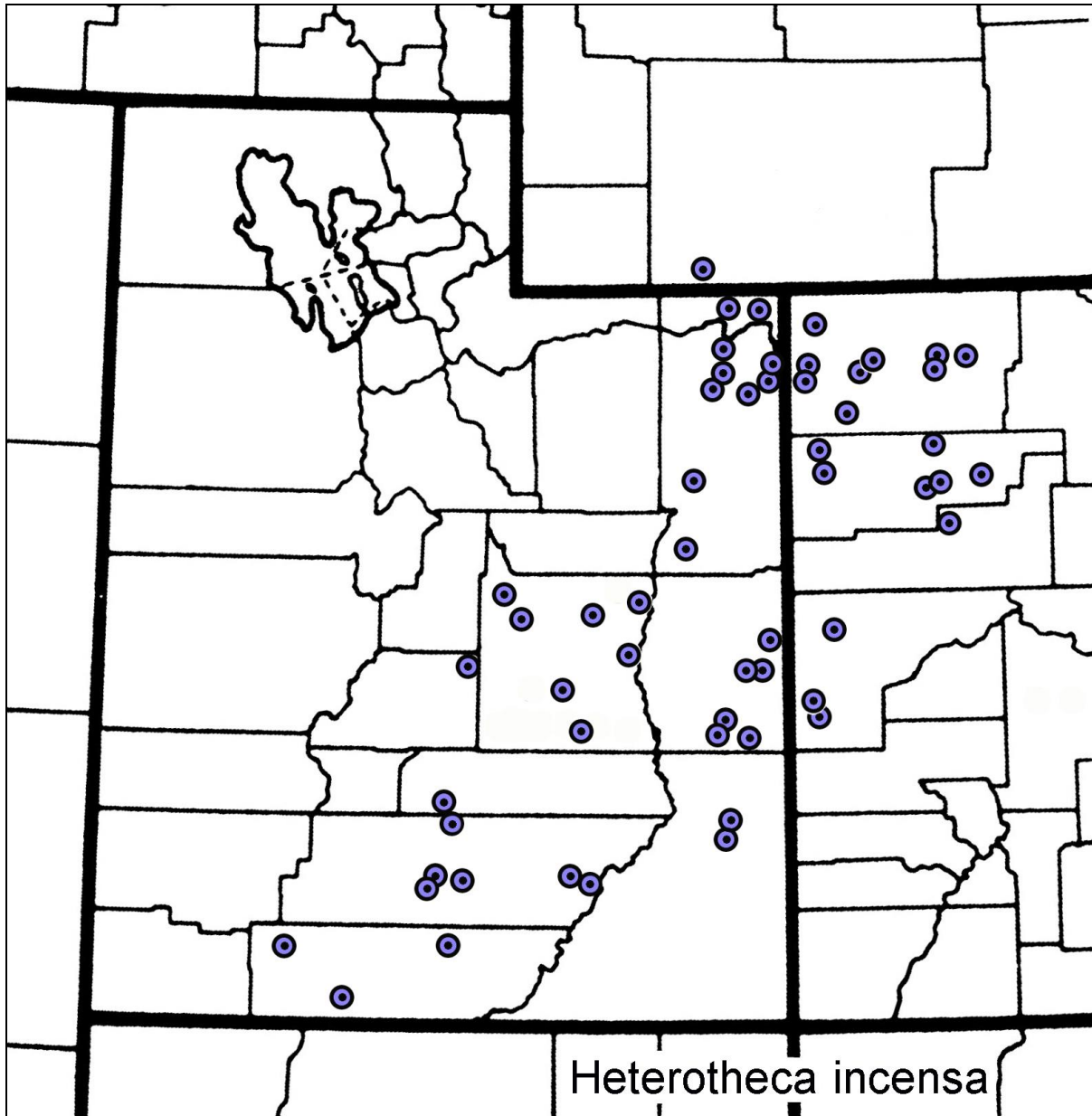
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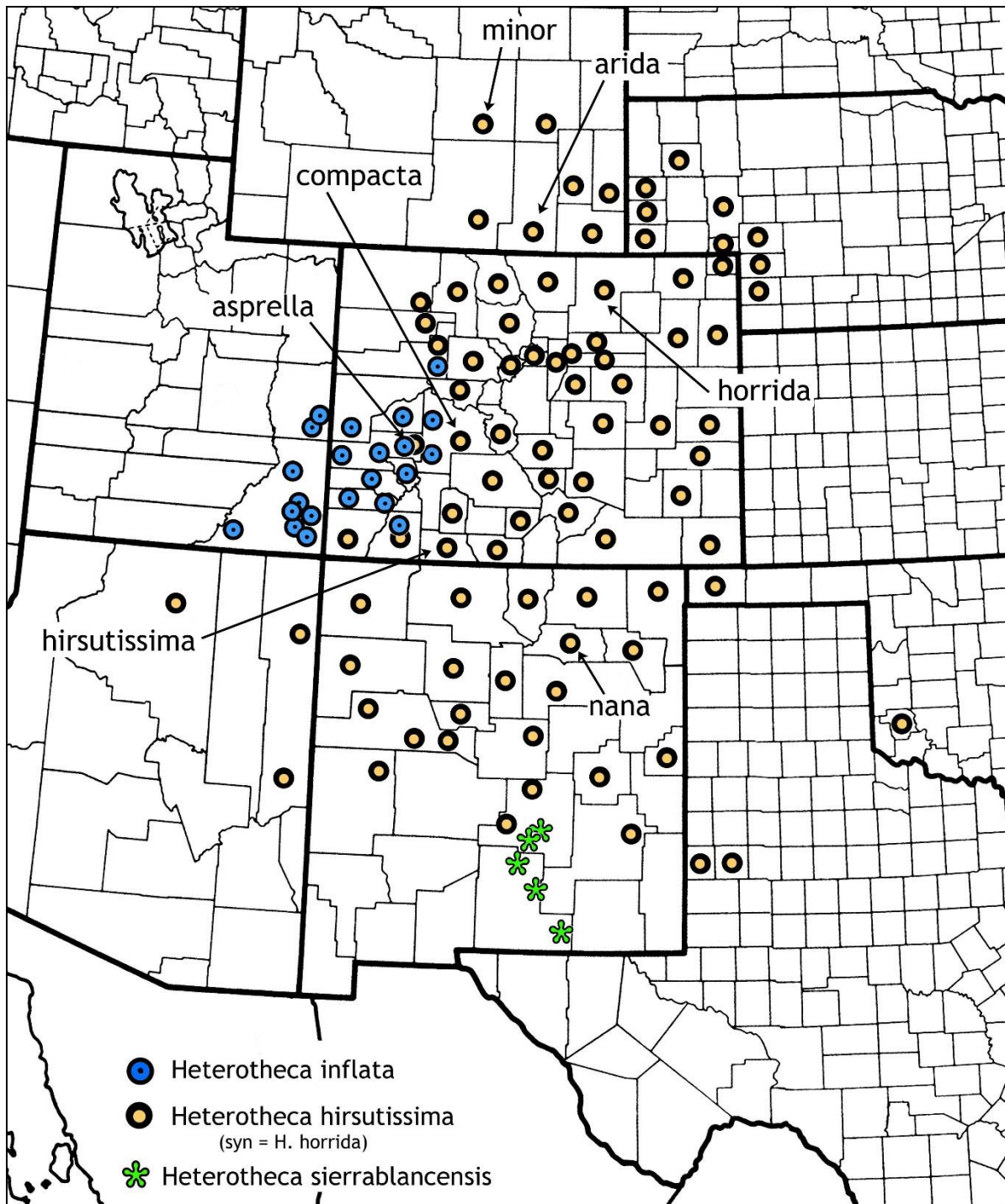
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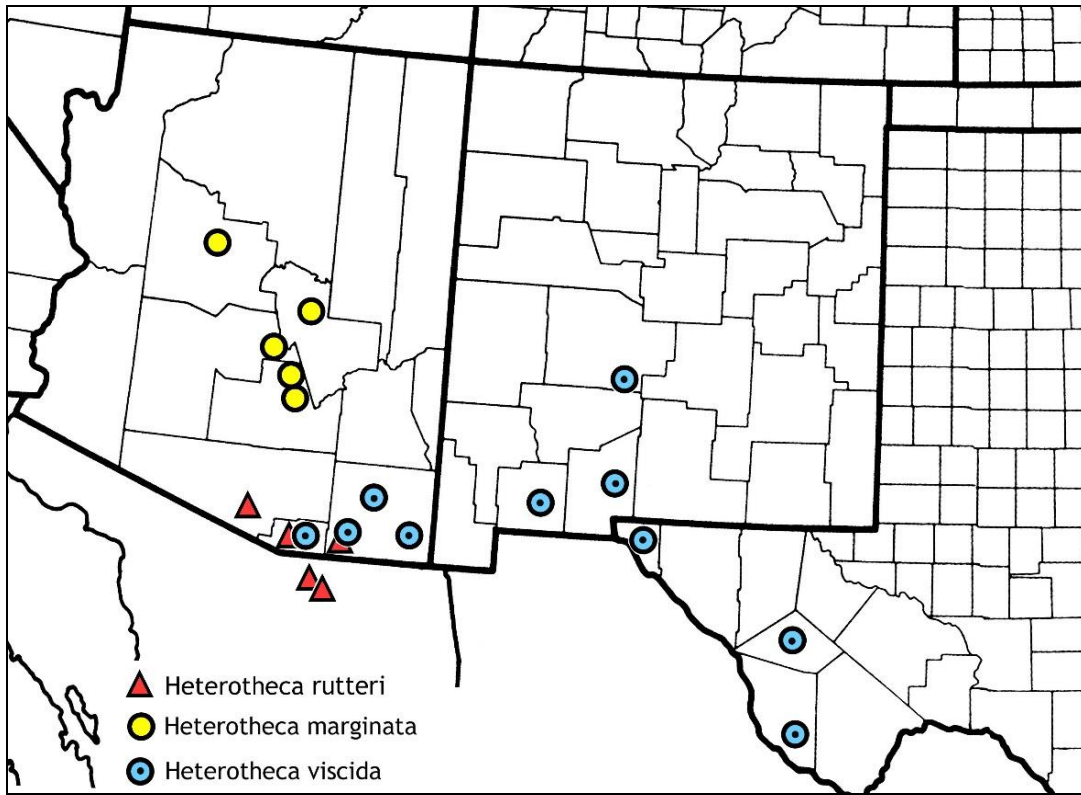
Map 11. Distribution of *Heterotheca* species. Symbols for *H. pedunculata* with lighter blue perhaps are a different species, yet undescribed. Also see text for comments on the "Uncompahgre variant" of *H. pedunculata*.



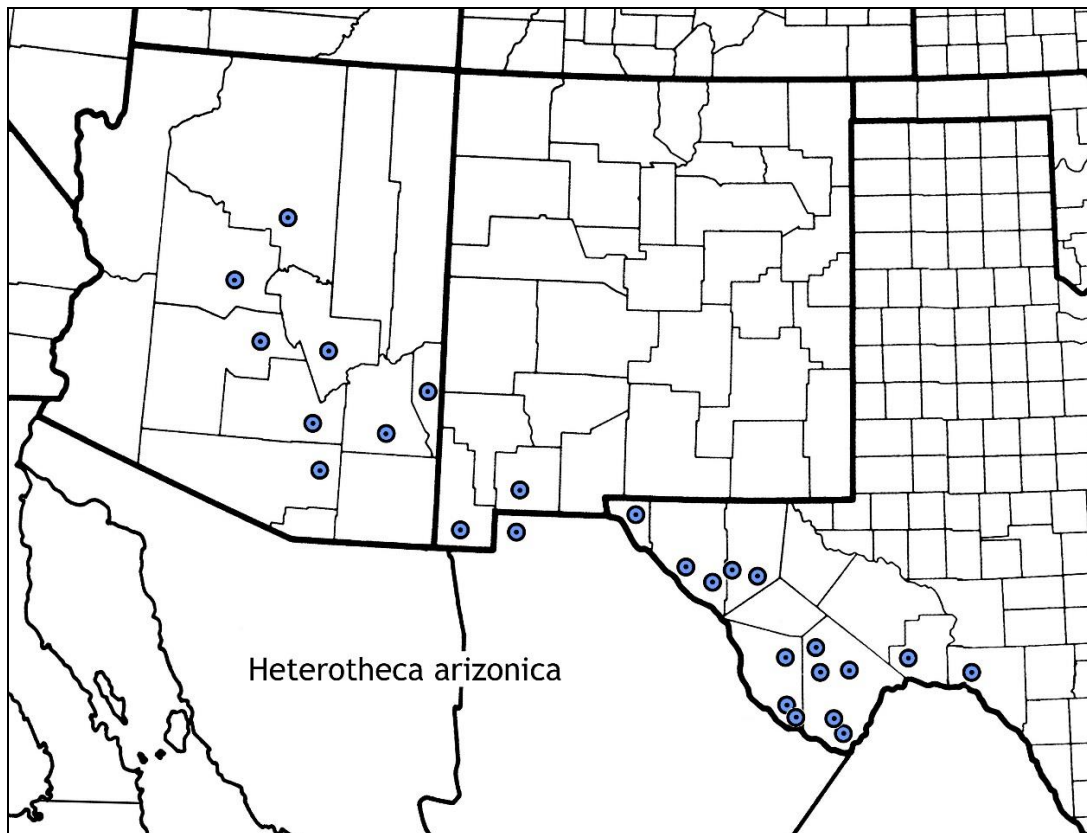
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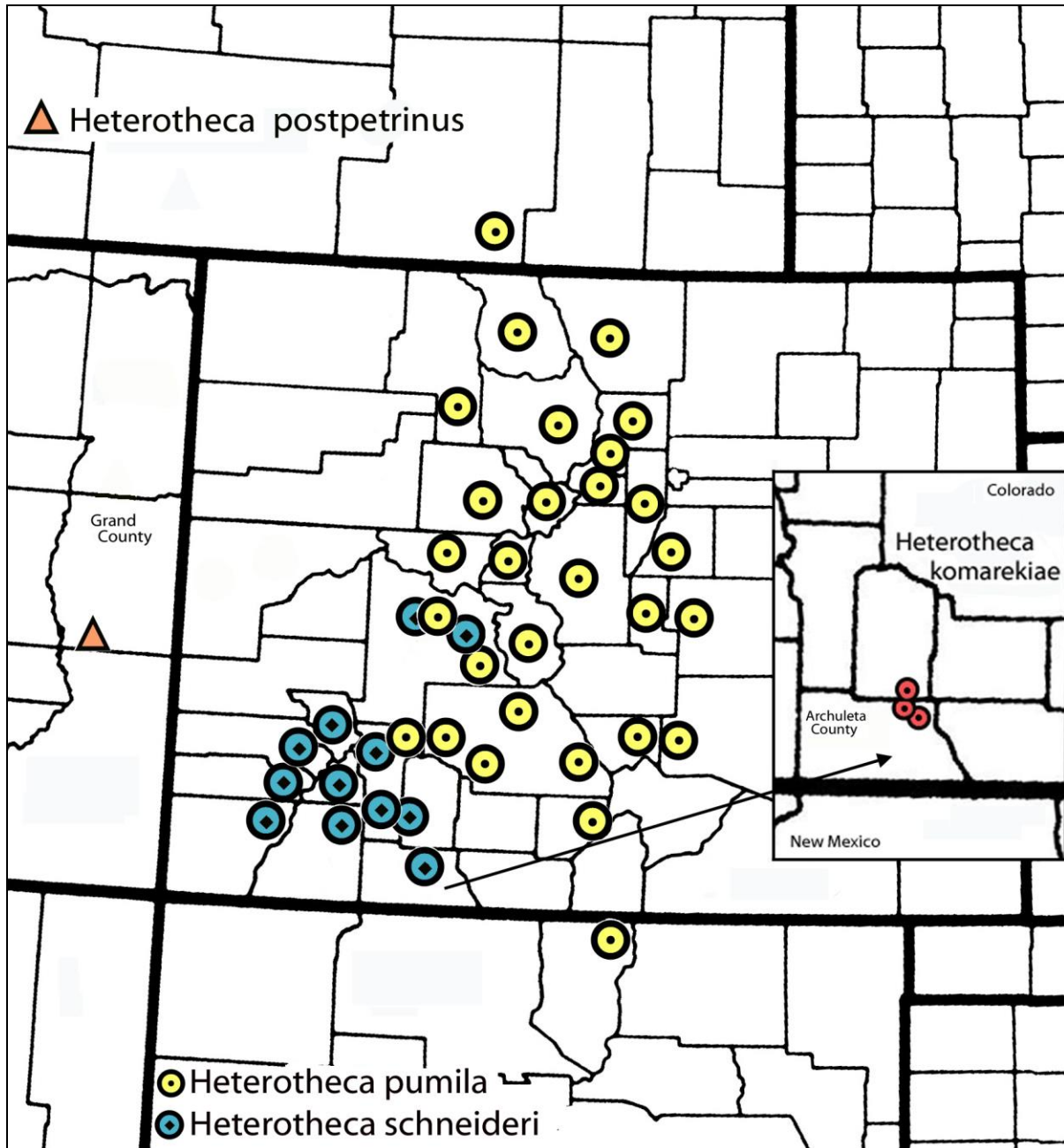
Map 13. Distribution of *Heterotheca* species. Names with arrows are types for *H. hirsutissima* and its synonyms. See text for comments on the disjunct locality in Oklahoma.



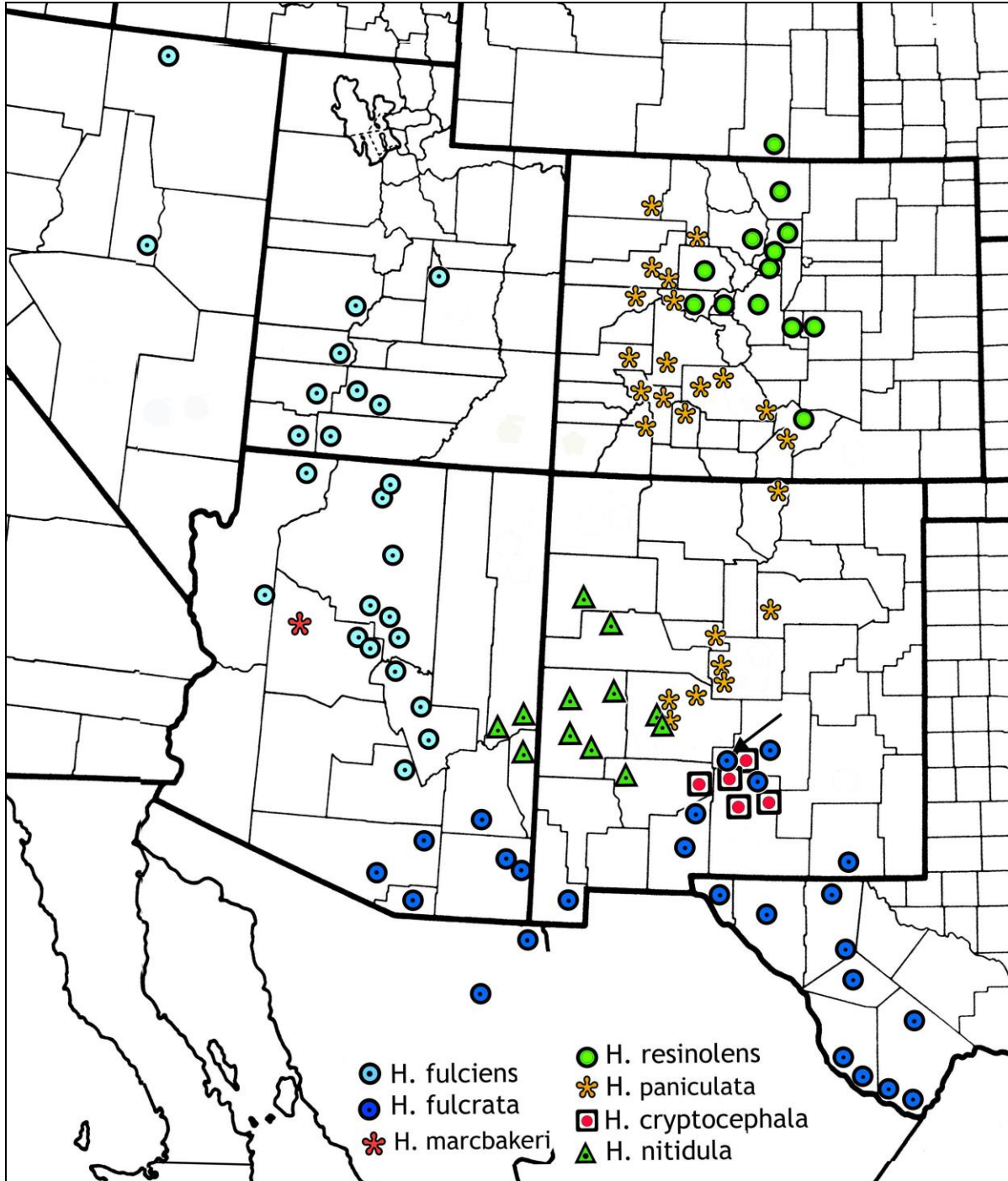
Map 14. Distribution of *Heterotheca rutteri*, *H. marginata*, and *H. viscida*.



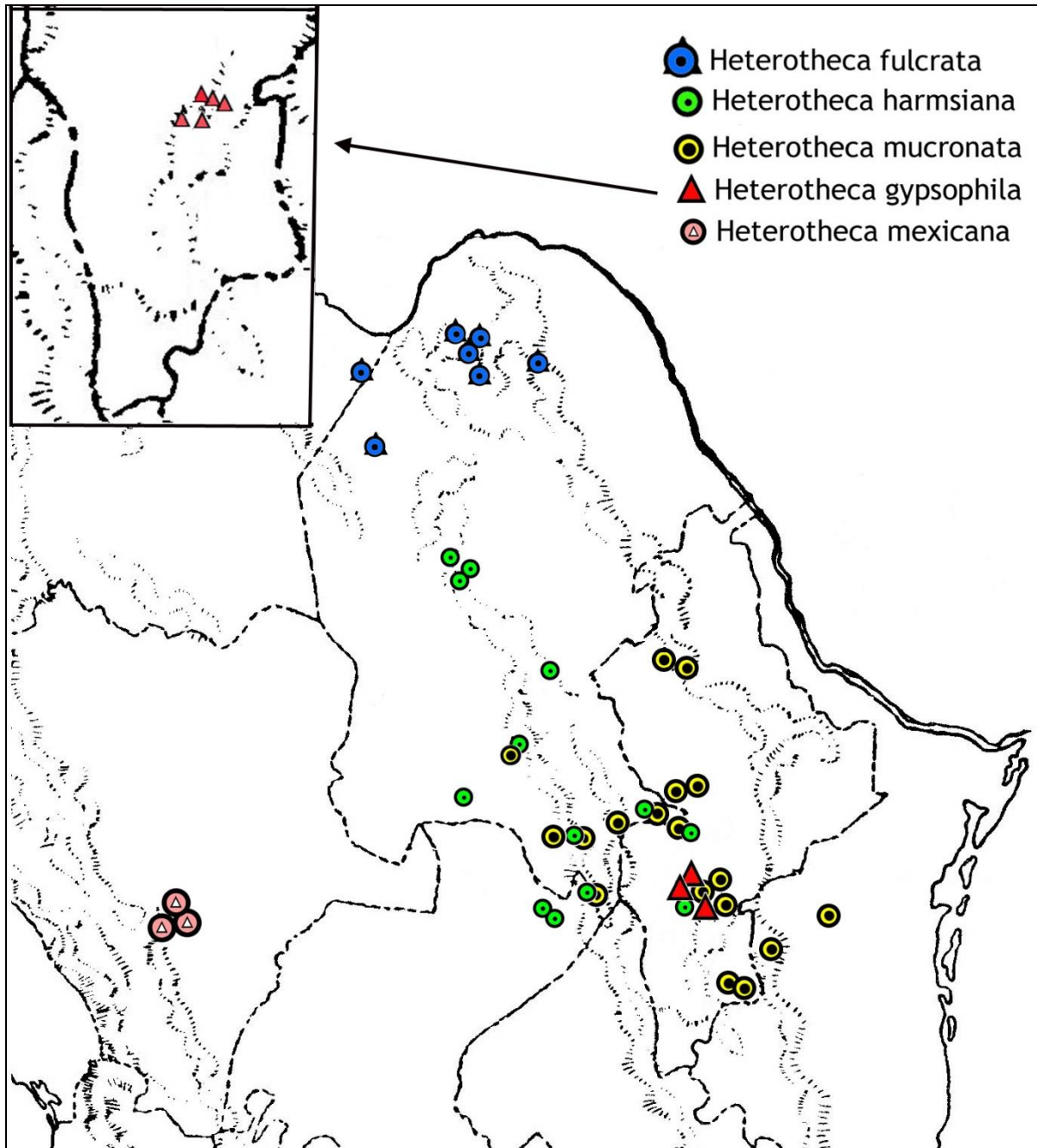
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Map 17. Distribution of *Heterotheca* species. Arrow points to the type locality of *H. fulcrata*.



Map 18. Distribution of *Heterotheca* species. The range of *H. fulcrata* in the USA is shown in Map 17.

HETEROTHECA SECT. **CHRYSANTHE** Nesom **TYPE:** *Heterotheca villosa* (Pursh) Shinnery

1. HETEROTHECA POLOTHRIX Nesom, Sida 22: 373. 2006 [as nom. et stat. nov.]. *Chrysopsis villosa* var. *scabra* Eastw., Proc. Calif. Acad. Sci. 2.6: 294. 1896. *Heterotheca villosa* var. *scabra* (Eastw.) Semple, Phytologia 73: 453. 1992. **TYPE: Utah.** San Juan Co.: Willow Creek, 14 Jul 1895, A. Eastwood 38 (holotype: CAS image!). Not *Heterotheca scabra* (Pursh) DC. 1836 = *H. subaxillaris*.

Stems and leaves usually distinctly green from reduced non-glandular vestiture. **Stems** erect, usually little branched until distal 1/3, prominently sessile-glandular, loosely strigose to hirsute-strigose, hirsute-villous, or hirsute, sometimes essentially without non-glandular hairs. **Leaves** relatively widely spaced, usually ascending, oblong to oblong-lanceolate to oblanceolate, distal lanceolate to triangular-lanceolate, acute at apex, surfaces moderately to densely sessile-glandular, the glands little obscured by the sparsely strigose (nonglandular) vestiture, non-glandular hairs often less dense abaxially, often restricted to midvein area (middle 1/3) of adaxial surfaces, or sometimes nearly absent on both surfaces. **Heads** characteristically solitary on unbranched stems or appearing solitary on long, sparsely reduced-bracteate peduncles 2–5(–10) cm, sometimes few in a loosely corymboid arrangement when peduncles shortest; involucre 10–13 mm wide; phyllaries sparsely to moderately strigose, eglandular or minutely sessile-glandular, not viscid. **Ray flowers** 12–27. **Chromosome number**, $2n=36$ (Semple & Heard 7895, Semple 8817, 8819, 8823, 8827, 8828, 8897, from Arizona, Colorado, and Utah).

Considerable variation occurs, but the characteristic form of the species occurs over the whole range. In northeastern Arizona, San Juan Co., Utah, and southwestern Colorado, stem vestiture of *Heterotheca polothrix* sometimes is antrorsely oriented and leaves have denser non-glandular vestiture, perhaps reflecting genetic influence of *H. pedunculata*. Some variants suggest gene exchange with *H. hirsutissima* where sympatric in the 4-Corners area.

In 2006, I included two species in the concept of *Heterotheca polothrix*, the typical expression (as in the present study) and *H. cinerascens* (recognized here as a distinct species). Semple (1987) first recognized the 'cinerascens' plants as distinct (as *H. horrida* subsp. *cinerascens*, from "western Utah and Nevada") but later (1996) included them as part of *H. villosa* var. *scabra*. The ranges of *H. cinerascens* and *H. polothrix* overlap slightly in southwestern Utah.

a. Phyllaries glandular or mostly eglandular, sparsely strigose with non-glandular hairs; cauline leaves commonly widely spaced, ascending, grading gradually into peduncular bracts; heads usually solitary on long, sparsely reduced-bracteate peduncles or few in a loosely corymboid arrangement; leaves often with adaxial and abaxial surfaces distinctly different in vestiture, the adaxial more densely glandular and less densely hirsute-strigose 1. **Heterotheca polothrix**

a. Phyllaries completely glabrous or minutely glandular and resinous-viscid, without non-glandular hairs; cauline leaves and bracts often closely spaced, often overlapping, commonly spreading to deflexed, usually abruptly reduced and becoming bracteate distally; heads usually numerous in a corymboid arrangement, peduncular bracts characteristically continuing to immediately below heads; leaves densely and evenly sessile-glandular on both surfaces 3. **Heterotheca cinerascens**

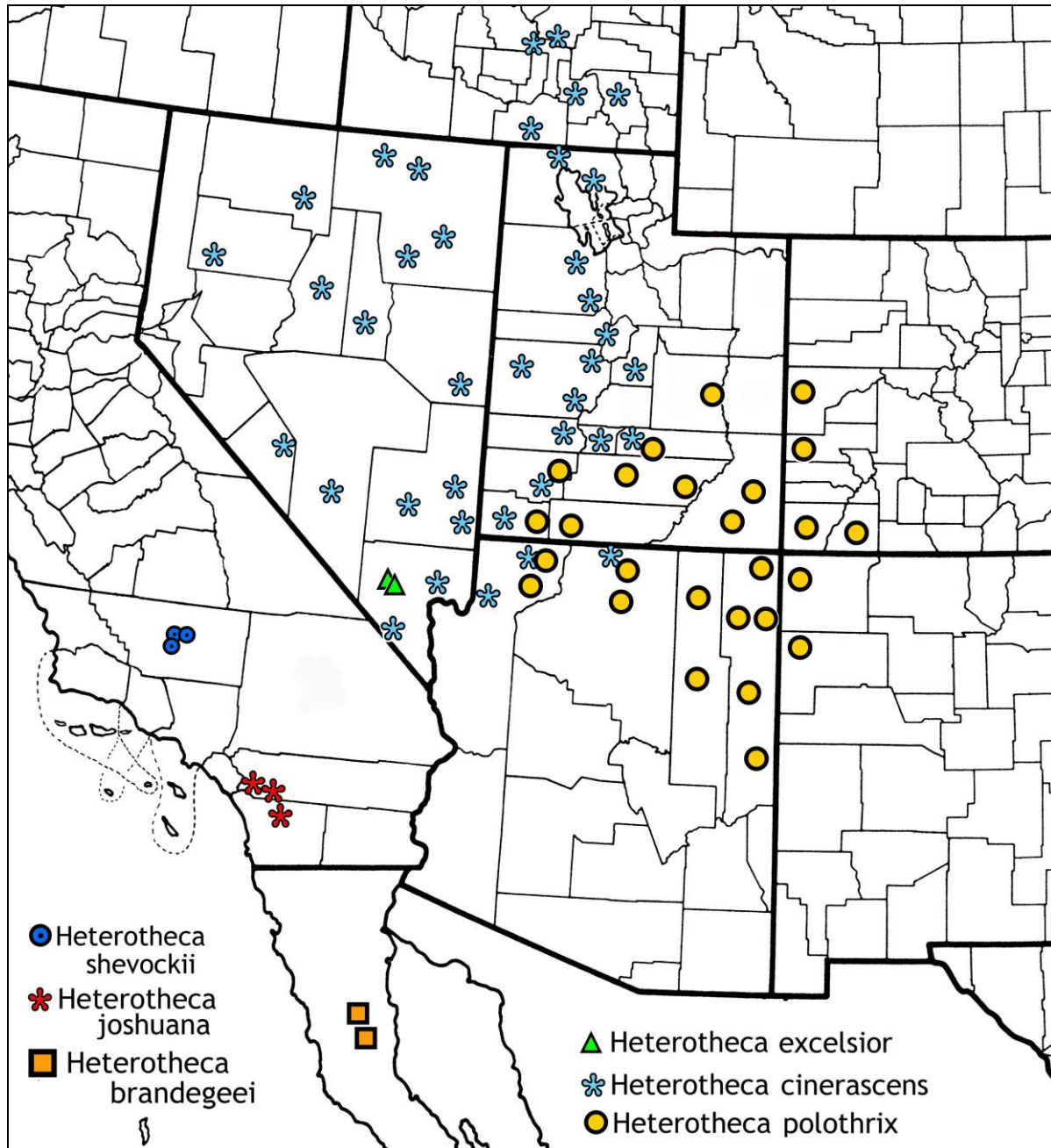


Figure 1. Distribution of *Heterotheca shevockii*, *H. joshuana*, *H. brandegeei*, *H. excelsior*, *H. cinerascens*, and *H. polothrix*.



Figure 2. *Heterotheca polothrix*, holotype (= *Chrysopsis villosa* var. *scabra*).



Figure 3. *Heterotheca polothrix*, McKinley Co., New Mexico.

Representative collections examined. **Arizona.** Apache Co.: Carrizo Mts, E. slopes, White Silver Mine Road, 7000-7500 ft, 26 May 1990, *Clifford AC-49* (BRY); Canyon de Chelly Natl Monument, 5700 ft, 13 Sep 1955, *Demaree 38385* (SMU); Hubbel Trading Post, Ganado, scattered across irrigation fields and ditches, 6300 ft, 2 Jul 1986, *Gandhi 220* (BRIT). Coconino Co.: Colorado River, Lees Ferry, River Mile 0, 2 May 1976, *Arnott 1994* (BRIT); Vermilion Cliffs Natl Monument, headwaters of Soap Creek above Cliff Dweller's Lodge, desert shrub, 6372 ft, 21 May 2003, *Atwood et al. 29266* (BRY); Navajo Mtn, 8000 ft, *Clute 38* (RM); San Francisco Mts near Clifton, 1 Nov 1880, *Greene 12856* (MO); Vermilion Cliffs Natl. Mon., 1570 m, 16 Jun 2003, *Higgins & Atwood 24673* (BRY); N side of Lee's Ferry, sandstone crevices, 7 Jul 1927, *Jaeger s.n.* (POM); 50 mi S of Lee's Ferry, 12 Jun 1890, *Jones s.n.* (POM); Grand Canyon, 7000 ft, 28 Jun 1898, *MacDougal 177* (RM); Cape Royal, N side of Grand Canyon, 7876 ft, 15 Jul 1927, *Peirson 7420* (RSA); halfway between Cameron and Desert View, Hwy 64, 15 Oct 1937, *Ramsey 2857* (RSA); 9.6 km E of Jacob Lake on US 89-Alt, pine woods, 12 Sep 1985, *Semple & Heard 7895* (MO). Mohave Co.: Near Robinson reservoir, T36N, R5W, S21, 12 Jun 1979, *Coombs & Bundy 2826* (BRY); Cottonwood Spring, T42N, R6W, S34, 5 Oct 1978, *Gierisch 4548* (BRY); Grand Canyon NP, Twin Springs Canyon, Redwall Narrows, beginning of perennial flowing water, 3080 ft, 28 Aug 2008, *Rink 8126* (BRY). Navajo Co.: 3.0 mi W of Boot Mesa, unnamed canyon drainage from N Todicheenie Bench, base of sandstone walls and talus slopes, 5600 ft, 23 Sep 2001, *Clifford & Heil 01-1314* (BRY); Holbrook, 18 Aug 1896, *Zuck s.n.* (MO). **Colorado.** La Plata Co.: ca. 10 mi N of Durango along US 550, ca. 2020 m, 24 May 2000, *King & Garvey 11292* (BRIT, MO, NY). Mesa Co.: Ca. 5 air mi NE of Gateway, dry wash and adjacent hillsides, pinyon-juniper, 5500 ft, 16 May 1994, *Lyon 3150* (RM); Gateway Nature Area N of Gateway between Colo Hwy 141 and Dolores River, base of N-facing Wingate cliff, 30 Aug 2010, *Yeatts 5953* (BRY, COLO, KHD). Montezuma Co.: Mesa Verde Natl Park, 8 Jul 1929, *Mathias 639*, mixed with *H. pedunculata* (PH). Montrose Co.: Western Montrose Co., bedrock, 5000 ft, 14 Jul 1924, *Payson 3922* (RM). **New Mexico.** McKinley Co.: Mesa between Peach Spring and Red Mesa canyons, rolling hills, sandy soil, ca. 6700 ft, 10 Sep 1976, *Wagner 2017* (UNM image!). San Juan Co.: 3 mi E of Farmington, alluvium of San Juan River, 31 Aug 1961, *Cannon s.n.* (UNM). **Utah.** Emery Co.: 10 mi W of Greenriver along I-70, roadside, 4700 ft, 11 Sep 1986, *Atwood 12432* (NY); Range Creek Canyon, ca. 0.7 road mi S of jct of Turtle Canyon and Range Creek roads, sandy loam with *Tamarix* and *Populus*, 4660 ft, 29 Jun 2007, *RCC 2007-27* (UT). Garfield Co.: 18 mi S of Notom Hwy 24 jct and ca. 2 mi N of Cedar Mesa Camp Ground road, pinyon-juniper, 1700 m, 15 Jun 1991, *Atwood 15588* (ID-2 sheets); ca. 3 mi N of Bakers Ranch, large side canyon just S of Millers Canyon in Halls Creek drainage, 4000-4500 ft, 30 May 1977, *Camp 25* (WTU); jct Calf Creek and Escalante River, sandy soil, 6000 ft, 21 Jun 1957, *Cottam 14687* (WTU); N of Escalante, sandy draw, 5900-6100 ft, 19 Jun 1938, *Pennell & Schaeffer 21963* (PH). Utah Hwy 95, vicinity of Hog Spring picnic area, just W of Glenn Canyon Natl Rec. Park, washes and ditches, 16 Jun 1987, *Semple 8819* (MO); Utah Hwy 12, 1 km S of Boulder, cracks in checkerboard sandstone, 16 Jun 1987, *Semple 8823* (MO); N of Escalante on Hells Backbone Bridge road, extensive rock outcrop below and E of road, common in sandy pockets, 16 Jun 1987, *Semple 8827* (BRIT); ca. 0.5 km NW of Hell's Backbone Bridge, ponderosa pine, 18 Sep 1987, *Semple 8899* (MO). Iron Co.: Cedar Breaks, dry meadow, 10,000 ft, 17 Jul 1930, *Goodman & Hitchcock 1618* (DS). Kane Co.: Side branch of Clear Creek ca. 2 mi N of East Entrance to Zion Natl Park, 6200 ft, 21 Jun 1979, *Ertter 2871* (WTU); along Colorado River, 2 mi below and on opposite side from Lake Creek, Shock Trail Bar, 18 Apr 1957, *Gaines 841* (WS); 0.5 km E of E boundary of Zion Natl Park, 17 Jun 1987, *Semple 8828* (MO); Clay Creek, dry hillsides, 8100 ft, 11 Aug 1927, *Taylor T-11* (RM); 1 mi S of Hwy 89 on hill of Chinley Fm, pinyon-juniper, 1600 m, 10 May 1992, *Thorne & Zupan 10134* (BRY, RM). San Juan Co.: Canyon No. 2, 1936, *Buss s.n.* (RSA); 8 mi N of Blanding, dry creek bed, 22 Jun 1938, *Cutler 2348* (MO); 4 mi W of Blanding, among pinyons, 5600 ft, 11 Sep 1939, *Cutler 3044* (SMU); Navajo Mts, Navajo Indian Reservation, ca. 40 air mi NE of Glen Canyon Dam, ponderosa pine, 8200 ft, 3 Aug 1967, *Gentry 1787* (ID! image!, SMU, WTU); Roan Bailey Mesa, ca 22 mi N of Monticello, 26 May 1986, *Grimes 2950* (MO); 30 mi SSE of Moab, E of US 163 near Lisbon Valley, just W of Big Indian Valley, W-facing dip slopes on carbonate cemented sandstone and mudstones, 6000-7000 ft, Jul 1984, *Jones 21* (BRIT); Sierra La Sal, 5-6000 ft, May-Oct 1899, *Purpus 7017* (MO); SW of Blanding, 2.1 km W of US Hwy 191 on Utah Hwy 95, cliff face of road cut, 16 Jun 1987, *Semple 8817* (MO). Wayne Co.: Fruita, sandy slopes, 4500 ft, 2 May 1944, *Cottam 9279* (UT); Natural Bridge near Fruita, dry sandy wash,

7000 ft, 6 Apr 1934, *Harrison 7394* (KANU); ca. 5 mi N of Caineville, N Caineville Mesa, Emery sandstone, juniper-mtn mahogany, 6000 ft, 25 May 1986, *Kass 2295* (BRY, RM); Canyonlands Natl Park, Virginia Park, 11 Jun 1967, *Kleiner & Harper s.n.* (UT); Canyonlands Natl Park, Virginia Park, 8 Aug 1967, *Kleiner & Harper s.n.* (UT); Canyonlands Natl Park, Virginia Park Canyon, 8 May 1968, *Kleiner & Harper s.n.* (UT); near Capitol Reef Natl Monument, 10 mi SSE of Fruita, sandy soil in steep narrow canyon, 1500–1650 m, 9 Jun 1953, *McVaugh 14531* (SMU, VDB); ca 5 km S of Grover on Utah Hwy 12, 7900 ft, 18 Sep 1987, *Semple 8897* (BRY, MO); San Raphael Desert, sandy wash, 4500 ft, 7 Jul 1930, *Stanton 494* (UT); Capitol Reef Natl Monument, along meadows and orchards of Robber's Roost Farm, 5400 ft, 18 May 1956, *Vickery 571* (UT). Washington Co.: Zion Natl Park, valley floor of Zion Canyon near visitor center, pinyon-juniper, dry rocky slopes, 3800 ft, 15 Aug 1986, *Charlton 526* (OBI); Zion Natl Park, Zion Canyon, 1–3 Aug 1925, *Pilsbry s.n.* (PH).

2. HETEROTHECA EXCELSIOR Nesom, **sp. nov.** **TYPE: Nevada.** Clark Co.: Charleston Mts [= Spring Mts], Excelsior Canyon, sandy soil with *Pinus scopulorum*, *Salix*, 1200 m, 7 Sep 1941, *Clokey 8759* (holotype: MO 1293502!; isotypes: BRY-3 sheets!, CAS!, CM fide Seinet, CS fide Seinet, DS!, IDS-Fig. 6, LL!, MO-1293502!, NY-2 sheets!, PH-2 sheets!, POM!, RM-2 sheets!, SMU!, TENN-Fig. 5, TEX!, UC!, VDB!, WTU-2 sheets!).

Recognized by its long, unbranched, eglandular and loosely strigose stems, gradually reduced cauline leaves, and relatively small heads in a corymboid panicle. Similar to *Heterotheca polothrix* and *H. cinerascens* in its relatively large heads, eglandular stems, leaves glandular on both surfaces and with reduced non-glandular vestiture adaxially, and its southwestern USA geography. Similar to *H. polothrix* in its few-branched stems (below the inflorescence) but distinct in its branched inflorescence (vs. few-headed inflorescence), shorter stem vestiture, denser and finely strigose, non-glandular leaf vestiture (vs. hispid to hispid-hirsute or strigose-hirsute), and more densely imbricate phyllaries (vs. phyllaries in 3–4 series). Distinct from *H. cinerascens* in its non-glandular stem vestiture, ascending branches (vs. stiffly spreading) and rigid leaves, strigose phyllaries (vs. glandular, completely without non-glandular hairs), densely short-strigose leaf vestiture (vs. glandular and sparsely strigose or non-glandular hairs absent), lack of capitular bracts, and leaf apices without an indurate apiculum.

Stems apparently stiffly erect, 50–80 cm, unbranched until the distal 1/4–1/5, without axillary buds, loosely strigose to puberulent-strigose with upward-arching hairs, eglandular. **Leaves** (only cauline observed) oblong-ob lanceolate to oblong-elliptic or lanceolate, not twisted, gradually reduced in size upward, closely ascending to spreading, mid cauline 2–35 x 4–6 mm, longest (proximal) to 40 x 9 mm, bracteate in the inflorescence, surfaces finely and densely strigose with short, thin-based hairs, more densely so abaxially, densely and minutely sessile-glandular on both surfaces, more conspicuously so adaxially, margins eciliate or with a few, spreading cilia at the very base. **Heads** in a compact to loose corymboid panicle; capitular bracts absent; involucre 6–9 mm wide (pressed), inner phyllaries 5–6 mm long, phyllaries loosely and finely strigose, glandular on a dark patch near the apex, imbricate in 4–5 series, linear-lanceolate, scarious-margined. Ray florets 10–21. The 24 sheets of the type collection include about 38 stems, all relatively consistent in morphology, but there is enough variation in vestiture and leaf shape and distribution to indicate that they were taken from more than a single plant.

Flowering Aug–Oct. Pine woods in sandy soil, rocky (sandstone) sites, ca. 1200 m. Apparently endemic to Red Rock Canyon National Conservation Area. Clokey's "Excelsior Canyon" refers to the site of a sandstone quarry operated by Excelsior Company, which operated between 1905 and 1912. All three known localities (including Willow Spring and Pine Creek Canyon) are in an area within a radius of 1.5–2 miles (Fig. 4).

Additional collection: Clark Co.: Spring Mts, common perennial in rocky sites about Willow Spring, ca. 4000 ft, 4 Oct 1968, *Niles 855*, NY, UT-2 sheets-Figs. 7 and 8). And see photo from Pine Creek Canyon, Figs. 9 and 10.



Figure 4. *Heterotheca excelsior* localities, Red Rock Canyon National Conservation Area, Clark Co., Nevada. Excelsior Canyon, *Clokey* 8759 (the type); Willow Spring, *Niles* 855; Pine Creek Canyon, photo by Stan Shebs (see Figs. 9 and 10). Google Earth.



Figure 5. *Heterotheca excelsior*, isotype (TENN).



Figure 6. *Heterotheca excelsior*, isotype (IDS).



Figure 7. *Heterotheca excelsior*. Willow Spring area, in Red Rock Canyon National Conservation Area, Nevada. Niles 855 (UT 119848).



Figure 8. *Heterotheca excelsior*. Willow Spring area, in Red Rock Canyon National Conservation Area, Nevada. Niles 855 (UT 119847).



Figure 9. *Heterotheca excelsior*. Detail from Figure 10. Pine Creek Canyon in Red Rock Canyon National Conservation Area, Nevada. Photo by Stan Shebs, 4 May 2007; Wikimedia Commons.



Figure 10. *Heterotheca excelsior*. Pine Creek Canyon in Red Rock Canyon National Conservation Area, Nevada. Photo by Stan Shebs, 4 May 2007; Wikimedia Commons.

Over the course of this study, I annotated some sheets of *Clokey 8759* as *Heterotheca polothrix*, but the Spring Mountains locality is disjunct — west of the *H. polothrix* range — and it became clear that many features of these plants are not within the morphological spectrum of *H. polothrix*. The only other *Heterotheca* collections I have seen from Clark County are *H. cinerascens*, which is even more different than is *H. polothrix* (see diagnosis). *Heterotheca cinerascens* in typical form grows in the Spring Mountains (e.g., *Jaeger s.n.*, *Pinzl 9868*), including the Red Rock Canyon area. Photographs (habit and details) of a goldenaster on red sandstone are typical *H. cinerascens* ([www.BirdandHike.com/Shrubs Around Las Vegas](http://www.BirdandHike.com/Shrubs%20Around%20Las%20Vegas) — Jim Boone).

Several UNLV collections (not seen) identified as *Heterotheca villosa* var. *villosa* from along Pine Creek in Red Rock Canyon National Conservation Area probably are *H. excelsior* — *Leary 592* and *3865*, *Fisher & Kennedy s.n.* These contrast with UNLV collections identified as *H. villosa* var. *hispida* from Clark County, including Red Rock Canyon NCA. *Pinzl 9868* from the Red Spring area of the Red Rock Canyon NCA is *H. cinerascens*.

3. HETEROTHECA CINERASCENS (Blake) Nesom, **comb. et stat. nov.** *Chrysopsis viscida* A. Gray subsp. *cinerascens* Blake, Proc. Biol. Soc. Washington 35: 173. 1922. *Heterotheca horrida* subsp. *cinerascens* (Blake) Semple, Brittonia 39: 381. 1987. **TYPE: Utah.** [Beaver Co.: fide Welsh 1982]: Beaver Creek Cañon, common among rocks, oak region, 2 Sep 1901, I. Tidestrom 2873 (holotype: US image!; isotype: WIS image!).

A distinctive species, almost always in rocky habitats, characterized by sparsely to moderately puberulent-hirsutulous stems, stiff, sessile-glandular and otherwise sparsely and loosely strigose to hirsute-strigose, eciliate leaves, linear to linear-oblongate or narrowly lanceolate capitular bracts, and evidently keeled phyllaries sessile-glandular and often resinous but otherwise glabrous. **Stems** mostly 10–40 cm, mostly erect from the base. **Leaves** narrowly elliptic-oblongate to elliptic, (5)10–20(–30) mm wide, (1–)2–7 cm long, petiolate, the distal cauline usually deflexed or at least spreading, often abruptly smaller, surfaces densely and evenly sessile-glandular, also sparsely to moderately hirsute to hirsute-strigose, vestiture sometimes more reduced adaxially. **Heads** numerous in a loosely corymboid arrangement, without capitular bracts; involucre (7–)9–11 mm wide, phyllaries linear-lanceolate, inner 5–7 mm long. **Ray flowers** 10–17. Chromosome numbers, $2n=18$ (Semple & Heard 7818, 7876; Semple et al. 9270), $2n=36$ (Semple & Heard 7857).

Flowering (Jun–)Jul–Oct. Steep rocky slopes, among boulders, rock outcrops, cliffs, crevices, on limestone, granite, lava flows, and tuff; (rarely 3000–4000)4450–8200(–8850, rarely 9500–10,500) ft.

Additional and representative collections examined. **Arizona.** Coconino Co.: Vermilion Cliffs Natl Recreation Area, Navajo blow sand, pinyon-juniper-sagebrush community, 6061 ft, 13 Sep 2005, Higgins 26873 [influence of *H. polothrix*?] (BRY); Vermilion Cliffs Natl Monument, Cathedral Wash, Upper Lowrey Spring, Navajo sandstone, high desert shrub, riparian, 4602 ft, 2 Aug 2012, Hodgson 27296 (BRY). Mohave Co.: Parashant Canyon, sandy to gravelly canyon bottom, *Chrysothamnus-Brickellia-Acacia* community, 1100 m, 11 Oct 2000, Higgins & Atwood 21849 (BRY). **Idaho.** Bannock Co.: McCammon side of Indian Rocks State Park, dry rocks, with cheatgrass, sagebrush, bitterbrush, and cactus, 4684 ft, 2 Jul 1996 Chipman 246 (IDS image!, SRP image!), 13 Jul 1996, Chipman 281 (IDS image!, SRP image!, UTC image!), 6 Aug 1996, McDougall & Chipman 348 (IDS image!, SRP image!, UTC image!); head of Mill Creek Canyon ca. 4 mi SE of Bancroft, seep area, 6750 ft, 8 Aug 1978, Foster 7134 (RM). Blaine Co.: Craters of the Moon Natl Reserve, W edge of the Carey lava flow, ca 2 mi E of Carey, in "Crater Lake" area, a large complex of seasonally ephemeral and longer-lasting water pools, 4780 ft, 1 Aug 2006, Mancuso et al. 2995 (BRY, CRMO image!). Butte Co.: Craters of the Moon Natl. Monument, Big Cinder Butte Flow, 7 Aug 1936, Collector not specified [Natl Park Service] 123 (CIC); Craters of the Moon Natl. Monument, young pahoehoe flow, 5600 ft, 7 Aug 1936, Egger 125 (MIN image!). Cassia Co.: Emery Canyon, Silent City of the Rocks, rocky ground, 23 Aug 1951, Baker 8676 (BRY, ID-2 sheets! images!, NY-4 sheets, UC, WTU-3 sheets); City of Rocks, base of rock, 6000 ft, 17 Jul 1974, Brown 862 (SRP image!); Keg Hollow Canyon, woodland to rockland, with *Pinus monophylla*, *Juniperus osteospermum*, and *Cercocarpus ledifolius*, 6600 ft, 22 Jul 1974, Brown 906 (CIC image!, IDS image!); Albion Mts, near City of Rocks, SW of Malta, pinyon-mountain mahogany community, coarse granitic sand, 1 Sep 1982, Goodrich et al. 17878 (BRY, ID! image!, NY); Albion Mountains, base of granite rocks and in soil pockets on rock faces at Twin Sisters, 10 Jul 1992, John 796 (IDS image!); City of Rocks, pinyon-juniper, 5700 ft, 16 Sep 1973, Johnson s.n. (ID! image!); main climbing area of lower City of Rocks, aspen understory, 6200 ft, 23 Oct 2006, Mansfield 6231 (CIC image!, ID! image!, NY); Albion Mountains, Sawtooth Natl Forest, Mt. Harrison proposed RNA, just S (below) Peak 8806, ca 1 mi NE of lookout on Mt. Harrison, ca 8 mi SE of Albion, deep, stony soil (quartzite), colluvial, unstable disturbed areas within *Artemisia tridentata* subsp. *vaseyana*-*Symphoricarpos oreophilus*-*Bromus carinatus* community, 8700 ft, 10 Aug 1987, Moseley 1165 (ID! image!); ca 1.5 mi NE of Mount Harrison, *Pinus flexilis*/ *Cercocarpus ledifolius*, 8860 ft, 14 Sep 1973, Steele 765 (CIC image!, ID! image!); City of Rocks, 28 Jul 1952, Zappettini 46 (ID! image!). Power Co.: Craters of the Moon Natl Monument, Wapi Park, W end of park by aspen, burned area and adjacent lava flow, 5082 ft, 5 Jul 2002, Atwood 28744 (CRMO image!, NY); Craters of the Moon Natl Monument, S edge of Wapi Lava Field, 0.2 mi W of Wapi

water tower, transitional edge of Snake River plain, sandy site and fissured Pahoehoe lava flow, 4450 ft, 23 Jun 2006, *Atwood 31595* (CRMO image!); Minadoka Natl Forest, Sublett Division [now Sawtooth NF; the Sublett Division is in SW Power Co.], 6500 ft, 10 Aug 1936, *Richardson s.n.* (ID! image!); Sublett Division, Minadoka Natl Forest [now Sawtooth NF], 6500 ft, 20 Aug 1936, *Richardson 94* (ID! image!).

Nevada. **Clark Co.:** Charleston Mts, sandstone cliffs near La Madre Spring [Red Rock Canyon Natl Conservation Area], 4700 ft, 12 Sep 1928, *Jaeger s.n.* (UC); Lincoln City, Condor Canyon, upland community, 5000 ft, 11 May 1988, *Koniak & Nelson s.n.* (BLM Herbarium, Las Vegas Dist image!); E side of Spring Mtns, Calico Hills, Red Spring area [Red Rock Canyon Natl Conservation Area], rock slope, 3651 ft, 27 Sep 1991, *Pinzl 9868* (NY image, UTC image); Muddy Mts, ca. 1.5 mi W of Logandale, Jurassic outcrop, 1400 ft [m?], 9 Aug 1979, *Swearingen 1206* (RSA); Muddy Mts, uncommon in wash which feeds into Colorado Quarry from unnamed valley, ca. 3000 ft, 11 May 1980, *Swearingen 1428* (RSA). **Elko Co.:** 0.25 mi W of Collar Elbow Basin, pinyon pine, granitic soil, 7000 ft, 9 Aug 1979, *Foster 8378* (BRY, NY, RM); Ruby Mts, mouth of Lamoille Canyon, dry soil in rock crevices, 14 Aug 1941, *Holmgren 1763* (UC, UTC); N slope of Brown Creek Canyon, dry sagebrush slopes, 7500 ft, 28 Aug 1983, *Holmgren 10265* (BRY, CAS, RSA, WTU); Jarbidge Wilderness, head of Cottonwood drainage, ledges, 9500 ft, 17 Aug 1976, *Lewis & Walters 4538* (BRY); Ruby Mts, Lamoille Canyon, dry wash, 7500 ft, 27 Jul 1940, *Munz 16176* (CAS, POM, UC, WTU); N end of Spruce Mtn, just E of Black Forest Mine Bldg complex, rock-lined narrow canyon, by rock outcrop with *Holodiscus*, 8200 ft, *Pinzl 10152* (TEX); Soldier Creek [labeled as from Humboldt Co.], woodland, 8 Jul 1928, *Price 216* (RM); Ruby Mts, Soldier Creek Trail area, E of Nev Hwy 227, cracks in canyon rock faces, 10 Aug 1990, *Semple et al. 9270* (BRY); Bull Run Mts, ridge just E of the Bull Run Reservoir, 7400 ft, on very steep limestone ridges, 24 Aug 1984, *Tiehm 9295* (BRY, CAS, ID! image!, NY, RSA, TEX, WTU); Jarbidge Mts, lower part of Camp Creek on the E side of the range, near the forks, with *Artemisia* in steep rock outcrops, 7000 ft, 2 Aug 1985, *Tiehm 10070* (BRY, CAS, ID! image!, NY, TEX, VDB); Robinson Creek, E side of Ruby Mts, 7000 ft, 5 Aug 1936, *Train 429* (MO); head of Copper Creek Basin, Jarbidge Mts, lava rimrock crevices, 8200-8800 ft, 6 Aug 1937, *Train 662* (DS, NY); Jarbidge River Canyon, 1-3 mi from Jarbidge, 6800 ft, 17 Aug 1937, *Train 783* (UC); W slope of Ruby Mts, Soldier Creek Canyon at Mine, dry granitic slope, 6400 ft, 1 Sep 1940, *Train 4650* (NY, UC); Ruby Mts, Lamoille Canyon, Lamoille Canyon Road, roadside, 2353 m, 30 Aug 2013, *Warman 79* (UTC); Ruby Mts, Lamoille Canyon, 1.9 road mi beyond Thomas Creek Campground, gravelly soil, roadside, 8400 ft, 22 Aug 1984, *Williams 84-105* (BRY, CAS, IDS, NY). **Esmerelda Co.:** Lone Mt area about 14 mi W of Tonopah, Springdale Canyon on the E side, in granite rock outcrops, 30 Jul 1983, *Tiehm 8250* (BRY, CAS, NY, RSA, TEX). **Eureka Co.:** Monitor Range, N Fork Allison Creek, ca 34 mi from Austin, 7920 ft, 3 Jul 1979, *Goodrich 13172* (BRY, NY); East Pahranaagat Range, 3.7 road mi W of Pahranaagat High School in Alamo, on silicic ash flow tuff rock outcrops, 4200 ft, 18 Jun 1982, *Tiehm 7231* (MO); Roberts Creek Mts, Roberts Creek near the campground, in steep limestone outcrops, 7000 ft, 18 Jul 1983, *Tiehm 8179* (CAS, NY, RSA, VDB); Diamond Mts, Davis Canyon on the NW side of the range, 0.2 mi E of the first creek crossing, 7000 ft, in steep rock outcrops N of the road, 19 Jul 1983, *Tiehm 8187* (BRY, CAS, NY, RSA, TEX, WTU); Fish Creek Range, near the entrance to Goodwin Canyon just S of Eureka, in steep limestone outcrop, 6350 ft, 15 Sep 1983, *Tiehm 8414* (CAS, NY, RSA, TEX, VDB); New York Canyon, dry rocky slopes, 7000 ft, 18 Oct 1937, *Train 1248* (DS, MO, UC). **Humboldt Co.:** Little Humboldt Ranch, 6500 ft, 28 Aug 1940, *Holmgren 756* (BRY, RM, WTU). **Lander Co.:** 17 mi from Austin, Birch Creek Canyon, dry rocky soil of decomposed granite, 7 Sep 1937, *Henning 41* (NY, UT). **Lincoln Co.:** Panaca, 5 Sep 1912, *Jones s.n.* (POM-2 sheets); Mt. Irish, Aug 1898, *Purpus 6352* (UC); East Pahranaagat Range, 3.7 road mi W of Pahranaagat High School in Alamo, tuff rock outcrops, 4200 ft, 15 May 1982, *Tiehm 6890* (CAS) and 18 Jun 1982, *Tiehm 7231* (CAS, NY, RSA); Mahogany Mts, jct of road to Deer Lodge Canyon and the road to Prohibition Flat, in sandstone outcrops near the junction, 6300 ft, 13 Sep 1983, *Tiehm 8375* (CAS, NY, RSA, TEX, VDB); Clover Mts, Pine Canyon Reservoir, just N of the dam, on the W side of the reservoir, with pinyon-juniper, *Artemisia tridentata* on rocky steep slopes, 5740 ft, 5 Sep 2005, *Tiehm 15068* (BRIT, BRY, CAS, ID! image!, NY, RSA); 10 mi W of Crystal Springs, E side Irish Mtn, W side of Pahranaagat Valley, 5500 ft, 28 Aug 1938, *Train 2395* (DS, MO, NY); 4 mi N of Caliente on road to Panaca, 4000 ft, 7 Sep 1938, *Train 2473* (UC). **Nye Co.:** NE Forty-Mile drainage basin, Nevada Test Site, common on cliffs

Figure 11. *Heterotheca cinerascens*, Lincoln Co., Nevada.

Figure 12. *Heterotheca cinerascens*, Eureka Co., Nevada.



Figure 13. *Heterotheca cinerascens*, Elko Co., Nevada.



Figure 14. *Heterotheca cinerascens*, Lander Co., Nevada. *Henning 41* (UTC).

and along rock outcrops of canyon wash, steep-walled canyon N of Twin Peaks, W of Back Rainier Mesa Rd and E of Pahute Mesa Rd, rays deep orange-yellow, 17 Sep 1971, *Beatley 13226* (CAS, NY, RSA, TEX); Nevada Test Site and vicinity, *Beatley 2916, 3132, 3930, 6439, 6525, 6582, 7280, 9693, 9915* (CAS, DS, NY, RSA); S end of Toquima Range NNW of Baxter Spring, canyon bottom, 7200-7600 ft, 25 Aug 1978, *Genz 8895* (BRY); Monitor Range, E Dobbin drainage, Miniature Grand Canyon, crevices, 7500 ft, 26 Sep 1977, *Goodrich 10775* (BRY); Toiyabe Range above Timblin Creek, 35 air mi SE of Austin, cracks and talus, 10,500 ft, 30 Aug 1978, *Goodrich 12236* (BRY, NY); Grant Range, Troy Canyon on W side of the range, 2.2 road mi E of the Nyala road, granite outcrops, 6000 ft, 17 Aug 1983, *Tiehm 8300* (BRY, CAS, NY, RSA, WTU); Monitor Range, East Dobbin Creek, Miniature Grand Canyon at the canyon entrance, steep rock outcrops, 7650 ft, 30 Aug 2001, *Tiehm 13761* (BRY, CAS, ID! image!, NY, RSA, UC, WTU). Pershing Co.: Juniper Range, rocks, 6000-7000 ft, May-Oct 1898, *Purpus 6247* (UC); Juniper Mts, 6000-7000 ft, May-Oct 1898, *Purpus 6248* (UC). White Pine Co.: Rocks on W side of cirque on N side of Mt. Sherman, 10,000 ft, 4 Aug 1939, *Hitchcock & Martin 5679* (CAS, DS, IDS image!, NY, RSA, UC, WTU); Cherry Creek, 17 Jul 1891, *Jones s.n.* (POM); [Snake Range], Jeff Davis Mtn, on slopes, 2400 m, 27 Aug 1919, *Tidestrom 11133* (LL); Snake Range, Murphy's Wash at the S end of the range, 4.9 road mi N of Big Springs Wash road, cracks of steep limestone canyon walls, 6600 ft, 9 Aug 1985, *Tiehm 10104* (BRY, CAS, NY, TEX, VDB); Schell Creek Range, McCoy Creek on E side of range, 2 road mi W of main Spring Valley road, rock outcrops, 7000 ft, 10 Aug 1985, *Tiehm 10127* (BRY, CAS, NY); Egan Range, foothills on E side of Jakes Wash, steep sandstone outcrops 6375 ft, 19 Jul 2000, *Tiehm 13328* (BRY, CAS, CIC image!, ID! image!, RSA, UC, WTU); Diamond Mts, Mining Canyon, SE end of range, 11.2 road mi N of Hwy 50 on Rte 892, limestone canyon with pinyon-juniper, 6350 ft, 30 Aug 2009, *Tiehm 15949* (BRY, CAS, CIC image!, NY). Utah. Beaver Co.: WahWah Mts, WahWah Mines, 13 air mi S of Wah Wah Pass, among quartzite boulders on N side of canyon, 7800 ft, with ponderosa pine, juniper, and *Cercocarpus*, 8 Aug 1969, *Holmgren 3830* (NY, RSA, WTU); Tushar Mts, Beaver River Canyon, S-facing cliff base, pinyon-juniper-oak-*Cercocarpus*, ca. 7600 ft, 16 Aug 1984, *Taye 3132* (BRY); ca. 5 km E of Beaver on Utah Hwy 153, at boundary of Fish Lake Natl Forest, near creek, edge of Gambel's oak woodland and near volcanic rocks, ca. 6000 ft, 10 Sep 1985, *Semple & Heard 7818* (BRIT, BRY, MO); Wah Wah Mts, Pine Grove Canyon, pinon-juniper woodland, 13 Sep 1963, *Welsh & Christensen 2705* (BRY, NY). Boxelder Co.: Raft River Mts, SW of Strevell, Clear Creek Campground, sagebrush hillside, 6400 ft, 26 Jul 1965, *Erdman 2400* (BRY); Sulphur Springs, Bear River Bay [Great Salt Lake], cliffs in foothills, 14 Aug 1929, *Garrett 5408* (LL) and *Garrett 5408a* (BRY, LL, RM). Iron Co.: Wah Wah Mts, 8 air mi N of Lund, Broae Hill, tuffaceous knoll NE of road across Blawn Wash, ca. 1750 m, 7 Sep 1988, *Erter 7941* (BRY, NY, RSA, UC); Cedar Breaks, dry meadow, 10,000 ft, 17 Jul 1930, *Goodman & Hitchcock 1618* (DS); Three Peaks Recreational Area, ca 9 mi W to NW of Cedar City, granitic boulders on mountain summit, 1767 m, 24 Sep 2007, *Spujt 16133* (BRIT, RSA); Pine Valley Mts, Paradise Spring Trail, pinyon-juniper-mahogany-oak, 7100 ft, 26 Jun 1986, *Warrick 2182* (BRY). Juab Co.: 8 mi E of Leamington, Dog Valley Wash, ca. 5000 ft, 12 Oct 1983, *Baird 293* (BRY); ca. 15 mi E of Leamington, 8 Sep 1965, *Welsh & Moore 5146* (BRY, NY). Kane Co.: Paria Plateau, 18 Aug 1972, *Atwood & Moore 4286* (ID); 1 km E of Zion Natl Park on Utah Hwy 9, red sand, junipers, 12 Sep 1985, *Semple & Heard 7876* (BRY). Millard Co.: Canyon Mts, Oak Creek near Oak Creek Campground and Guard Station, 4.2 mi SE of Oak City, quartzite outcrop, 6300 ft, 7 Aug 1981, *Goodrich 16084* (BRY); House Range, Painter Spring, granite, riparian, 6500 ft, 2 Sep 1981, *Kass & Preston 624* (BRY); Pavant Range, Piute ATV trail on conglomerate outcrop, white fir community, 7800 ft, 18 Sep 1999, *Tilley 961* (BRY). Piute Co.: Falls of Bullion Creek, [the MO label says "Marysvale, Tate Mine"], 9500 ft, 24 Aug 1894, *Jones 5903* (MO, NY, POM, RM, UC); Bullion Canyon, in and near the Gorge, 27 Jul 1905, *Rydberg & Carlton 7288* (NY, RM-2); Tushar Mts, Bullion Canyon, outcrop cracks, aspen-white fir, 8791 ft, 20 Jul 1990, *Taye 4886* (BRY). San Pete Co.: Maple Canyon, vicinity of Ephraim, 24 Jul 1934, *Olsen s.n.* (UTC image!). Tooele Co.: Sheeprock Mts, narrows of Joe's Canyon, granite outcrop cracks, mountain brush community, 2250 m, 13 Sep 1995, *Bates 918* (BRY); Stansbury Mts, Muskrat Canyon, quartzite slope, 7200 ft, 28 Jul 1981, *Taye 1429* (BRY). Washington Co.: St. George, arid hills near Sugar Loaf, 20 Jun 1942, *Degener & Peiler 16,639* (MO, NY); N of St. George, red sandstone ledges, 3000 ft, 8 Sep 1935, *Galway s.n.* (BRY-2 sheets); 2.8 mi N of St. George on road to Enterprise, dry rocky wash with *Rhus trilobata*, *Juniperus*, and *Artemisia tridentata*, 3000 ft, 7 Sep 1941, *Gould 1357* (CAS, DS, ID!

image!, NY, PH, POM); Dixie State Park, ca. 5 mi NW of Ivins, sandy soil, 3200 ft, 13 May 1967, *Higgins* 988 (BRY); Red Mts, Navajo sandstone and blow sand, *Artemisia-Quercus*-mixed shrub, 1250 m, 9 Jun 1999, *Higgins et al.* 20387 (RM); Pine Park, conglomerate ash of volcanic origin, ponderosa pine-oak-pinyon-juniper, 1750 m, 25 Sep 1999, *Higgins* 20871 (BRY, MO, RM); Zion NP, near canyon bottom, dry hot slopes, 15 Aug 1932, *McDonald* 1161 (RM); Zion Natl Park, Narrows Trail, ca. 1 mi N of Temple of Sinawave, 12 Jun 1970, *Moor* 2118 (BRY); St. George, 1875, *Palmer s.n.* (MO); W of Leeds on Silver Reef Road, 2.0 km into Dixie Natl Forest, road cut through red sandstone, 10 Aug 1985, *Semple & Heard* 7857 (BRY). Wayne Co.: Top of North Caineville Mesa, ca. 16 mi W of Hanksville, cap of Emery sandstone along NW rim, 5900 ft, 6 Sep 1985, *Tuhy* 2506 (BRY).

Variant: Leaves widely spaced, oblanceolate, 7 mm wide, 3–4.5 cm long: **Arizona**. Mohave Co.: Short Creek, crevices of rocks, 4500 ft, 10 Jun 1941, *Cottam* 8578 (RSA).

Variant: Vestiture completely glabrous, outer phyllaries foliaceous, and heads few-flowered (disc): **Nevada**. Clark Co.: Muddy Mts, 11 May 1980, *Swearingen* 1428 (RSA). *Swearingen* 1206 (RSA) from the same area is typical *Heterotheca cinerascens*. The Muddy Mountain plants occur at ca. 3000 ft, at the lowermost elevational limit for the species.

Variant: Habit and aspect of *Heterotheca cinerascens* but phyllaries strigose: **Utah**. Washington Co.: Zion Natl Park, Emerald Pool Trail, 9 Oct 1937, *Ramsey* 1267 (POM) and *Ramsey* 1268 (POM).

Variant: Some collections from Zion National Park resemble *Heterotheca cinerascens* in vestiture but have long (40–50 cm), lax-flexuous stems, thin leaves relatively evenly spaced and even-sized (all the way to the heads), and solitary heads (on long peduncles). These are consistent in aspect and apparently are plants with suppressed lateral buds (buds sometimes occur in nodes immediately below the heads). **Utah**. Washington Co.: The Narrows Trail, 8 Sep 1938, *Eastwood & Howell* 6325 (CAS); The Narrows Trail, 13 Sep 1968, *Howell & True* 45301 (CAS); Zion Natl Park, no other locality data, 25 Jun 1933, *Eastwood & Howell* 1105-a (CAS); Zion Natl Park, Narrows Trail, rocky slopes, ca. 4420 ft, 30 Sep 1972, *Nelson* 10134 (RM); Zion Natl Park, no other locality data, 24 Sep 1928, *Thackery* 507 (TEX-2 sheets); Zion Natl Park, Zion Canyon, N Fork Virgin River, along river bottom, between trailhead and The Narrows, riparian, on alluvium, 8 Aug 1987, *Thorne & Chandler* 5586 (RM); Zion Natl Park, side canyon of Clear Creek along Washington-Kane county line, Navajo sandstone, 5240 ft, 15 Oct 1987, *Thorne & Franklin* 5749 (RM). This distinctive growth form, with solitary heads on long, flexuous stems, also occurs in plants identified here as *H. zionensis*, e.g., **Utah**. Garfield Co.: California Creek Canyon, *Cox & Baumann s.n.* (BRY). Washington Co.: South Ash Creek, *Warrick* 2717 (BRY). On the other hand, typical plants of *H. cinerascens* occur in the same area of Zion National Park (see citations above) and these monocephalous variants, highly distinctive in appearance, should be studied further.

4. HETEROTHECA JOSHUANA Nesom, *sp. nov.* **TYPE: California**. San Bernadino Co.: Joshua Tree Natl Park, Little San Bernardino Mts, Queen Mountain, near Oak Canyon, bouldery wash, locally infrequent in boulder crevices, 1460 m, 3 Nov 2008, *T. LaDoux et al.* 1841 (holotype: JOTR image!, Fig. 15).

Similar to *Heterotheca cinerascens* in aspects of vestiture (especially leaves with glandular surfaces and phyllaries glandular and without other hairs), different in its (1) stems with fine, spreading-ascending hairs (vs. puberulent-hirsutulous with patent hairs), (2) leaves linear to linear-lanceolate, sharp-pointed and apiculate, even-sized, and densely arranged (vs. narrowly elliptic-oblanceolate to elliptic, apex rounded, usually diminishing in size distally, characteristically more widely spaced), (3) heads smaller (rays 6–14 vs 10–17, involucre (5–)6–9 mm wide vs (7–)9–11 mm wide), and (4) consistent lack of prominent capitular bracts.

Plants perennial from a woody taproot; axillary buds produced along entire length of the stems. **Stems** mostly 20–25 cm, erect or slightly ascending from the base, internodes 1–7 mm long, densely minutely glandular, sparsely hirsute-strigose to stiffly villosulous with fine, spreading to spreading-ascending or ascending hairs of relatively even length. **Leaves:** basal and lowermost spatulate with narrow petiole, mostly 15–23 mm, cauline abruptly linear to linear-lanceolate, linear-oblongate, or narrowly elliptic-lanceolate, 5–17(–21) x 1–2.5(–)4 mm, distally carinate, epetiolate, stiffly spreading, continuing mostly unreduced in size up to the heads, apex sharply acute with a long, white-indurate, sharp-pointed, straight to slightly falcate apiculum, both surfaces minutely glandular, hirsute with ascending hairs to hispid-hirsute, margins eciliate. **Heads** solitary or 2–8 in a loosely corymboid cluster, peduncles 10–20 mm, capitular bracts linear to linear-lanceolate and very small if present, usually not evident; involucre (5–)6–9 mm wide, inner phyllaries 6–7 mm long, narrowly oblong-lanceolate, slightly keeled, sessile-glandular to minutely stipitate-glandular, without other hairs. **Ray flowers** 6–14, laminae ca. 1 mm wide. Chromosome number unknown.

Flowering (Apr–)Aug–Nov. Rocky habitats, commonly with *Quercus cornelius-mulleri*, *Pinus monophylla*, *Nolina parryi*, *Acacia greggii*, *Haplopappus cuneatus*, *Opuntia phaeacantha*, and *Opuntia basilaris*; ca. 2400–5200 ft (–5500 ft at top of Queen Mtn in Joshua Tree Natl Park). Little San Bernadino Mountains of Riverside and San Bernadino counties, California.

Heterotheca joshuana is distinctive in its linear to linear-lanceolate, even-sized, and densely arranged leaves (short internodes) with a long, white-indurate, sharp-pointed, straight to slightly falcate apiculum. Identification is further secure as *H. joshuana* apparently does not occur in sympatry with any other *Heterotheca* species and no similar species occurs in California, Arizona, or Mexico. Obvious similarities in vestiture and leaf arrangement and geographical proximity suggest that it is closely related to more northern *H. cinerascens* but the California plants are about 200 miles disjunct from the nearest populations of *H. cinerascens* in Clark and Nye cos., Nevada. While most of the Nevada and Idaho population systems of *H. cinerascens* also are essentially isolated and geographically disjunct from one another, the *H. joshuana* system is more distantly isolated and in a different ecology — the Colorado Desert (part of the Sonoran Desert) and Mojave Desert, both of which occur in the Joshua Tree National Park. It is a reasonable hypothesis that *H. joshuana* and *H. cinerascens* are sister taxa, with *H. joshuana* more derived in morphology than the widespread *H. cinerascens*.

Additional collections. California. Riverside Co.: Joshua Tree Natl Monument, Barker Dam, 4300 ft, 14 Oct 1966, *Baker & Baker s.n.* (JOTR image!); Joshua Tree Natl Monument, 1/2 mi S of Desert Queen Mine, boulder crevice, 4400 ft, 19 Oct 1966, *Baker & Baker s.n.* (JOTR image!); Joshua Tree Natl Monument at campground area by Hidden Valley, 9 Oct 1947, *Dunn 3533* (MO); Little San Bernadino Mts [W end], Morongo Pass [ca. 7 mi N of Whitewater on Hwy 62, at ca. 2400 ft], 15 Nov 1921, *Jaeger s.n.* ([POM]); Joshua Tree Natl Park, Little San Bernardino Mountains, Wonderland Wash, N of Wall Street Mill parking area, frequent on bouldery outcrops above wash, 4319 ft, 17 Aug 2005, *LaDoux 1545* (JOTR image!); Keyes Ranch, Morongo Pass, among rocks, 4000 ft, 30 Apr 1921, *Munz 4536* ([POM]); Wonderland of Rocks, Joshua Tree Natl Monument, 24 Oct 1942, *Roos 2571* ([POM]); Little San Bernadino Mts, [Joshua Tree Natl Park], Wonderland of Rocks, crevices in boulders, 4000 ft, 21 Oct 1950, *Roos 5011* (DS, NY, [RSA], UCR); Joshua Tree Natl Monument, granitic rocks at Hidden Valley Campground, 22 Aug 1979, *Thorne 53595* ([RSA]). San Bernadino Co.: Joshua Tree Natl Park, top of Queen Mountain, along climber's trail just W of peak, rocky wash and surrounding large bedrock outcrops, frequent through rock outcrops, 5182 ft, 5 Oct 2011, *Harding 31* (JOTR image!); Joshua Tree Natl Park, Queen Valley, Wonderland of Rocks near Wonderland Wash, 18 Sep 2012, *LaDoux et al. 3141* (JOTR image!). Collections cited by the Consortium of California Herbaria at POM-RSA were unavailable for study when I was there in 2016.

Figure 15. *Heterotheca joshuana*, holotype.

5. **HETEROTHECA SHEVOCKII** (Semple) Semple, Univ. Waterloo Biol. Ser. 37 (Rev. *Heterotheca* *Phyllothea*): 148. 1996. *Heterotheca villosa* var. *shevockii* Semple, *Phytologia* 73: 453. 1992 [published 1993]. **TYPE: California.** Kern Co.: S end of Hot Springs Valley between Bodfish and Lake Isabella, at onramp of California Hwy 117 adjacent to Kern River, granitic roadbank of hwy with *Eriogonum fasciculatum* and ruderal vegetation, 2465 ft, 16 Nov 1981, *J. Shevock 9110* (holotype: CAS image!; isotype: WAT).

Heterotheca shevockii grows only along the Kern River below Lake Isabella in chaparral and woodland habitat in sandy soils in crevices and ditches near the river and along roadsides. It has been abundantly collected. Apparently no other species of *Heterotheca* occurs in the same area. In its original description (as "var. *shevockii*"), Semple noted that it is "distinguished from other races of [*Heterotheca villosa*] by its unusually tall stems [up to 2 meters, pers. observ.] and lanceolate-deltoid leaves with inrolled margins. Smaller plants are similar to [*H. polothrix*] to which [*H. shevockii*] is undoubtedly closely related." The heads are large and without capitular bracts. Given its distinctive morphology and geography, it is securely identified but its evolutionary affinity is uncertain.

6. **HETEROTHECA HIRSUTA** (Greene) Nesom, **comb. nov.** *Chrysopsis hirsuta* Greene, *Pittonia* 3: 296. 1898. **TYPE: Washington.** [Spokane Co.]: Near Spokane, banks of Hangman Creek, 3 Sep 1896, *C.V. Piper 2385* (holotype: NDG 53918, Fig 17; isotype: GH image!).

Chrysopsis barbata Rydb., *Bull. Torrey Bot. Club* 37: 130. 1910. *Heterotheca barbata* (Rydb.) Semple, *Brittonia* 39: 379. 1987. **TYPE: USA. Idaho.** Kootenai Co.: Valley of Spokane River, 17 Jul 1893, *J.H. Sandberg, D.T. MacDougal, & A.A. Heller 664* (holotype: NY image!; isotypes: CAS! image!, GH-Fig. 18!, US image!).

Semple (1996) placed *Chrysopsis hirsuta* as a synonym of *Heterotheca villosa* var. *minor* but the type of *C. hirsuta* is essentially identical in morphology to the *C. barbata* type and probably was collected no more than 30 miles from the *C. barbata* type locality. Kootenai Co. (Idaho) and Spokane Co. (Washington) are directly adjacent on opposite sides of the Spokane River.

Chrysopsis elata Osterh., *Bull. Torrey Bot. Club* 57: 560. 1931. **TYPE: Colorado.** Eagle Co.: Red Cliff, 16 Aug 1906, *G.F. Osterhout 3359* (holotype: RM image!; isotype: NY image!).

The protologue states that Osterhout "3335" is the type, but the RM and NY sheets both are labeled with the collection number "3359." The original manuscript, in Osterhout's hand, is stapled to the RM holotype and has "3359" as the type number. On Osterhout's distinctive red-colored type label, C.L. Porter in 1950 noted that publication of the number "3335" was in error.

Chrysopsis resinolens var. *ciliata* A. Nels., *Bull. Torrey Bot. Club* 28: 233. 1901. *Chrysopsis viscida* var. *ciliata* (A. Nels.) Blake in Tidestrom, *Contr. U.S. Natl. Herb.* 25: 537. 1925. **TYPE: USA. Wyoming.** Albany Co.: Dunn's Ranch, sandy river bottoms, 16 Jul 1900, *A. Nelson 7566* (holotype: RM! image!; isotype: NY image!, Fig. 22).

The collection number cited in the protologue is "Nelson 7560" and the NY specimen is labeled as "7560 ... n. var." on a label (ex Rocky Mountain Herbarium) apparently handwritten by Nelson, with "Dunns Ranch, July 16, 1900." The RM specimen, however, is labeled 7566 and Nelson's original notes state that 7566 = *Chrysopsis resinolens* var. *ciliata*; Nelson 7560 is listed as a moss (*Mnium serratum*). Thus the collection number in the protologue as well as the label on the NY collection are interpreted as resulting from errors in transcription, and holotype and isotype appear secure as cited here. The RM and NY collections are clearly the same entity.

Stems 15–40 cm, sparsely to moderately hirsute to hirsute-villous or villous with spreading to slightly deflexed hairs, sparsely to densely minutely glandular. **Leaves** cauline, narrowly elliptic to elliptic-lanceolate or elliptic-oblongate, essentially epetiolate, mostly 2–4.5 cm, largest at midstem, leaf and bract surfaces loosely strigose to hirsute or hirsute-villous, at least the distal evidently sessile-glandular, petiole margins and at least proximal blade margins evenly long-ciliate. **Heads** more or less

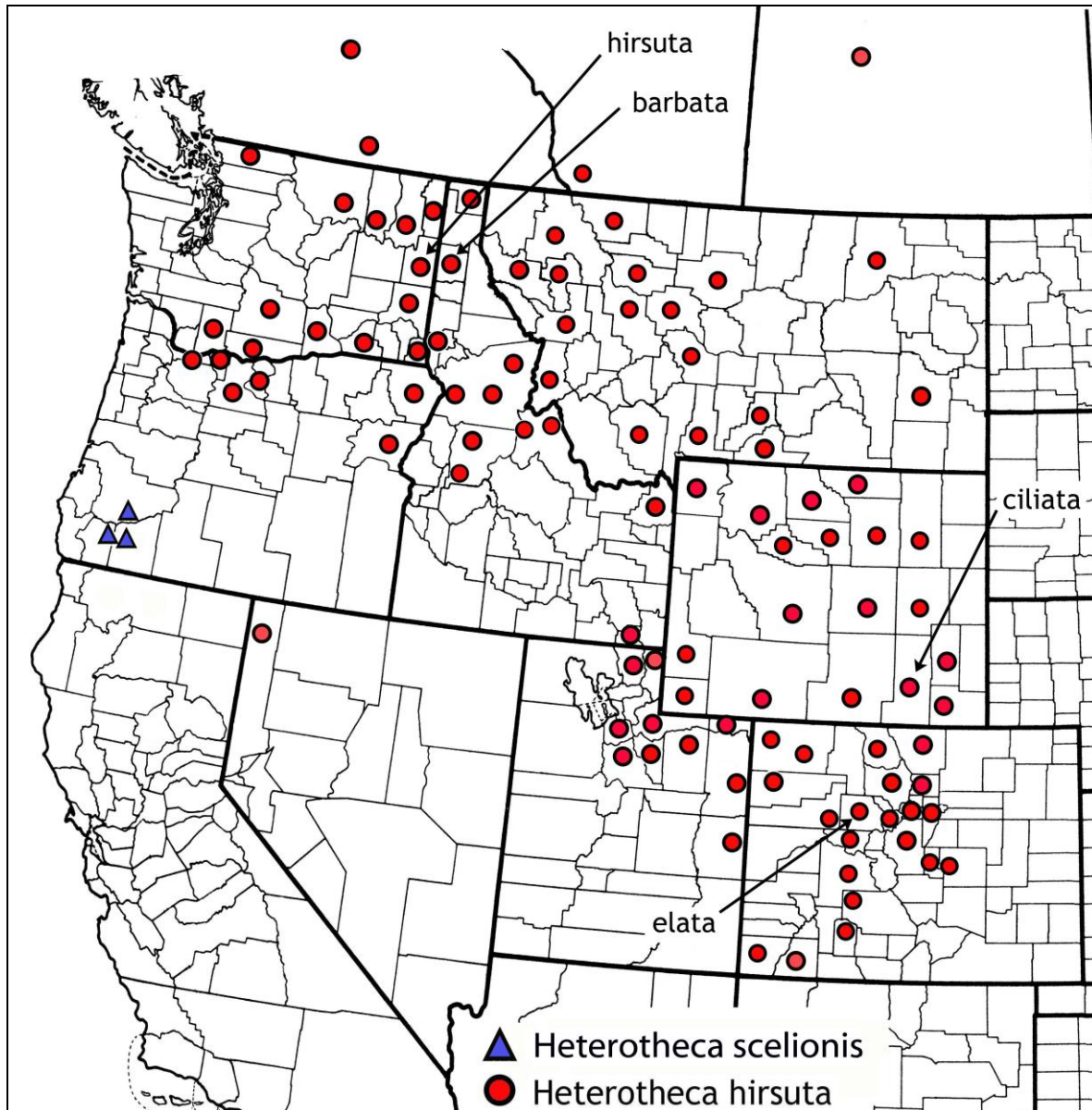


Figure 16. Distribution of *Heterotheca hirsuta* and *H. scelionis*. Arrows point to localities for the type and synonyms of *H. hirsuta*.

solitary on leafy-bracteate peduncles 4–10(–15) cm long, sometimes loosely corymbose; capitular bracts linear-oblong to linear-oblongate or oblongate, sometimes longer than the phyllaries. **Involucres** 8–12 mm wide; phyllaries 8–10 mm long, narrowly lanceolate to linear-lanceolate, sparsely villous, eglandular or minutely glandular distally. Chromosome number, $2n=18$ (*Semple* 9247 from Salt Lake Co., Utah; *Windham* 97-133 from Cache Co., Utah).

Aven Nelson described this taxon as a variety of *Heterotheca* [*Chrysopsis*] *resinolens*, but it is not clear that *H. resinolens* (in the sense of the present study) is closely related. The two are similar in their prominent capitular bracts and conspicuous sessile glands and relatively reduced non-glandular vestiture (the plants often with a dark green color), but *H. resinolens* differs in its larger stature, larger and more closely spaced leaves, larger heads with broader capitular bracts, and lack of coarsely ciliate leaves and bracts. It has a different geographical range and generally grows at higher elevations.



Figure 17. *Heterotheca hirsuta*. Spokane Co., Washington. Holotype of *Chrysopsis hirsuta*.



Figure 18. *Heterotheca hirsuta*. Kootenai Co., Idaho. Isotype of *Chrysoopsis barbata*.



Figure 19. *Heterotheca hirsuta*, Lemhi Co., Idaho. Romano 269 (SRP).



Figure 20. *Heterotheca hirsuta*. Albany Co., Wyoming. Isotype of *Chrysopsis resinolens* var. *ciliata*.

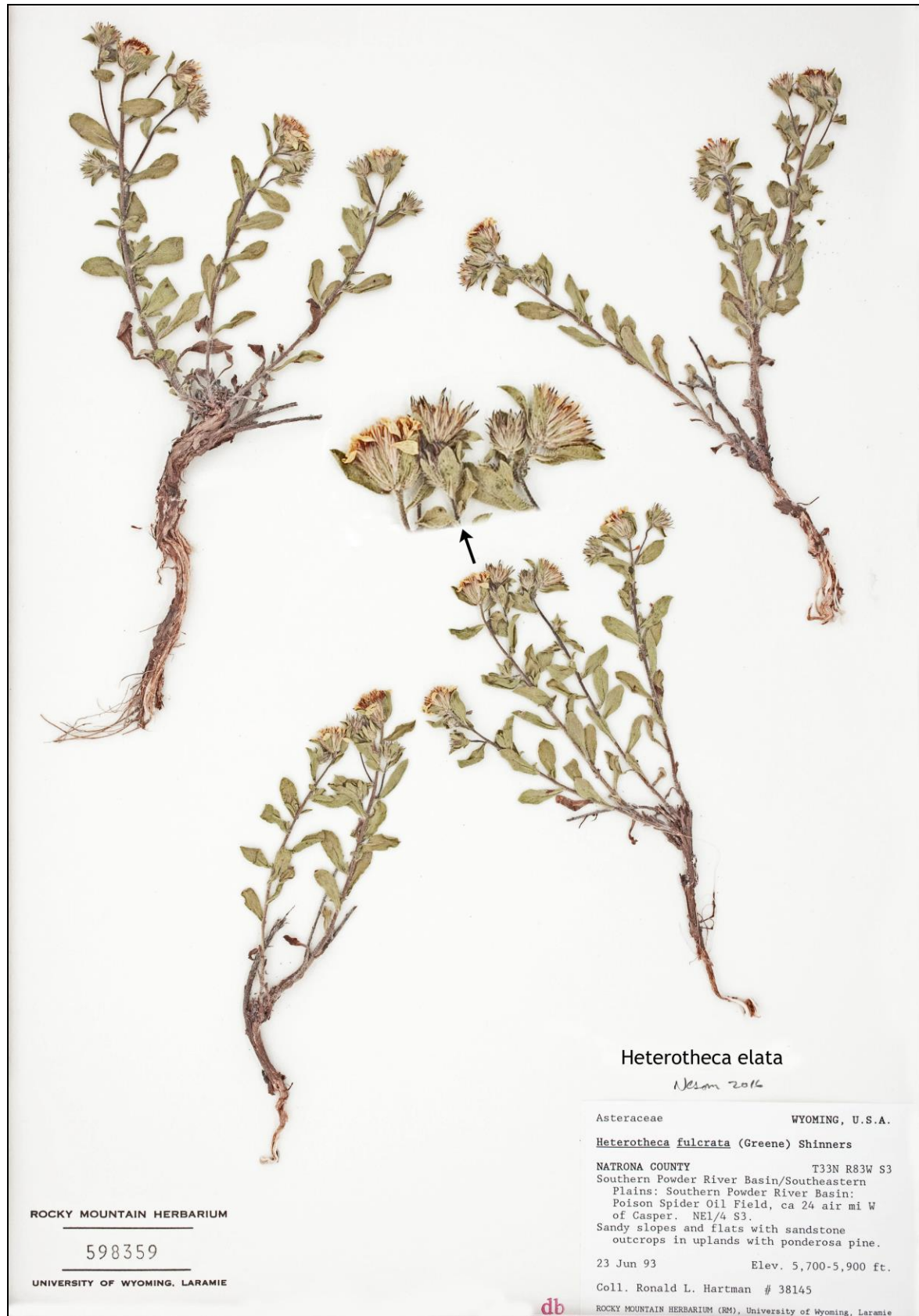


Figure 21. *Heterotheca hirsuta*, Natrona Co., Wyoming. Hartman 38145 (RM).



Figure 22. *Heterotheca hirsuta*, Washoe Co., Nevada. Tiehm 10816 (NY).

I first identified and annotated *Heterotheca hirsuta* and "*Heterotheca* [Chrysopsis] *elata*" (or "*Heterotheca ciliata*") as separate species, concluding only later in the study, especially when looking at numerous collections from Idaho and western Montana, that a geographic discontinuity in their morphology was not easily apparent. Over the whole range, the plants have relatively sparse (though variable) leaf and stem vestiture of non-glandular hairs but leaf and bract surfaces usually are prominently sessile-glandular. Leaves (including petioles) and bracts are coarsely ciliate at least on the proximal margins. Capitular bracts are consistent and characteristic.

In Oregon, Washington, and Idaho (compared to Montana, Wyoming, Utah, and Colorado), leaf and bract margins of *Heterotheca hirsuta* often are evenly long-ciliate along the whole length, matching the long-hirsute stems and commonly giving the whole plant a shaggy appearance, stems are relatively taller and usually more strictly erect, axillary branches are longer, leaves are longer and narrower, and phyllaries are narrower. *Heterotheca hirsuta* in this area may prove to be evolutionarily distinct, and given the variability within the species as identified here and its wide range, it would not be surprising to find that more than a single entity is represented.

Some morphological variants of *Heterotheca hirsuta* in Montana and Wyoming perhaps reflect influence of sympatric *H. hispida*, which in typical form can hardly be confused with *H. hirsuta*.

Although the range of typical *Heterotheca hirsuta* reaches into central and southwestern Colorado, it has not been commonly collected there. The plants apparently long-disjunct in Washoe Co., Nevada (Fig. 22), are typical of the southern plants.

Additional (representative) collections examined. CANADA. Alberta. Lee Creek near golf course, Cardston, riverbottom forest, gravelly soil, 3800 ft, 24 Jul 1972, *Shaw 1681* (BRY). **British Columbia.** 1 mi N of Heffley along road to Little Fork, N. Thompson River, open wooded slopes, 1400 ft, 15 Jun 1956, *Calder et al. 17499* (UC); 5 mi E of Grand Forks, dry N slope of valley, roadside, 31 Aug 1937, *McCabe 4640* (UC). **Saskatchewan.** Nisbet Provincial Forest, a few mi E of Prince Albert, sandy jack pine woods, 20 Jun 1949, *Boivin & Breitung 6107* (NY). **USA. Colorado. Boulder Co.:** El Dorado Springs State Park, South Boulder Creek at emergence from the canyon, ca. 5500-6000 ft, 30 Aug 1981, *Brewster 47* (BRY); railroad ROW, E of Tunnel 10, near El Dorado Spgs, 22 Aug 1964, *Evers 81308* (MO); Hwy 119 in Clear Creek Canyon, 2408 m, 20 Oct 1998, *King & Garvey 10804* (MO); SW of Lyons, S. Drain River, 6500 ft, 28 Jun 1939, *Rose 39355* (CAS); Comforter Mtn, Boulder Creek Canyon, *Pinus ponderosa*, 7000 ft, 17 Jul 1979, *Taylor 7196* (TEX); Rogers Park, Boulder Canyon, ca 3 mi above Boulder Falls, canyonsides and gravelly flats, 6 Aug 1953, *Weber 8627* (CAS); ca. 7 mi W of Boulder, Boulder Canyon just above Boulder Falls, base of cliffs on S-facing slope, ca. 7000 ft, 2 Oct 1970, *Weber 14419* (NY); along State Hwy 7, St. Vrain River, ca. 0.5 mi SW of mouth of Deadman Gulch and 4.5 mi SW of Lyons, 5720 ft, ponderosa pine, 17 Sep 1984, *Wilken 14298* (BRY, NY). **Clear Creek Co.:** rocky precipices of Georgetown Pass, 28 Aug 1874, *Engelmann s.n.* (MO); rocks of Georgetown Pass, near Empire, 5 Aug 1874, *Engelmann s.n.* (MO); near Clear Lake, Georgetown, among rocks, 17 Aug 1895, *Shear 4532* (RM). **Eagle Co.:** Sawatch Range, White River Natl Forest, Homestake Rd, ca. 13 air mi S of Dowds Junction, 6 mi W of US Hwy 24, lodgepole pine, 9160 ft, 12 Aug 2010, *Kirkpatrick 4441* (RM). **El Paso Co.:** Rainbow Gulch, 800 m W of Rampart Reservoir, 9100 ft, 6 Sep 1989, *Beland & Corkran 47* (RM). **Garfield Co.:** Flat Tops/White River Plateau, Flat Tops Wilderness, Devils Causeway, ca. 15 air mi SW of Yampa, narrow basal ridge, 11,700 ft, 22 Aug 1991, *Vanderhorst 4294* (RM); Flat Tops/White River Plateau, Main Elk Creek, ca. 15 air mi WNW of Glenwood Spgs, bottom of shale slopes with sagebrush, 5800 ft, 20 Sep 1991, *Vanderhorst 4536* (RM). **Gilpin Co.:** ca. 4 air mi WNW of Central City, 6.5 air mi NE of Empire along small stream through spruce, 9800 ft, 10 Aug 2003, *Foley 4621* (NY); small lake 1/4 mi below Tolland, prairie, ca. 8800 ft, 19 Aug 1907, *Ramaley & Robbins 3444* (RM); Tolland, 10 Aug 1935, *Zobel s.n.* (MO). **Grand Co.:** canyon walls just E of Hot Sulphur

Springs at MILE 21 on Hwy 40, 11 Aug 2010, *Atwood 33657* (BRY). Gunnison Co.: West Elk Creek, dry rocky soil, 7460 ft, 11 Jul 1961, *Stock 423* - x *H. paniculata?* (MO). Jackson Co.: summit of North Park Range, rocky ledges, 10 Aug 1903, *Goodding 1826* (RM). Jefferson Co.: Kerr Gulch Rd, ca. 3 mi S of I-70, 2263 m, 15 Aug 1999, *King & Garvey 11105* (BRIT, MO, NY). La Plata Co.: Las Animas [river], Durango, mesa among oaks, 2 Jul 1907, *Clements s.n.* (NY — without capitular bracts but = *H. hirsuta* in all other features). Larimer Co.: Loveland, Thompson Cañon, among rocks, 9000 ft, 5-10 Aug [no year], *Johnston 699* (NY); Hwy 34 just W of Loveland city limits, 23 Aug 1998, *King & Garvey 10700* (MO); Poudre Canyon along Hwy 14, ca 5 mi E of Stove Prairie Rd, ca. 5800 ft, 27 Sep 1998, *King & Garvey 10785* (MO); Big Thompson Canyon on US Hwy 34, ca. 5 mi W of Drake, ca. 1785 m, 20 Aug 1999, *King & Garvey 11120* (BRIT, MO, NY); Cherokee Park, rich meadow, 30 Jul 1923, *Nelson 10007* (MO, RM); Medicine Bow Mts, Laramie River valley from Rawah Trailhead on Laramie River Rd (Co. Rd. 103), ca. 41 air mi NW of Ft. Collins, lodgepole pine, 8300-8500 ft, 20 Jul 2001, *Nunn 3160* (BRY, RM); Dale Creek, 14 Aug 1916, *Osterhout 5521* (RM-2); Dale Creek, 14 Aug 1916, *Osterhout 5522* (BRY); Thompson Canyon, 25 Aug 1916, *Osterhout 5542* (BRY, POM, RM); mts of Estes Park, Windy Gulch, 7 Sep 1916, *Osterhout 5553* (POM). Mineral Co.: Wagon Wheel Gap, 8500 ft, 25 Aug 1912, *Griffin 173* (RM). Moffat Co.: Dinosaur Natl. Mon, 1.25 mi S of Lodore Ranger Station, E side of Green River, ca. 1/4 mi SE of Gates of Lodore, pinyon-juniper, 5800 ft, 10 Jun 1987, *Neely 4245* (COLO, RM); Dinosaur Natl. Mon, ca. 1 mi E of Gates of Lodore, pinyon-juniper, 11 Jun 1987, *Neely 4267* (COLO, RM); Yampa River between Craig and Maybell, N side of Duffy Mtn near Sand Spring Gulch, sagebrush scrub, 6100 ft, 15 Aug 1984, *Stein 1901* (MO, RM). [Montezuma Co.: Mesa Verde Natl Park], "sw Colorado, Johnston Cañon," Aug 1892, *Eastwood s.n.* (CAS). Park Co.: Hwy 285 ca. 1/2 mi E of Bailey, 8176 ft, 16 Jul 2003, *King & Garvey 12548* (MO); NW of Lake George, Round Mtn, Campground on US Hwy 24, ponderosa pine, 7 Sep 1985, *Semple 7731* (MO). Pitkin Co.: 7 mi SE of Aspen along State Rte 82, 29 Jun 1981, *Nelson 6554* (RM); Hwy 82, 6.6 km E of Aspen, roadside, broadleaf and conifer, 29 Aug 1995, *Semple 10446* (NY). Rio Blanco Co.: Flat Tops/White River Plateau, Flat Tops Wilderness, Marvine Lakes, ca. 29 air mi ESE of Meeker, rocky area, 9300 ft, 17 Aug 1990, *Vanderhorst 1879* (RM); 1.8 mi WSW of jct of E and W Forks of Fawn Creek, pine and amelanchier, 2215 m, 24 Jun 1982, *Walker & Riefler 82-260* (NY); 4 mi W of Rangely on N side of White River, crevices, white sandstone cuesta, 1600 m, 15 Jun 1978, *Weber 15398* (COLO-2 sheets); ca. 19 mi E of Dinosaur, salt desert shrub community, sandstone outcrops, 5500 ft, 10 Aug 1979, *Welsh 320* (BRY). Saguache Co.: Cochetopa Hills, road to Spanish Creek, ca. 0.5 air mi N of Colo Hwy 114, ca. 20 air mi WNW of Saguache, stream side, rocky slopes, 8700 ft, 3 Jul 1998, *Hartman 61969* (RM). Salt Lake Co.: Wasatch Mts, Big Cottonwood Canyon, 9100 ft, 5 Aug 1905, *Garrett 1585* (PH). Summit Co.: 2 mi E of Frisco on Hwy 9, open area near pine forest, 29 Jul 1978, *Lowry 1303* (NY); town of Frisco, weedy lot, 2770 m, 16 Aug 1991, *Miller et al. 6831* - x *pumila?* (MO, WTU); Gore Range, Arapaho Natl Forest, S base of Green Mtn along Co. Rd. 30, above Green Mtn Reservoir, ca. 22 air mi NE of Silverthorne at I-70, cliffs, 8000 ft, 16 Aug 2011, *Nelson 83663* (RM). Teller Co.: Manitou Expt Station, 7700 ft, 22 Aug 1963, *Gierisch 2649* (RM); Co. Road 42 in Florissant Fossil Bed Natl Monument, ca. 5 mi SE of Florissant, 8560 ft, 23 Aug 20000, *King & Garvey 11547* (MO); near Florissant, ca. 2400 m, 1-8 Aug 1905, *Ramaley 1401* (RM). **Idaho.** Boundary Co.: 1 mi N of Bonners Ferry, sandy hillside, 9 Aug 1955, *Baker 13865* (ID, WTU); just S of Naples, sandy, dune-like soil in *Pseudotsuga* woodland, 1 Aug 1953, *Keck 6541* (UC). Franklin Co.: Franklin Basin, White Canyon, 8300 ft, 30 Jul 1958, *Cottam et al. 15304* (BRY, DS). Fremont Co.: Willow Creek RNA, sandy loam on basalt, 5850 ft, 28 Aug 1985, *Wellner 3586* (ID). Idaho Co.: Salmon River ca. 1 mi S of Slate Creek, dry rocky bank, 4 Aug 1951, *Baker 8368* (ID, WTU-2 sheets); Middle Fork of Clearwater River at mouth of Three Devils Creek, sandy, exposed N bank, 1400 ft, 12 Jul 1937, *Constance 1978* (UC, WTU); mouth of Salmon River, 27 Jun 1925, *Eastwood 13292* (CAS); ca. 1.6 air mi W of Blackhawk Bar on the Salmon River above the Crooked Road (672) on the ridge between Rhett Creek and Christie Creek, rocky ridge, lodgepole pine, 4460 ft, 12 Aug 2004, *Hays 2761* (ID); Middle Fork of the Clearwater River, near Three Devils Creek, sandy bar,

17 Aug 1950, *Jones 363* (DS, NY, RSA, SMU, WTU); Selway Falls, no date, *Rust 2601* (ID); 15 mi N of Riggins, Christie Creek, 23 Jul 1963, *Schlatterer 136* (ID). Kootenai Co.: mountain sides, Jun 1888, *Sandberg s.n.* (BRIT); mountainside, Jun 1890, *Sandberg s.n.* (UC). Lehmi Co.: Challis Natl Forest, Warm Spring Creek drainage, by hot springs ca. 0.25 mi up Hot Creek, dry outcrops, 5600 ft, 25 Jul 1980, *Brunsfeld 1624* [x *H. vespertina*] (ID); Salmon Natl Forest, near the mouth of Jacks Creek along the Middle Fork Salmon River trail, flat rocky area, 3560 ft, 2 Jun 1992, *Mancuso 651* (ID image!, SRP image!); Salmon Natl Forest, Fenster Creek, 4500 ft, 25 Jun 1929, *Romano 269* (RM, SRP image!). Nez Perces Co.: along Hatwai Creek, dry bank and copses, 17 Jun 1894, *Henderson 2805* [x *H. hispida*] (RM). Valley Co.: 3-4 mi E of Lick Creek Summit along main road, sandy granitic soil along road in mtn brush community, 27 Jul 1988, *Atwood 13419* (BRY, NY, RM, RSA); above Trail Creek Campground, ca. 5000 ft, 9 Jun 2003, *Davis 247* (BRY). **Montana.** Carbon Co.: 40.5 mi NE of Cook City, above head of Wyoming Creek on Line Creek Plateau, 9994 ft, 6 Aug 1988, *Thorne 6544* (BRY). Cascade Co.: Great Falls, 9 Jul 1895, *Anderson 120* (UC); Little Belt Mts, Smith River, mouth of Trout Creek and up Trout Creek ca. 0.5 mi, 31 air mi S of Great Falls, dry creek bed, 1183 m, 15 Jul 2009, *McNeill 6579* (RM). Chouteau Co.: Square Butte, E base, ca. 32 air mi SE of Ft. Benton, rocky slope, pine-fir, 1342 m, 3 Jul 2009, *McNeill 5707* (RM); Turecks Ranch, ESE of Square Butte, ca. 33 air mi SE of Ft. Benton, open meadow, dry draw, 1184 m, 3 Jul 2009, *McNeill 5838* (RM). Custer Co.: Miles City, westernmost exit on I-94, 24 Aug 1975, *Semple 2026* (MO). Flathead Co.: Mt Holbrook, Big Prairie, 4900 ft, 27 Aug 1925, *Kirkwood 2234* (RM); Big Fork, 1000 m, 24 Jul 1901, *MacDougal 755* (NY). Gallatin Co.: Madison Range, Gallatin Natl Forest, along Deer Creek Trail ca. 2-3 mi W of Hwy 191, ca. 27 mi SSW of Bozeman, S-facing talus, 7300 ft, 11 Aug 1990, *Evert 20288* (RM). Glacier Co.: Browning, near S city limits, prairie roadside, 1 Aug 1973, *Harms 20226* (KANU image). Lake Co.: Ravalli, 26 Aug 1908, *Butler 121* (NY); Jocks River near Ravalli, Aug 1897, *Elrod 200* (NY); 2 mi S of Polson, open grassy hills, 27 Jun 1948, *Hitchcock 17751* (ID, RM, WTU). Madison Co.: 5 mi SW of Anceney, dry slope in pasture, 5 Jul 1948, *Booth 2894* (WTU). Lewis & Clark Co.: Lewis & Clark Natl Forest, Sawmill Flats on Forest Rd 233, ca. 3.5 air mi S of Gibson Overlook, open meadow, 1556 m, 30 Jul 2008, *McNeill 2989* (RM). Madison Co.: 5 mi SW of Anceney, pasture, 5 Jul 1948, *Booth 2894* (RM). Meagher Co.: 10 mi NW of White Sulphur Springs, shale outcrop, 8 Jul 1947, *Hitchcock 16178* (ID). Missoula Co.: ca. 10 mi up Blackfoot Canyon above Bonner, rocky embankment, 25 Jul 1945, *Hitchcock & Muhlick 11448* - x *H. hispida*? (MO, NY, RM); Missoula, near campus, 3200 ft, 30 Jun 1921, *Kirkwood 1337* (DS); E of Missoula, Mt. Jumbo, below 300 year tree, 11 Jun 1935, *Rose 234* x *H. hispida*? (ID, MO); just N of Missoula, ridge of Waterworks Hill, dry rocky soil, 3300 ft, 4 Jun 1966, *Woodland 250* (DS). Park Co.: along N side of Yellowstone River just W of Bear Creek, 2 mi E of Gardiner, Gallatin Natl Forest, saltbrush-greasewood grassland, barren S-facing slope, 5300-5400 ft, 29 Jun 1998, *Evert 35208* (RM); Yellowstone Natl Park, NW side of Mt. Everts, just above Rescue Creek Trailhead, 1 mi S of Gardiner, 5500 ft, 1 Jul 1998, *Evert 35478* (RM). Teton Co.: Lewis & Clark Natl Forest, S slope of Elk Hill along FS Trail 268, ca. 7 air mi NW of Mortimer Gulch, open dry meadow, 1596 m, 15 Aug 2008, *McNeill 3704* [x *H. hispida*] (RM); Lewis & Clark Natl Forest, confluence of the N Fork Sun River and Circle Creek, ca. 7 air mi NW of Mortimer Gulch Campground, island and riparian, 1495 m, 15 Aug 2008, *McNeill 3724* (RM); Lewis & Clark Natl Forest, N Fork Sun River valley, along FS Trail 268, from S slope of Elk Hill to jct Trail 201, meadow, 1641 m, 16 Aug 2008, *McNeill 3752* (RM). Sanders Co.: National Bison Range, 1966-1968, *Thomas 11866, 13205, 14655, and 14773* (DS). Valley Co.: Bull Pasture Coulee and above, E of Windy Ridge, ca. 1.5 air mi NE of Erie Reservoir, ca. 17 air mi N of Hinsdale, sandstone outcrop, 2520-2680 ft, 27 Jul 2010, *Charboneau 2348* (RM). **Nevada.** Washoe Co.: Granite Range, steep unnamed canyon on SW end of range, S of Granite Peak, 7000 ft, along a steep canyon of granite rocks, 30 Jul 1986, *Tiehm 10816* (BRY, CAS, COLO, ID, NCSC, NY-Fig. 22, RM, RSA, TEX). **Oregon.** Baker Co.: limestone rocks of Hurricane Creek, 28 Aug 1898, *Cusick 2186* (WTU); rocky slopes of Wallowa Mts near Cornucopia, 18 Jul 1936, *Thompson 13325* (CAS, MO, RSA, WTU). Hood River Co.: Hood River, 10 Aug 1928, *Suksdorf 3399* (ID, x *H. vespertina*); near Cornucopia, rocky slopes

of Wallowa Mts, 18 Jul 1936, *Thompson 13325* (PH). Multnomah Co.: Woodville, Jun 1888, *Howell s.n.* (PH). Sherman Co.: Wallowa Mts, limestone rocks, 9 Aug 1898, *Cusick 2074* (DS, MO, UC); Wallowa Mts, limestone rocks of Hurricane Creek, 28 Aug 1898, *Cusick 2186* (MO, UC); near mouth of John Day, dry sandy hillsides, 25 May 1925, *Henderson 5265* (DS, MO). Wallowa Co.: Wallowa Mts, limestone rocks, 9 Aug 1898, *Cusick 2074* - x *H. hispida?* (MO, RM-2 sheets); Wallowa Mts, limestone rocks of Hurricane Creek, 28 Aug 1898, *Cusick 2186* - x *H. hispida?* (MO); 4 mi from Innaha on road to Joseph, rocky slope, 2 Jul 1952, *Howell 28552* (CAS); upper reaches of Toomey Creek above "Grand Canyon" of Innaha River (near mouth of river) along Vance Drew Trail, bare stony slopes, 16 Jul 1950, *Kruckeberg 2304* (UC, WTU); Wallowa Mts, stony banks of Slickrock Creek, vicinity of Hurricane Creek, 16 Aug 1946, *Maguire & Holmgren 27045* (UC); sandy banks of Snake River Canyon, Johnson's Bar, 10 Jul 1943, *Murley 1716* (MO); Innaha, dry ground, 4 Jun 1923, *Sherwood 434* (LL); Innaha, 5 Jun 1923, *Sherwood 433* (LL). Wasco Co.: Mayer State Park, Rowena, banks of the Columbia River, common in sand and rocky sites, mostly below high water mark, 12 Aug 1981, *Chambers 4899* (Portland State image!); along I-84 ca. 4.6 mi W of Exit 97 at Celilo, hillside, sandy soil, 55 m, 5 Sep 2011, *Halse 8356* (SRP image!); The Dalles, Jun 1869, *Harford & Dunn s.n.* (UC); E of The Dalles, 29 Jun 1938, *Milburge 1471* (WTU); The Dalles, 7 Sep 1916, *Shantz & Piemeisel 6178* (LL); The Dalles, dry ground, 1 Jul 1927, *Thompson 2820* (DS); The Dalles, 4 Jul 1931, *Thompson 7199* (CAS). Utah. Cache Co.: Bear River Range, head of Crescent Lake Canyon, 1.5 mi W of Logan River, loamy sand, 9000 ft, 24 Jul 1981, *Neely 589* (BRY); Wasatch Range, Tony Grove Lake, NW ridge, limestone outcrops, 8200 ft, doug fir-aspen, 1 Aug 1982, *Thorne 2187* (BRY); S end of Cache Valley on ridge extending NE from James Peak, ca. 5.9 km SSE of the summit of Middle Mtn, ledges of S-facing quartzite outcrop, 9200 ft, 15 Jul 1997, *Windham 97-133, n=9* (MO). Daggett Co.: Carter Creek, 8000 ft, 4 Jul 1944, *Jensen s.n.* (IDS image!, UC; a dup of this sheet at WS is *H. incensa*). Duchesne Co.: Uintah Mts, Pole Mtn, Farm Creek Mtn, Whiterocks drainage, burned lodgepole pine area, 9920 ft, 27 Sep 2011, *Huber 5260* (BRY). Grand Co.: Ryan Creek, ca. 2 air mi due W of Renegade Peak, S exposure of canyon slope, pinyon-juniper, 5940 ft, 31 May 1984, *Atwood et al. 9810* (BRY, NY); San Miguel and Lower Dolores River Drainages, slopes above Buckhorn draw, granitic slopes with juniper and *Purshia*, 4900 ft, 26 May 1994, *Lyon 3439* (FLD, RM). Rich Co.: Bear Lake State Park, N side of Bear Lake, 5926 ft, 20 Jul 2006, *Moon 2083* (NY). Salt Lake Co.: Little Cottonwood Canyon, 1 mi below Tanners Flat, roadside, 6800 ft, 22 Jul 1961, *Allan 178* (BRY-2 sheets); Lake Blanche, Big Cottonwood Canyon, 9500 ft, 9 Jul 1935, *Cottam 6284* (LL); Little Cottonwood Canyon, roadside, 7500 ft, 18 Aug 1956, *Cottam 14526* (RSA); Big Cottonwood Canyon, among rocks in exposed places, 9100 ft, 5 Aug 1905, *Garrett 1585* (DS-2 sheets, NY, PH, RM); Mose Falls Trail, Big Cottonwood Canyon, 25 Jul 1940, *Garrett 8353* (UC); Wasatch Mts, Alta, 8000 ft, 14 Aug 1879, *Jones 1271* (MISSA image!, NY, POM); Salt Lake City, Aug 1883, *Jones s.n.* (POM); Big Cottonwood Canyon, 26 Aug 1928, *Kildale 6684* (DS-2 sheets); Brighton, below Twin Lake, rocky slopes, 9200 ft, 5 Aug 1939, *Maguire 17340* (NY); Big Cottonwood Canyon, 10,500 ft, 14 Aug 1961, *Rowland 16976* (BRY); E of Midvale on Utah Hwy 190, Big Cottonwood Canyon, Mill B Picnic Area, Wasatch Natl Forest, cracks of exposed rocks, 7 Aug 1990, *Semple et al. 9247, 2n=18* (BRY, MO); Wasatch Mts, vic. of Clayton Peak, 10,00 ft, 12-26 Aug 1903, *Stokes s.n.* (MO). Summit Co.: Rocky slopes just above Snydermill Lodge (E of Olympic ski jump, NNW of Park city), 6900 ft, drying loamy soil of crevices, 22 Jul 2008, *Anderson 23,057* (UTC image!); Kamas, dry rocky slopes, 7200 ft, 1916, *Brower 325x* (RM); Gogorza, 11 Aug 1908, *Garrett 2304a* (LL, NY, RM); East Canyon, Sep 1929, *Garrett 5466* (LL); East Canyon near Gogorza, dry hillside, 6300 ft, 15 Aug 1953, *Garrett 8631* (SMU, UC); just W of Gogorza, along side of hwy [from Parley's Canyon to Evanston, Wyo.], 8 Aug 1945, *Garrett & Milner 8848* (RSA-2 sheets); Wasatch Mts, Smith & Morehouse Canyon, limestone ledges and cliffs, 8050 ft, 24 Aug 1984, *Goodrich 21436* (BRY, NY). Uintah Co.: Ca. 10 mi S of Bonanza on Hwy 45, common on sandy soil, 5600 ft, 25 Jul 1965, *Holmgren 2264* (NCSC, NY). Utah Co.: Mt. Timpanogos, dry summit, 11,000 ft, 2 Aug 1927, *Cottam 1336* (BRY); Upper Grove, 4 Aug 1925, *Garrett 3405* (NY); Wasatch Mts, Mt. Timpanogos, 22 Jun 1928, *Garrett 3887* (LL); Wasatch Mts, Mt. Timpanogos, 14 Aug

1930, *Garrett 5712* (LL); Cascade Mtn, cirque up Dry Fork, cliff crevices, 9600 ft, 17 Aug 1995, *Johnson 605* (BRY); American Forks, 26 Jul 1880, *Jones s.n.* (CAS, DS); American Fork, 28 Jul 1880, *Jones s.n.* (POM); Mt. Timpanogos, Aspen Grove, 6800 ft, 1 Jul 1949, *Murphy 60* (BRY); Aspen Grove [in Provo Canyon], creek bank, 6800 ft, 28 Jun 1939, *Ream 9297* (BRY, UC); American Fork Canyon, pass between Alpine and Granite Flat, 9400 ft, 12 Jul 1961, *Rowland 16887* (BRY); along trail to and at Stewarts Cascade, riparian and mixed mtn brush, 6600-6800 ft, 12 Sep 1980, *Welsh 633* (BRY, NY). Wasatch Co.: Deer Creek, 3 Aug 1880, *Jones 1271A* (POM). **Washington.** Asotin Co.: Along Snake River, 4 mi S of Asotin, sandy soil, 29 Jun 1958, *Baker 15234* (SRP image!). Ferry Co.: At Haag Cove on the Columbia River, 20 Jul 1973, *Saufferer 294* (BRIT, DS, NY, TEX, VDB); steep slope uphill side of Deadman Creek Rd, 1800 ft, 7 Aug 1995, *Swartz 129* (ID); slope below Deadman Creek Rd, 1400 ft, 17 Aug 1996, *Swartz 450* (ID). Klickitat Co.: White Salmon, gravel pit, 132 m, 17 Jul 1983, *Halse 2708* (WTU); 10 mi E of Bingen, base of basaltic cliff, 31 May 1946, *Hitchcock & Muhlick 13775* (WTU); S side of Dalles Airport, 200 ft, 23 May 2004, *Legler 1623* (WTU); ca 1 mi N of Dalles Dam on Hwy 97, dry sandy roadcut, 200 ft, 31 Aug 1960, *Munz 24228* (RSA, UC). Okanogan Co.: above Green Lake W of Omak, rocky hillside, 13 Aug 1931, *Fiker 466* (LL, WTU); Omak, 3 Jul 1911, *Jones s.n.* (POM); valley of Methow River, gravel bar of river, 21 Jul 1921, *St. John et al. 5518* (LL, UC); near Tonasket, dry open slopes, 2000 ft, 2 Jul 1932, *Thompson 8697* (MO, LL, WTU); near Tonasket, rocky sagebrush banks of Columbia River, 18 Jun 1935, *Thompson 11701* (CAS-2 sheets, LL, MO, PH, POM, WTU-2 sheets). Pend Oreille Co.: shores of Boundary Dam, Aug 1969, *Layser 1113* (WTU; x *H. vespertina*). Skamania Co.: S of Dalles Airport, loose and stabilized dunes and volcanic rock outcrops between runway and RR River, 16 Jun 2001, 262 ft, *Colwell 01-40* (ID, WTU). Spokane Co.: Spokane River, sand bar, 24 Sep 1913, *Johnson 2020* (WTU); near Spokane, 1912, *Nelson 60* (RM); by the Spokane River at Spokane Bridge, 14 Sep 1916, *Suksdorf 9061* (GH, WS); S side of Spokane, sandy soil on hills above jct of Hwys 10 and 195, 1 Jul 1941, *Weber 2234* (MO, NY, UC, WTU). Stevens Co.: Meyers Falls, RR embankment, 29 Jun 1903, *Beattie & Chapman 2198* (UC, WTU); Kettle Falls, dry sandy roadside, 2 Jul 1939, *Boner & Weldert 192* (CAS, DS, MO, NY, RM, UC, WTU); 3 mi NW of Northport, sandy alluvial soil, S slope, 1550 ft, 28 Jun 1932, *Hedgcock s.n.* (RSA); Myers Falls, sand 25 Aug 1902, *Kreager 516* (UC); Gold Creek at hwy, dry gravelly soil, *Purshia* association, 1900 ft, 5 Aug 1937, *Livingston s.n.* (BRY). Whatcom Co.: Ross Lake, mouth of Lightning Creek, S-facing cliffs, 3 Aug 1989, *Every & Vanbianchi s.n.* (WTU). Whitman Co.: Wawawai, Jun 1898, *Elmer 1017* (WTU). Yakima Co.: Yakima region, Oct 1883, *Brandege 838* (UC). **Wyoming.** Albany Co.: Centennial-Rambler Road, gravelly slopes, 1 Sep 1903, *Goodding 2070* (DS, MO, RM); Sheep Mtn, near aspen groves, 2 Sep 1903, *Goodding 2079* (DS, MO, NY, RM, UC); Medicine Bow Mts, Medicine Bow Natl Forest, along Rd 517 SE of Albany, grassy meadow, 14 Jul 1991, *Keil 22283* (OBI, UC); Lookout, granite flats, 1 Aug 1913, *Macbride 2595* (MO, RM); Hermosa, deep pine woods, 3 Aug 1913, *Macbride 2601* (MO, RM); Cummins, 29 Jul 1895, *Nelson 1497* (MO, RM); Laramie Hills, ravines, 18 Sep 1890, *Nelson & Nelson 6851* (MO); Centennial, moist canyons, 7 Aug 1902, *Nelson 8814* (MO); Bacon's Ranch, river bottoms, 15 Aug 1903, *Nelson 8921* (MO, NY, RM, UC); Laramie Plains, 1 Jul 1909, *Nelson 9310* (MO, RM, UC); near Tie Siding, Sep 1897, *Osterhout 1327* (NY). Big Horn Co.: Red Bank, in the dryer meadows, 20 Jul 1901, *Goodding 331* (MO, NY, UC). Campbell Co.: South Pumpkin Butte, 5093 ft, 27 Jul 1978, *Dueholm 5057* (RM). Carbon Co.: Windy Ridge Rd, rocky grassland, 6800 ft, 19 Jul 2008, *Dorn 10509* (RM); Medicine Bow Mts, Cedar Ridge and Cottonwood Creek, ca. 3 air mi NW of Hwy 130-230 intersection, ca. 9 air mi SE of Saratoga, sagebrush at base of ridge, ca. 7050 ft, 22 Jun 2009, *Lukas 9126* [atypical in reduced capitular bracts] (BRY); Beaver Creek, along road to North Park, 18 Aug 1916, *Osterhout 5538* (RM). Fremont Co.: Sweetwater Rocks, Craner Rock, 14.8 mi ESE of Jeffrey City, soil between granite boulders, 6280 ft, 13 Jun 1986, *Haines 6313* (NY); Split Rock Historical Marker site E of Jeffery City on Wyo Hwy 287, in soil pockets in cracks of gigantic outcrop, 26 Aug 1995, *Semple & Zhang 10417* (BRY, MO). Johnson Co.: E side Lake Desmet, sagebrush plain, 4800 ft, 21 Jul 1979, *Dueholm 8462* (RM); Big Horn Mts, Soldiers Park, 9000 ft, 19 Aug 1898, *Williams s.n.* (NY). Hot Springs Co.: Owl Creek

Mts, lower end of Wind River Canyon, along US Hwy 20/Wyo 789, 4 mi S of Thermopolis, rocky riparian, 4430 ft, 22 Jun 1997, *Evert 33231* (RM). Laramie Co.: 1.5 mi NW of Granite Reservoir, grassy hillside, 7400 ft, 12 Sep 1991, *Dorn 5318* (RM); Cherokee Park, rich moist meadowlands, 30 Jul 1923, *Nelson 10007* (DS). Lincoln Co.: Salt River Range, along Greys River at Forest Park, ca. 16.5 air mi ESE of Thayne, 14 air mi NE of Afton, gravel soil of flood channel, 6900 ft, 13 Jul 1996, *Harrison 727* (RM). Natrona Co.: Rattlesnake Mts, Burnt Wagon Draw and N slope of range, limber pine-covered N slope with drainages and open slopes and flats, 6800 ft, 26 Jun 1981, *Fonken 1261* (MO); Platte River, rocky foothills, 27 Jun 1901, *Goodding 120* [*x H. hispida?*] (BRY); Seventeen Mile Well on Salt Creek Rd, sandstone hillsides, 8 Jul 1901, *Goodding 215* (DS-2 sheets, MO, POM-2 sheets, RM-2 sheets, UC). Park Co.: Bighorn Basin, along Co. Rd 7WC at Dry Creek, ca. 3 air mi WNW of Cody, riparian, 5200 ft, 17 Jul 2001, *Lum 879* (BRY); Yellowstone Natl Park, Gardiner River, dry stony river bottom, 19 Jul 1899, *Nelson 5967* (MO, NY); Cody, Shoshone Canyon, 15 Aug 1910, *Nelson 9552* (MO, RM, UC); Bighorn Basin, along Gooseberry Creek, ca. 10.5 air mi SSE of Meeteetse, clay slopes with sandstone outcrops and ledges, 6000 ft, 31 Jul 1983, *Nelson 10610* (BRY); Yellowstone Natl Park, Bechler Canyon, Three Rivers Jct, wet meadows along Gregg Littles Fork, pine-spruce-fir, 7225 ft, 29 Aug 1986, *Thorne 5033* (BRY). Platte Co.: T28N R68W Sect 14-23 line, sandy wash, 4600 ft, 12 Sep 1992, *Dorn 5376* (MO, NY, RM). Sheridan Co.: Sherman, gravelly ridges, 6 Aug 1901, *Nelson 8575* (MO); Big Horn Mts, soil crevices of granite rocks above Story, 13 Jul 1934, *Rollins 633* (MO). Sweetwater Co.: Rock Springs, dry prairie, 10 Jul 1942, *Degener & Peiler 16096* (MO, NY); Leucite Hills, dry ledges, 18 Jun 1901, *Merrill & Wilcox 508* (NY); Point of Rocks, rocky slopes, 12 Jun 1900, *Nelson 7157* (MO). Washakie Co.: foothills of W slope of Bighorn Mts, 0.25 mi NE of Choate, slopes on S side of Billy Creek, 6800 ft, 23 Aug 1993, *Fertig 14456* (RM).

7. HETEROTHECA SCELIONIS Nesom, **sp. nov.** **TYPE: Oregon.** Jackson Co.: E of Central Point, banks of the Rogue River at Bybee's bridge, dry gravelly places, 25 Jul 1918, *A.A. Heller 13080* (holotype: US-Fig. 24; isotypes: CAS, DS, MO, NY, PH-2 sheets, WTU).

Similar to *Heterotheca hirsuta* in its glandular surfaces with reduced non-glandular vestiture and its long-ciliate leaf and bract margins but different in its linear peduncular bracts, lack of capitular bracts and broader, more triangular phyllaries. Distinct from *H. orovillosa* in its less dense vestiture of longer non-glandular hairs, linear-bracteate peduncles, triangular phyllaries with glandular surfaces, and long-ciliate petiole margins.

Stems 25–40 cm, erect to ascending-erect, branching mostly above midstem, hirsute to hirsute-villous with spreading to deflexed non-glandular hairs, sparsely to densely minutely glandular. **Leaves** cauline, basal mostly withered by flowering, 2–3 cm long, oblanceolate with a petiolar base, largest at midstem, midstem oblanceolate to oblong-oblanceolate and becoming epetiolate, mostly 3–3.5 cm long, gradually decreasing in size distally, becoming linear and bracteate, leaf and bract surfaces loosely strigose to hirsute or hirsute-villous, at least the distal evidently sessile-glandular, petiole margins and at least proximal blade margins long-ciliate. **Heads** solitary on axillary branches 4–8 cm long, peduncles becoming linear-bracteate; capitular bracts absent. **Involucres** 9–12 mm wide (pressed); phyllaries narrowly triangular, shallowly keeled, in 4–5 series evenly graduate in length, longest 7–8.5 mm long, minutely glandular, without non-glandular hairs, medial area broad and darkened, margins narrow, whitish. **Ray flowers** 15–20, ligules ca. 10 mm long.

Flowering Jun–Aug. Sandy and rocky banks of creeks and rivers, 500–2400 ft. Known by collections from along the Applegate, Clearwater, Rogue, and Umpqua rivers and from Evans Creek, a tributary of the Rogue River.

The epithet ("of the rogue") alludes to the Rogue River, a major feature in the range of the species. The river's name supposedly originated with French fur trappers, who regarded native

Americans living along it as rogues. Latin pronunciation of the beginning "sc" of scelionis is "sh" as in shall.

Additional collections. Oregon. Douglas Co.: Sandy ground along Umpqua River, near Dillard, 13 Jul 1945, *Peck* 23728 (POM); Clear Water, [no date], *Spalding s.n.* (MO). **Jackson Co.:** Evans Creek near Wimer, 22 Jul 1892, *Hammond* 233 (MO, US-Fig. 25); no specific locality, 1917, *Hawkins s.n.* (MONTU, Fig. 26); along the Applegate River 2 mi S of Ruch, 25 Aug 1927, *Wolf* 944 (DS, RSA). **Josephine Co.:** Rogue River 10 mi N of Grants Pass, 9 Jul 1926, *Abrams* 11239 (DS); Woodville [now the town of Rogue River], Jun 1888, *Howell* 1805 (HPSU); Grant's Pass, 17 Jun 1909, *Howell* 1806 (HPSU, Fig. 27); Grant's Pass, 17 Jun 1909, *Howell* 1807 (HPSU, Fig. 28); Rogue Canyon, 3 mi below Galice, sandy along river, 850 m, 4 Jul 1948, *Ripley & Barneby* 9625 (CAS).

Heterotheca scelionis varies in density of vestiture but the otherwise morphological and geographic cohesiveness and consistency of ecology support its recognition. The species overlaps in distribution with *H. oregona* in Douglas and Josephine counties but it otherwise is not sympatric with any other goldenaster.

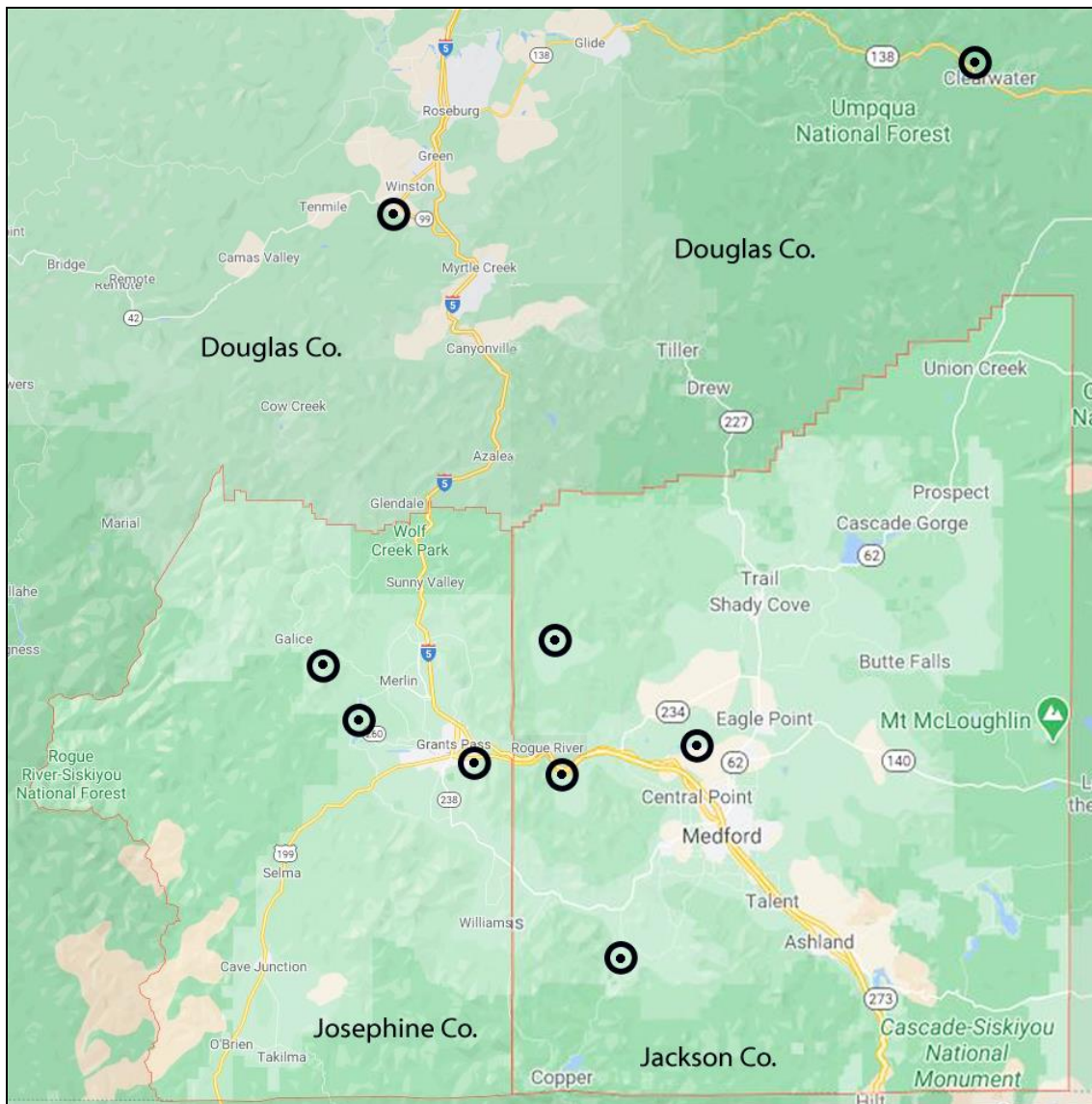


Figure 23. Distribution of *Heterotheca scelionis*. Douglas, Jackson, and Josephine counties, Oregon.



Figure 24. *Heterotheca scelionis*. Jackson Co., Oregon. Holotype (US).



Figure 25. *Heterotheca scelionis*. Wimer, Jackson Co., Oregon. Hammond 233 (US).



Figure 26. *Heterotheca scelionis*. Jackson Co., Oregon. Hawkins s.n. (MONT).



Figure 27. *Heterotheca scelionis*. Grant's Pass, Josephine Co., Oregon. Howell 1806 (HPSU).



Figure 28. *Heterotheca scelionis*. Grant's Pass, Josephine Co., Oregon. Howell 1807 (HPSU).

8. HETEROTHECA VESPERTINA Nesom, **sp. nov.** **TYPE: Washington.** Chelan Co.: Sandbars of Columbia River at Entiat [at mouth of Entiat River], 28 Jun 1934, *J.W. Thompson 10809* (holotype: MO!; isotypes: DS-2 sheets, LL, POM, US-Fig. 30, WTU-2 sheets).

Similar to *Heterotheca villosa* sensu stricto in its strigose, often silvery-sericeous stems and leaves but distinct in its lack of capitular bracts, broader involucre, fewer ray flowers, and different geography.

Perennials from a thick, woody taproot. **Stems** erect, (10–)15–40 cm tall, vestiture all strigose with appressed hairs or understory appressed with spreading overstory hairs, eglandular. **Leaves** usually ascending, narrowly to broadly oblong-oblancheolate or oblanceolate, epetiolate, not clasping, or sometimes proximal petiolate, mostly 2–4 cm long, relatively even-sized along the stem or sometimes smaller approaching the inflorescence, strigose with closely appressed hairs, sometimes silvery-sericeous, margins usually eciliate, sometimes long-ciliate or sometimes ciliate only along proximal margins. **Heads** solitary or in close clusters on bracteate peduncles 10–30 mm long, with narrow peduncular or subpeduncular bracts often as long as or longer than the involucre, without capitular bracts. **Involucre** (8–)11–15 mm wide (pressed), inner phyllaries 7–9 mm long; phyllaries strigose to strigose-sericeous with loosely appressed hairs, eglandular, tips not differently colored. **Ray flowers** (8–)14–16. Chromosome number, $2n=18$ (*Semple 2001, 2002*, Nez Perce Co., Idaho; *Semple & Brouillet 7082*, Klickitat Co., Washington; *Chinnappa & Chmielewski 257*, Alberta; *Taylor & Taylor 5342*, British Columbia).

Heterotheca vespertina is characterized by its large, often solitary (long-pedunculate) heads, inconsistently produced capitular bracts, and appressed cauline and leaf vestiture of fine-based hairs, usually giving plants a silvery-sericeous aspect. It is similar in vestiture to *H. villosa* but the two entities are allopatric — they perhaps are an evolutionarily vicariant pair but convergence is common in *Heterotheca* and their relationship is speculative. Although both entities are variable over their relatively wide ranges, *H. vespertina* differs consistently from *H. villosa* in its lack of prominent capitular bracts, broader involucre, and fewer ray flowers. Their allopatry is significant in the recognition of *H. vespertina* as distinct.

1. Heads usually in a compact corymboid arrangement, capitular bracts present; involucre 7–12 mm wide (pressed), inner phyllaries 6–8 mm long; ray flowers 16–28; phyllary tips often purplish

..... 11. **Heterotheca villosa**

1. Heads solitary (long pedunculate) or in a loosely corymboid arrangement; capitular bracts present or absent; involucre (8–)11–15 mm wide (pressed), inner phyllaries 7–9 mm long; ray flowers (8–)14–16; phyllary tips not colored

..... 7. **Heterotheca vespertina**

Additional collections examined. CANADA. British Columbia. Jackman Flats, ca. 110 km on the Jasper-Kamloops road, sandy soil with open lodgepole pine forest, 600 m, 14 Aug 1997, *Breteler 13887* (MO); E side of Kootenay Lake near Sanca Creek, open, rocky, W-facing cliffs, 18 Jun 1953, *Calder & Saville 9345* (CAS, ID, WTU); W side of Okanogan Lake, 26 Jun 1953, *Calder & Saville 9699* (NY, WTU); Ashcroft, 28 Jun 1907, *Cowles 206* (MO); Lytton, 16 Jul 1899, *Diehl s.n.* (BRY); Ashnola River Road (km 7), open *Pinus ponderosa*, gravel floodplain, 900 m, 29 Jun 1980, *Douglas 11661* (BRY); Glacier, Jul 1896, *Dudley s.n.* (DS); 2 mi N of Lytton (jct of Fraser and Thompson rivers), bone-dry banks and cutting of dry river bench, 21 Jun 1933, *McCabe 187* (UC); Skagit River, 17 Jun 1905, *Macoun 76937* (NY). **USA. Idaho.** Clearwater Co.: 6 mi NE of Ahsahka, gravelly banks of the N Fork Clearwater River, 11 Jul 1946, *Christ & Smith 15408* (NY). Idaho Co.: 2 mi S of Pollock along the Little Salmon River, 21 Jul 1954, *Baker 11975* (WTU); Riggins, rock outcrop along Salmon River, 5 Aug 1937, *Christ 8499* (NY) and *8500* (NY); 1.5 mi below Kooskia, sandy flat near Clearwater River, 31 May 1936, *Constance & Rollins 1697* (WS, WTU); White Bird, 20 Jun 1939, *Davis 959* (RM, UC); Spring Bar on Salmon River Road, 7.5 air mi E of Riggins, sandy margin of dried river bed, 5 Oct 2013, *Ertter 21688* (UC); Goff, 1700 ft, Dec 1899, *Jones s.n.* (POM); 1.6 mi E of Slate Creek up Slate Creek road, dry rocky hillside with

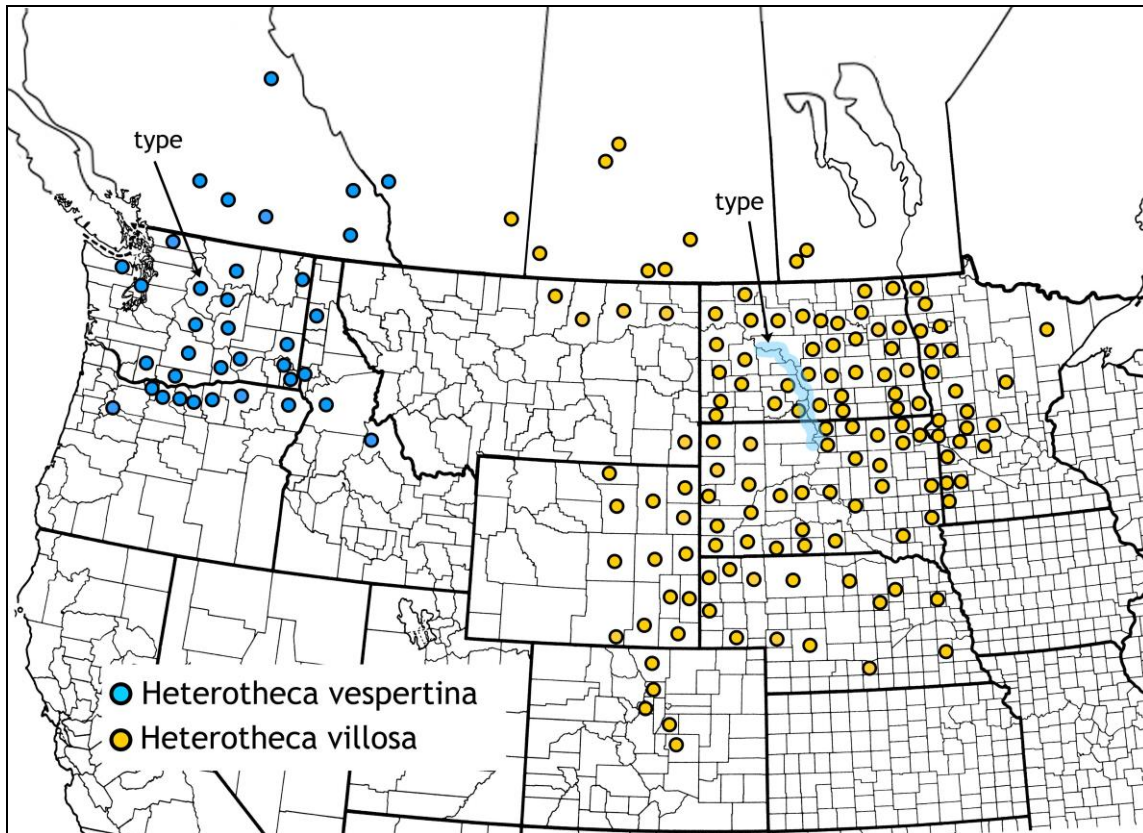


Figure 29. Distribution of *Heterotheca vespertina* and *H. villosa*. Blue highlight shows stretch of Missouri River along which the type collection was made (see Nesom, *Phytoneuron* 2020-67).



Figure 30. Detail from isotype (US).



Figure 31. *Heterotheca vespertina*, Benton Co., Washington. Sackschewsky 156 (PNNL).



Figure 32. *Heterotheca vespertina*, Island Co., Washington. Legler 1692 (WTU).

Opuntia, 28 Jun 1950, *Jones 125* (DS, NY, RSA, SMU, WS, WTU); Middle Fork Clearwater, near Three Devils Creek, sand bar, 17 Aug 1950, *Jones 363* (WTU); 2.3 mi S of Slate Creek, sandy bench, 1800 ft, 12 Jul 1951, *Pringle 74* (ID). Kootenai Co.: Rocky places, Aug 1892, *Sandberg 5067* (POM, WTU). Lemhi Co.: Near mouth of Jacks Creek along Middle Fork Salmon River, flat rocky area, 3560 ft, 2 Jun 1992, *Mancuso 651* (ID). Nez Perce Co.: Lewiston, gravel bar in river, 16 May 1934, *Christ 4260* (NY); Lewiston, sandy river bank, 6 Jul 1913, *Dunkle 299* (ID); lower level adjacent to Clearwater, riparian, alluvium, 775 ft, 23 Aug 2000 *Foster 11997* (BRY); Craig Mtn, along the lower Salmon River, sand bar near mouth of China Creek, 29 Jun 1994, *Mancuso 1195* (ID); island near mouth of Clearwater, gravelly soil, 12 Oct 1924, *Ridout s.n.* (WS); E of Lewiston, just W of US Hwy 95 and US 12 junction, 22 Aug 1975, *Semple 2001* (MO-2 sheets); 17 mi NW of Orofino, rest area on US Hwy 12 between Lewiston and Orofino, 22 Aug 1975, *Semple 2002* (MO); Upper Ferry, Clearwater River, E of Lewiston, 31 May 1892, *Sandberg Exped. 280* (DS, NY-2 sheets, PH). **Oregon.** Gilliam Co.: Quinton, cliffs along the Columbia River, 250 ft, 27 Aug 1941, *Rose 41416* (CAS). Hood River Co.: Hood River, 10 Aug 1928, *Suksdorf 3399* (RM, RSA, WS [x *H. hirsuta?*], WTU-2 sheets); along I-80, W of The Dalles, 0.1 mi E of milepost 92, 8 mi W of the Sherman Co. line, roadside S of the freeway, 5 Aug 1983, *Sundberg 2032* (TEX, WTU). Marion Co.: 1.5 mi W of Orville, gravelly shore of Willamette River, 12 Jul 1922, *Nelson 4399* (WS, WTU); 1 mi S of Talbot, gravelly woods along Santiam River, 2 Aug 1922, *Nelson 4536* (WS); 2 mi W of Keizer, gravelly shore of Willamette River, 12 Aug 1922, *Nelson 4613* (PH). Multnomah Co.: Portland, dry areas, 3 Aug 1936, *Demaree 13411* (NY). Polk Co.: 1.5 mi N of West Salem, gravelly shore of Willamette River, 29 Jul 1923, *Nelson 4902* (PH). Sherman Co.: Near Biggs, Columbia River, 16 Jul 1923, *Peirson 3892* (RSA); mouth of Deschutes River, 13 May 1923, *Sherwood 418* (LL). Umatilla Co.: S bank Columbia River at Corps of Engineers Coldstream Park, E of Hat Rock State Park, dry river bank, 350 ft, 13 Sep 1982, *Grable 9646* (WS). Wallowa Co.: Snake River Canyon, Christmas Creek, dry slopes near river, 1035 ft, 11 Jun 1937, *Packard 236* (UC, WS). Wasco Co.: 15 mi NE of The Dalles, 14 Aug 1941, *Brenckle & Shinnors 230* (PH); along Columbia River E of The Dalles, 10 Aug 1936, *Milburge 1257* (WTU); The Dalles, dry exposed slope, 26 Jun 1925, *Munz 9906* (POM); bank of John Day River at Clarno, 3 Jul 1921, *Peck 10011* (DS-2 sheets). Wasco/Sherman Co.: Bank of Columbia River at mouth of Deschutes River, 28 Jun 1921, *Peck 9927* (RSA). **Washington.** Asotin Co.: 4 mi S of Asotin, along Snake River, sandy soil, 29 Jun 1958, *Baker 15234* (ID, NY-2 sheets, WTU); 3 mi S of Asotin, gravel and sand bar of Snake River, 26 May 1944, *Hitchcock & Muhlick 8337* (NY, WS, WTU). Benton Co.: Roadside W of Midway, base of Umtanum Ridge, rocky soil, ca. 400 ft, 18 Jun 1983, *Baird 204* (BRY, NY); Hanford Works (DOE), disturbed area with rabbitbrush, 395 ft, 7 Jun 1984, *Baird 997* (BRY, NY); along Columbia River, 1 mi N of E White Bluffs ferry site, riparian, 380 ft, 13 Jun 1984, *Baird 1087* (BRY, NY); ca. 1/4 mi SE of Hanford reactor, above river, 9 Jul 1991, *Sackschewsky 156* (BRY). Chelan Co.: Meyers Falls, 22 Aug 1902, *Kreager 516* (NY); near Leavenworth, just outside Wenatchee Natl Forest, 9 Aug 1938, *Purer 7757* (MO); rocky banks of the Columbia River at Entiat, 16 May 1931, *Thompson 6368* (MO, PH); rocky banks of the Columbia at Entiat, 25 Jun 1931, *Thompson 6899* (DS, LL, MO, PH, WTU-2 sheets). Clallam Co.: Eastern shore of Washington Harbor, steep sand bank above beach, 14 Sep 1921, *St. John 5869* (MO). Franklin Co.: 8 mi N of Kahlotus, partially compacted sand between dunes, sandhills, 7 Jul 1935, *Constance & McMurray 1138* (LL, MO); Fish Hook Ferry, 210 m, 18 Sep 1894, *Leiberg 931* (UC). Garfield Co.: Glendale Bar, Snake River, 19 Jun 1892, *Henderson s.n.* (WTU); 4 mi below Lower Granite Dam of Snake River, sand dunes, 19 Jul 1983, *Jenkins SD-1* (WS); Illia, 25 Jun 1892, *Lake & Hull 752* (WS); 5 mi NE of Central Ferry, gravel bar, 31 May 1925, *St. John et al. 6984* (WS); Illia, gravelly river bank, 23 Oct 1927, *St. John et al. 9231* (LL, WS). Grant Co.: Gopher Island of Columbia River, E of Ginkgo Petrified Forest State Park, 24 Jun 1936, *Smith 1243* (DS) and 15 Aug 1936, *Smith 2003* (DS). Island Co.: Whidby Island, between Ebey's Landing and Perego's Lagoon, 15 ft, 20 May 2001, *Beck 200120* (WTU); Whidby Island, Jul 1896, *Gardner s.n.* (UC); Glendale, 19 Jul 1892, *Lake & Hull s.n.* (MO); Whidby Island, Ebey's Landing, bluff 1/4 mi N of parking area, 7 ft, 4 Jun 2004, *Legler 1692* (WTU); Whidbey Island, scattered on sandy, grassy slope near salt water, 19 Jun 1983, *Naas 4218* (BRIT); ca. 3.5 mi W of Coupeville, sandy bluff, 7 Jul 1990, *Naas 5579* (WTU). Kittitas Co.: Yakima River, 24 Jul 1923, *E. Nelson s.n.* (RM); Rock Island, sandy plains, 610 ft, 14 Jul 1893, *Sandberg & Leiberg 454* (CAS, MO, NY, UC, WS); Ginkgo State Park, Gopher Island, 24 Jun 1936, *Smith 1243* (WTU); Ginkgo Petrified Forest State Park, Columbia River, 19 Jul 1936, *Smith 1375* (SMU, WS);

Ellensburg, 18 Jul 1897, *Whited 575* (WS). Klickitat Co.: Outlet of Rock Creek into Columbia River, N side of Hwy 14, 4 Jun 1980, *Camp 401* (WTU); Goldendale, prairies, 21 Jun 1926, *Gorman 7717* (DS); Bingen, 9 Aug 1926, *Jones 2427* (WTU); Columbia River, dry grounds, 25 Aug 1882, *Suksdorf s.n.* (MO, PH); near Columbus, 10 Jun 1886, *Suksdorf 2376* (WS); sand drifts at North Dalles, sagebrush region, 29 Jul 1934, *Thompson 11111* (LL). Okanogan Co.: Orville, 26 Jun 1911, *Jones s.n.* (POM); Methow River, gravel bar, 21 Jul 1921, *St. John et al. 5518* (WS, WTU). Pend Oreille Co.: Box Canyon, stony bank of Pend Oreille River, 3 Aug 1902, *Kreager 397* (UC, WS, WTU). Skamania Co.: Dalles of the Columbia, 2 Aug 1880, *Engelman s.n.* (MO). Walla Walla Co.: Fish Hook ferry, 210 m, 18 Sep 1894, *Leiberg 931* (NY). Whatcom Co.: Ross Lake Natl Rec Area, Lightning Creek Trail, ca. 1 mi above Ross Lake, 2400 ft, 14 Jul 2002, *Legler 43* (WTU). Whitman Co.: Snake Canyon E of Steptoe Canyon, crumbly basalt, 9 Jul 1964, *Daubenmire 6410* (WS); Snake River Canyon opposite Clarkston, Aug 1934, *Clarke s.n.* (WTU); Wawawai, 8 Jul 1898, *Piper s.n.* (NY, WS); Snake River, Indian, sandy bank, 20 May 1923, *St. John & Warren 3396* (NY, UC); alluvial fan entering Snake River, 0.2 mi E of USGS Gaging Station, 2 Jun 1965, *Wakefield 671* (WS, WTU). Yakima Co.: S bank Naches River, near confluence of Yakima River, ca. 40 ft, 3 Oct 1992, *Gage & Rodman 855* (WTU); Naches River, E of Naches town, 15 Oct 1942, *Hoover 6001* (CAS, OBI); near Yakima, 17 Jul 1927, *Jones 1792* (WTU); N Yakima, Aug 1895, *Watt s.n.* (WS).

9. HETEROTHECA OROVILLOSA Nesom, **sp. nov.** TYPE: **California.** Plumas Co.: Marble Mts, 4 Aug 1939, *Howell 15049* (holotype: UC; isotype: CAS).

Distinct in its caespitose habit, hirsute (1-storied vestiture) stems, mostly oblanceolate and essentially epetiolate leaves, solitary or loosely arranged heads on relatively long, bracteate peduncles without capitular bracts, and northeastern California-southwestern Oregon geographic range.

Perennials from a thick, woody taproot, sometimes with woody, rhizome-like caudex branches. **Stems** erect-ascending from the base, 10–40 cm, eglandular to evenly and densely sessile-glandular, sparsely to densely hirsute to hirsute-villous with curving, spreading to spreading-ascending or deflexed non-glandular hairs in a single story. **Leaves** evenly distributed up to the peduncles, mostly oblanceolate or oblong-oblanceolate to narrowly obovate or oblong-lanceolate, without a distinct petiolar region, 1.1–3 cm x (1–)2–8(–10) mm, mostly even-sized, sparsely to moderately hirsute-strigose, hirsute-villous, or pilose at least along the midvein, usually densely sessile-glandular to stipitate-glandular (especially adaxially), sometimes eglandular, margins ciliate proximally. **Heads** solitary or loosely arranged on relatively long (2–8 cm), bracteate peduncles, usually without capitular bracts or sometimes (especially in El Dorado, Placer, Sierra cos.) with 1-2 linear to linear-lanceolate bracts. **Involucres** 9–18 mm wide (pressed), inner phyllaries 7–10 mm; phyllaries finely loosely strigose to strigose-hirsute or villous-hirsute, sometimes sparsely so, eglandular to minutely sessile-glandular, margins prominently hyaline. **Disc corollas** glabrous. **Ray flowers** 9–24. **Chromosome numbers**, $2n=18$ (Plumas Co., *Suripto & Ahmed 9313*, as cited by Semple 2008), $2n=36$ (Shasta Co., *Semple & Suripto 5715*).

Flowering Jun–Aug(–Sep). Along rocky stream and lake sides, meadows, low alkaline areas, roadsides and roadbanks, rock outcrops, cliffs and rock crevices, lava beds, fir and mixed conifer, pine-fir, yellow pine, juniper-sagebrush, sagebrush scrub; (1200–)3600–8200(–8650) ft. California, sw Oregon (Josephine Co.), nw Nevada (Washoe Co.).

These plants previously have been identified as expressions of a broadly conceived *Heterotheca villosa* but they form a geographically discrete population system not sympatric with any other similar species. The southward-disjunct populations in Kern County appear to belong with the species.

Early in the study I thought two species existed among these plants and annotated some collections as "H. doradoensis" based on the strongly expressed glandularity of stems and leaf surfaces, but geographic patterns in vestiture are not evident *Heterotheca orovillosa* apparently varies widely in glandularity as well as in ecology.

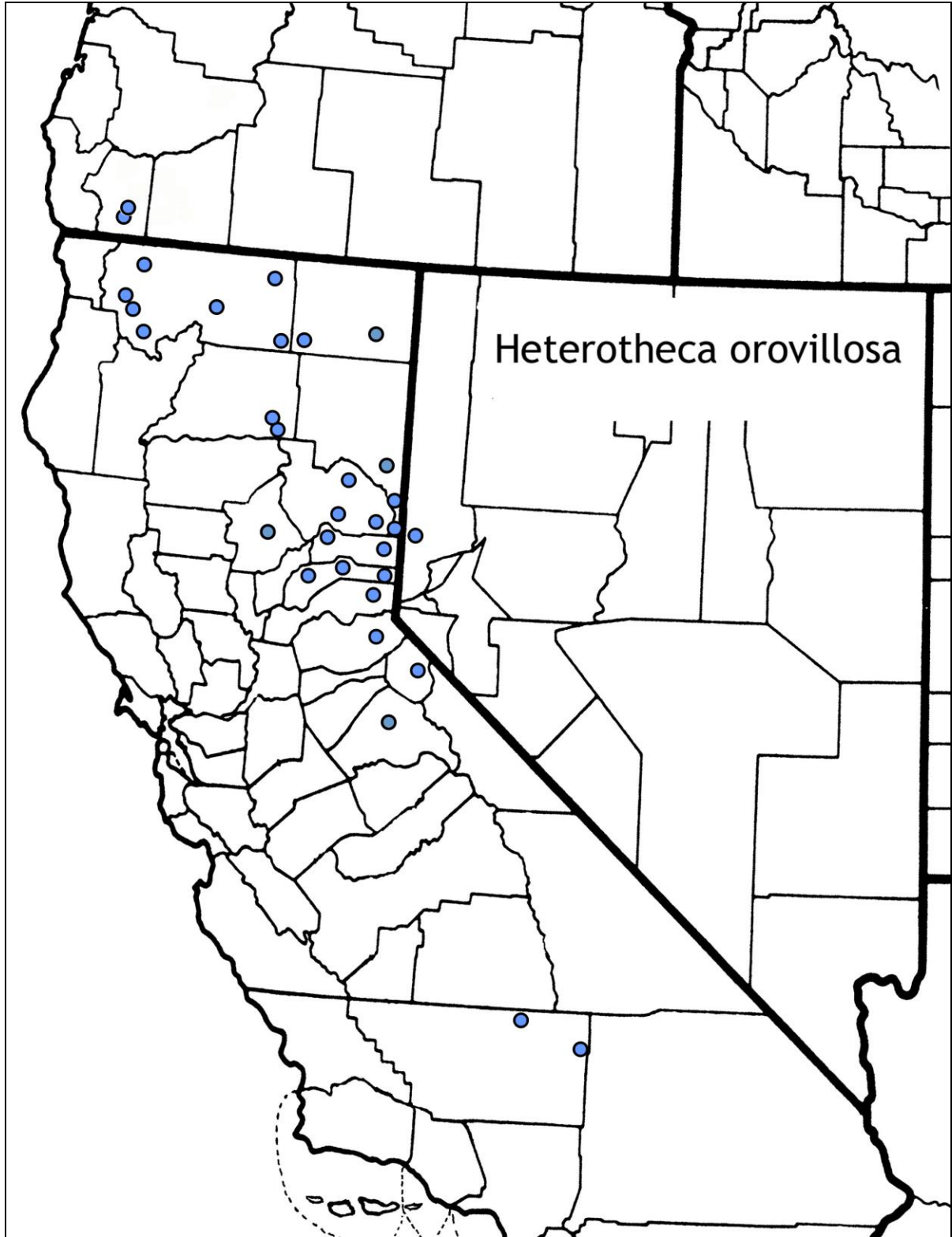


Figure 33. Distribution *Heterotheca orovillosa*.

Figure 34. *Heterotheca orovillosa*, Plumas Co., California.



Figure 35. *Heterotheca orovillosa*, Tuolumne Co., California. Colwell AC05-299 (UC).



Figure 36. *Heterotheca orovillosa*, Siskiyou Co., California. Howell 15049 (UC).

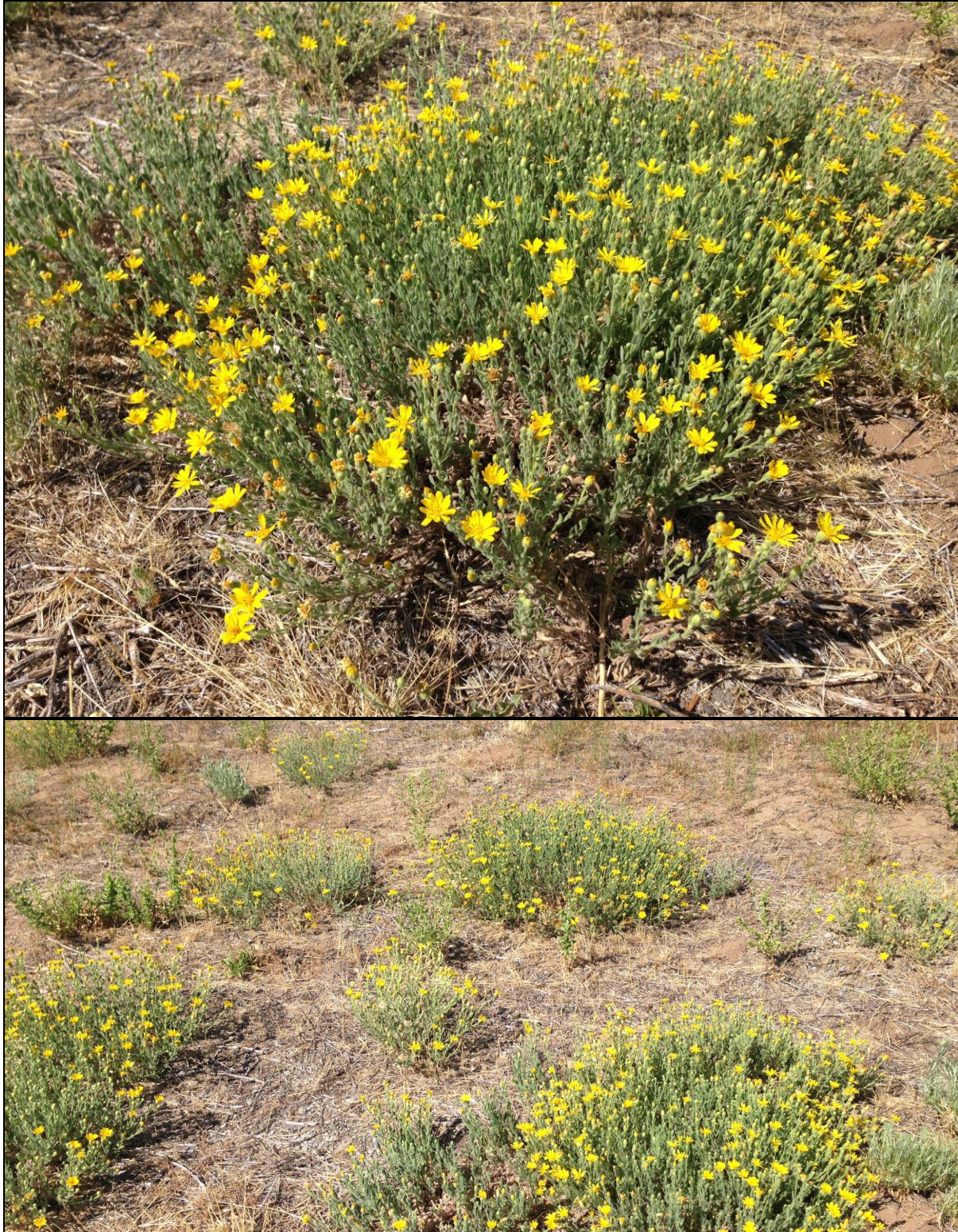


Figure 37. *Heterotheca orovillosa*, Plumas Co., California, roadside on N side of Chilcoot, locality of Nesom CA2017-7. Upper: Single plant, many decumbent-ascending stems. Lower: Population aspect. Photos by Nesom, 22 Jul 2017.

Additional collections examined. California. Alpine Co.: stream between Raymond Lake and Pleasant Valley, ca. 6000 ft, granite, sand, 11 Aug 1970, *Hardham 17711E* (CAS, TEX); N side of Pigeon Flat, 23 Jul 1939, *Hoover 4154* (LL, UC-2 sheets); Dixon Mine, ca 4 mi up Wolf Creek from E Fork of Carson River, 19 Jul 1959, *Wilkey s.n.* (CAS). El Dorado Co.: Lake Tahoe Region, Lake Valley, 6400 ft, 27 Jul 1911, *Abrams 4786* (DS, NY, UC); Heather Lake, crevices in granite, 8200 ft, 15 Aug 1930, *Abrams 12737* (LL, MO, SMU, WTU); Emerald Bay, Jun-Jul 1912, *Geis 60* (UC); Heather Lake, 7900 ft, 28 Aug 1918, *Jepson 8179* (JEPS, VDB); vicinity of Fallen Leaf Lake, summer 1923, *Lorraine s.n.* (DS); near foot of North Trail to Tallac, on rocks a few feet above the lake, 6400 ft, 15 Jul 1925, *Peirson 6283* (DS, POM); between Wright's Lake and Crystal Basin, SE of Four Cornered Peak, *Pinus jeffreyi* and *Abies concolor*, 6100 ft, 7 Sep 1970, *Stebbins 7093* (CAS). Kern Co.: 5 mi NW of Searles Station, 3500 ft, 10 May 1947, *Benson 12375* (POM); "Chico Rancheria" just N of Bull Run Creek, 1 mi NW of Kernville, sandy soil beside trail after creek crossing, 3000 ft, 31 Oct 1976, *Luthey 464* (CAS). Lassen Co.: Honey Lake Valley, ca. 5 mi W of Doyle on US 395, just inside Plumas Natl Forest boundary, open understory of pines, 9 Jun 1993, *André 19697* (UCR); Long Valley, Honey Lake Valley, 17-24 Jun 1897, *Burt Davy s.n.* (UC); ca 3/4 mi ENE of Beckwourth Pass at end of old crumbly paved road, meadow at head of streamlet in sagebrush zone, ca 5000 ft, 24 Jul 1987, *Ertter 7302* (NY, RSA, UC); along state Hwy 70 at Beckwourth Pass, 1.6 mi E of Sierra Valley, 1584 m, 26 Aug 2010, *Halse 8091* (BRY, NY, RSA ID); Chat [2 mi ESE of Beckwourth Pass], 12 Jul 1897, *Hillman s.n.* (POM); Chat, 5000 ft, 18 Jun 1897, *Jones s.n.* (MO, POM); intersect. of Hwy 70 and Scott Road, 2.2 mi W of Hwy 395, roadside bank, sagebrush scrub, 4800 ft, 25 Jul 1990, *Oswald & Ahart 4397* (MO, UC); Ft. Sage Mts, big sage, decomposed granite, 5400 ft, 28 Jun 1982, *Schoolcraft 735* (NY); W of Hwy 395 and S of Hwy 70, near Hallelujah Junction, 4900 ft, 27 Jul 1974, *Williams 74-61-61* (CAS, TEX). Modoc Co.: lava beds at W side of Egg Lake, 1300 m, *Pinus ponderosa*, 6 Jul 1991, *Bartholomew 5980* (CAS); lava beds of SW part of the county, 21 Jun 1903, 4000 ft, *Hall & Babcock 4237* (UC). Nevada Co.: ca. 5 mi N of Nevada City, large rocks along along South Fork Yuba River, 2.5 mi E of the bridge, E of Lake Vera Road, foothill woodland, 400 m, 22 Aug 1983, *Ahart 4343* (CAS, MO); N side of Bowman Lake, rocks along dirt road, 5680 ft, 23 Oct 1986, *Ahart 5412* (CAS, MO); below Floriston granite soil, 5000 ft, 27 Jun 1933, *Benson 4564* (POM); along and near Interstate Hwy 80 at Farad Interchange, 5200 ft, 10 Oct 1976, *McPherson 76-31-2* (CAS); road paralleling the N side of Bowman Lake, ca 5 air mi E of Graniteville, fir forest, 5640 ft, 20 Aug 1998, *Oswald & Ahart 9513* (JEPS); Soda Springs, 19 Sep 1882, *Pringle s.n.* (CAS, SMU); on Nevada/Calif. state line, Jul 1888, *Sonne 465* (MO); old shingle mill near state line, Jul 1888, *Sonne s.n.* (UC-2 sheets); near Verdi, at Shingle Mill, Jul 1888, *Sonne s.n.* (UC); Lang's Crossing on S. Yuba River, Bear Valley-Bowman Rd, 4500 ft, 20 Sep 1962, *True 1098* (CAS) and *1099* (CAS); N shore of Bowman Lake, ca 11 mi N of Emigrant Gap, crevices in granite, 5600 ft, 27 Aug 1964, *True 1679* (CAS); Truckee River at Farad Powerhouse, dry rocky slope, 5200 ft, 30 Jun 1965, *True 2088* (CAS); ca 6 mi W of Truckee just S of Hwy 80 on Donner Lake Road, Negro Canyon, roadcut, 6700 ft, 23 Jun 1966, *True 2940* (CAS). Placer Co.: Donner, Jul 1889, *Brandege s.n.* (UC); [no other data], Sep 1892, *Carpenter s.n.* (UC). Plumas Co.: W side of Little Last Chance Creek, on the strand of Frenchman Lake, mtn meadow in yellow pine forest, 5580 ft, 29 Aug 2001, *Ahart 9269* (JEPS); along US Hwy 40A, 6 mi E of Portola, abundant in field with sagebrush, 4825 ft, 3 Aug 1962, *Barclay et al. 1516* (LL); Plumas Natl Forest, 2.4 mi S of Johnsville or 7.8 mi S of Hwy 89 and road to Eureka State Park, just W of Eureka State Park, frequent on rocky slopes, greenstone rocks, 5440 ft, 13 Jun 1976, *Denton 3882* (WTU); NW edge of Sierra Valley, ca. 3.9 air mi E of Portola, Beckwourth-Calpine road (A23), roadside of disturbed dry meadow in sagebrush scrub, 4885 ft, 8 Aug 2003, *Dittes 2003-80* (RSA); Frenchman Lake, Plumas Natl Forest, 5670 ft, roadside, 22 Aug 1989, *Goeden 1* (UCR); Indian Valley, 3600 ft, Jul 1903, *Hall & Babcock 4435* (DS, RM, UC); Sierra Valley, Hindoo Ranch, roadside, 4890 ft, 29 Jun 1989, *Harnach 201* (CAS); Jamison Creek, ca 6000 ft, 27 Jun 1951, *Howell 27632* (CAS); Vinton, Sierra Valley, 5000 ft, 20 Aug 1951, *Howell 28230* (CAS); Sierra Valley near Beckwourth, ca. 4900 ft, 25 Sep 1959, *Howell 35011* (CAS); canyon of Little Last Chance Creek between Chilcoot and Frenchman Reservoir, 5500 ft, 11 Aug 1977, *Howell 52670* (CAS, UCR); near Cascade Creek, ca 1.25 mi SW of Little Grizzly Creek, edge of dirt road, 6100 ft, 15 Aug 1990, *Janeway 3829* (CAS); S-most end of Diamond Mts ca. 4.5 N of Beckwourth Pass, E-facing slope of soft, decomposed granite soil, 30 Jul 2005, *Janeway 8502* (RSA); dirt road on N side of Jamison Creek 0.3 road km W of Plumas Eureka State Park boundary, N side (upslope) of road, 1704 m, 6 Aug 2011, *Janeway*

10629 (RSA); Genesee Valley, 3600 ft, 16 Aug 1918, *Jepson 8022* (JEPS); Rich Point, Middle Fork Feather River, rocky river bed, 3000 ft, 22 Jul 1924, *Jepson 10609* (JEPS); Sierra Valley, just S of Vinton, wet meadow area, 5000 ft, 16 Jun 1983, *Lavin 4419* (CAS, MO, TEX); N side of Chilcoot along Hwy 70, sagebrush plains in Sierra Valley, 5000 ft, with *Grindelia* and *Gutierrezia*, just into full flower, very abundant from here west to Vinton, each plant multicapital with 10-20 decumbent-ascending stems from a woody taproot, 22 Jul 2017, *Nesom CA2017-7* (ARIZ, CAS, COLO, MO, OSU, RSA, RM, TEX, UC, US, WTU); Chilcoot, Sierra Valley, 4995 ft, 23 Jul 1934, *Rose 34419* (CAS, WTU); Vinton, low alkaline area among sagebrush, ca 4940 ft, 19 Jul 1955, *Rose 55150* (CAS, RSA); SW of Portola, loamy soil with *Pinus jeffreyi*, *Artemisia tridentata*, *Purshia tridentata*, 4860 ft, 17 Jun 1981, *Schoolcraft 469* (UC); couple of mi N of Chilcoot, sandy slopes and flats with big sagebrush, 5000 ft, 27 Jul 1982, *Schoolcraft s.n.* (UC); N of Chilcoot, sagebrush, 5400 ft, 27 Jul 1982, *Schoolcraft 814* (NY); E side of Ramelli Ranch, S of Feather River, ca 2 mi ESE of Beckwourth, sagebrush scrub, dry sandy soil, 4800 ft, 13 Jul 1981, *Taylor 4005* (MO); Wemple Cabin, Antelope Creek, 1 air mi NE of Antelope Lake, shoulder of gravel road edge of sagebrush meadow, 6100 ft, 12 Aug 2000, *Taylor 17550* (JEPS); ca 3 mi SW of Johnsville, ca. 1 mi W of Plumas-Eureka State Park, along N side of Jamison Creek Road (507) on cliffs, 5900 ft, 11 Aug 1982, *Taylor & Swanson 4970* (CAS, MO); near Chilcoot, 5000 ft, 23 Jul 1974, *Williams 74-P-1* (CAS, NY).

Shasta Co.: Lassen Natl Forest, lava flats ca 1.5 mi ENE of Sugarloaf Peak, 1303 m, 19 Jun 2011, *Baniaga 380* (OBI, UC); Upper Falls River Valley, 3400 ft, 11 Aug 1914, *Jepson 5783* (JEPS); 1 mi E of Old Station on Hwy 44, base of large lava flow where hwy turns to ascend, 26 Aug 1981 [all past flower], *Semple 5715*, **2n=36** (MO, NY); Calif Hwy 89, 1.3 km N of Calif Hwy 44 (Old Station), lava flow and gravel road margins, 12 Aug 1990, *Semple et al. 9302* (MO); Hwy 89 N of Lassen Peak, 25 Jul 1972, *Shevock 2215* (RSA).

Sierra Co.: ca 5 mi E of La Porte, ca 1/4 mi N of Pacific Mine, yellow pine, 1700 m, 28 Jul 1982, *Ahart 3702* (CAS); Plumas Natl Forest, ca halfway down SE side of Port Wine Ridge to Canyon Creek, 3.1 air km SW of Table Rock, steep, S-facing rock opening in mixed conifer forest, 1603 m, 8 Sep 2008, *Janeway 9578* (JEPS); Sierra Valley, Aug 1874, *Lemmon s.n.* (UC).

Siskiyou Co.: ca 7.5 mi NE of Weed on Hwy 97, 3700 ft, 2 Jul 1961, *Bacigalupi 7982* (JEPS-2 sheets); Marble Valley, crevices of Marble Rocks, 5500 ft, 8 Aug 1908, *Butler 338* (JEPS, UC); ca 7 mi NNE of Seiad Valley, W of Cook & Green Pass, ca 1/2 air mi from Red Butte, rock crevices, 1850 m, 16 Jul 1986, *Heckard 6324* (JEPS-2 sheets); SE corner of county, 4 Jul 1934, *Howell 12405* (CAS, POM); near Marble Mt. Lookout, dry ridge, 28 Jul 1965, *Muth 311* (RSA); Marble Valley, cracks in marble, 4 Aug 1965, *Muth s.n.* (CAS-2 sheets, RSA); Marble Valley, alpine fell field, 6800 ft, 25 Jul 1966, *Muth 453* (CAS-2 sheets, JEPS); ca 0.1 mi W of Julia Grover Flat, USFS 3, ca 6 air mi W of Mosquito Lake and Whitehorse Flat Reservoir, ca 2 air mi NW of Indian Spring Mtn, yellow pine forest, 3700 ft, 8 Sep 1998, *Oswald & Ahart 9607* (JEPS-2 sheets); Marble Mtn Wilderness Area, Marble Valley Guard Station, 9 Sep 1976, *Stillman 467* (CAS, UCR); Klamath Natl Forest, Hwy 3 ca. 7 mi E of Fort Jones (tributary to Scott River), dry open conifer forest on serpentine, ca. 2000 ft, 30 Jul 1993, *Taylor 14019* (JEPS); SW ridge of Black Mtn, Marble Mtn Wilderness Area, decomposed marble scree, SE-facing slope, 7000 ft, 18 Aug 1963, *Tucker 3753* (RSA); Marble Mtn ridge, limestone, 6750 ft, 12 Aug 2011, *York 3049* (CAS).

Tuolumne Co.: Yosemite Natl Park, Jack Main Canyon, 2.4 km SW of Dorothy Lake, marble outcrop, decomposed marble, loamy sand texture, 2717 m, 18 Aug 2005, *Colwell AC05-299* (UC); above NE side of Benson Lake, vernal moist metamorphic bedrock benches in shallow sandy soil, 2460 m, 23 Jul 2003, *Grossenbacher 573* (UC); Yosemite Natl Park, slope above E margin of Benson Lake, base of Piute Mtn, 8650 ft, 11 Aug 1936, *Sharsmith 3813* (DS, UC).

Nevada. Washoe Co.: Seven Lakes Mtn at N end of Red Rock Valley, with *Artemisia* in a juniper area, 7000 ft, 21 Aug 1985, *Tiehm 10228* (BRY, CAS, COLO, NY, TEX).

Oregon. Josephine Co.: Illinois River, Anderson Ranch, Siskiyou Forest, shady canyon, rock crevices and among rocks in river bed overflowed during high water but dry and hot during growing season, 1000 ft, 12 Sep 1919, *Ingram 1234* (RM, SOC image); W slope above Illinois River, along trail in Douglas fir-sclerophyll forest, olivine gabbro, 1200 ft, 20 Jul 1951, *Whittaker 537* (WS).