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TAXONOMY OF THE *PYRROCOMA RACEMOSA* GROUP (ASTERACEAE, ASTEREAE)

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ABSTRACT

The *Pyrrocoma racemosa* group includes *P. racemosa* Nutt., *P. congesta* Greene (incl. *P. balsamitae*), **P. pinetorum** (Keck) Nesom, **comb. et stat. nov.**, **Pyrrocoma nivis** Nesom, **sp. nov.**, *P. elata* Greene, **Pyrrocoma ebulliens** Nesom, **sp. nov.**, and *P. longifolia* Greene. Each of these occurs in areas mostly bordering the Pacific coast. *Pyrrocoma congesta*, *P. pinetorum*, *P. nivis*, and *P. ebulliens* are endemics with a narrow geographic range and each occurs on ultramafic substrate. The type of *P. ebulliens* is from serpentine in Napa County, but problems exist in its definition from collections from Solano County. **Pyrrocoma benitoana** Nesom, **sp. nov.**, from San Benito Co., California, also is an ultramafic obligate from a near-Pacific locality and probably is part of the group, but its glandular phyllaries are unusual. A lectotype is designated for *P. congesta*. A distribution map and illustrations are provided for each of the eight species.

Hall (1928) considered *Haplopappus racemosus* to be a widespread species including plants with a racemoid inflorescence, and that broad concept has been followed by Mayes (1976) and by Pacific Coast and California botanists (e.g., Ferris 1960; Munz & Keck 1968; Giblin et al. 2018); and Bogler 2006 for FNA). The most recent California treatment (Keil & Brown 2012) has *Pyrrocoma racemosa* var. *racemosa* (as the name for *P. elata* sensu lato), var. *congesta*, and var. *pinetorum*. *Pyrrocoma racemosa* also has been interpreted to include var. *paniculata*, var. *sessiliflora*, and others, but these are different species (Nesom in prep.). Welsh et al. (2015) identified various Utah entities as *Haplopappus racemosus* but noted that they are "hardly representative of the variation within the assemblage of forms which lie to the west of this region."

Considered here is a group of 8 species that occur mostly in areas mostly bordering the Pacific coast. *Pyrrocoma racemosa* sensu stricto (Oregon), *P. elata* (California), *P. longifolia* (California) occur in saline habitats, and *P. congesta* (with one exception), *P. pinetorum*, *P. nivis* (probably), *P. ebulliens*, and *P. benitoana* are obligate inhabitants of ultramafic substrates. The group is characterized by a mostly spicate inflorescence, eglandular vestiture, persistent fibrous remnants of old petiole bases, sericeous-strigose achenes, and a near-Pacific geographic range — it seems likely that they comprise a monophyletic group.

1. PYRROCOMA RACEMOSA (Nutt.) Torrey & Gray, Fl. N. Amer. 2(2): 244. 1842. *Homopappus racemosus* Nutt., Trans. Amer. Philos. Soc. ser. 2, 7: 332. 1840. *Haplopappus racemosus* (Nutt.) Torrey in Sitgreaves, Rep. Exped. Zuni & Colorado Rivers 162. 1853. *Aster pyrrocoma* Kuntze, Revis. Gen Pl. 1: 317. 1891 (not *Aster racemosus* Elliott 1823). *Hoorebekia racemosa* (Nutt.) Piper, Contr. U.S. Natl. Herb. 11: 560. 1906. **TYPE**: **Oregon**. [Clackamas Co.]: Protologue: "Plains of the Wahlamet," 30 Sep 1834, *T. Nuttall s.n.* (holotype: BM 1025338, Figures 1, 2; isotypes: GH 00008678-with Nuttall's annotation, GH 00009253-with original label by Nuttall). The BM sheet has a full specimen with Nuttall's original label and annotation, including the asterisk denoting a new species. The label of GH 8678 says "Wahlamet" in Nuttall's hand.

At the end of September 1834, Nuttall and ornithologist John Townsend joined Nathaniel Wyeth on an brief side trip along the Willamette River, going as far as Willamette Falls (Graustein 1967; Love 2022; Townsend 1839). From the Columbia River, their boats departed on September 29th, reaching the Falls the next day and then immediately returning to the Columbia. Nuttall's collections from the "Wahlamet" apparently all were made during this brief trip.

Haplopappus lanceolatus var. *strictus* A. Gray, Proc. Amer. Acad. Arts 8: 389. 1872. **TYPE**: **Oregon** Without locality [see below], Aug 1871, *E. Hall 256* (holotype: GH; isotypes: BRU, F, MO-2 sheets, NY, PH, RSA, UC).

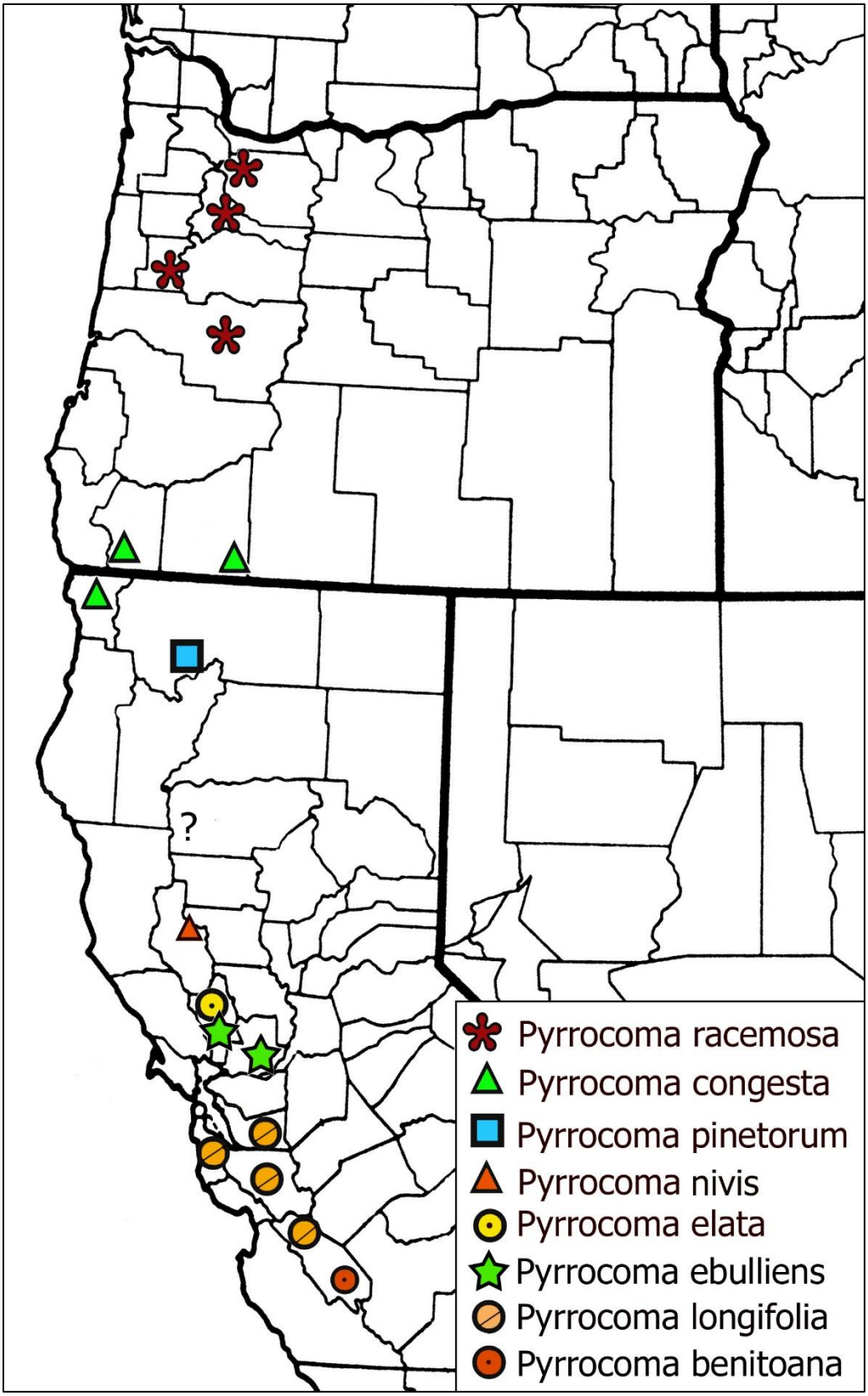
The protologue is in an article by Asa Gray entitled "Determination of a collection of plants made in Oregon by Elihu Hall during the summer of 1871 … " (Amer. Acad. Arts 8: 372–412. 1872.). In a letter to Asa Gray (3 Sep 1871, from Salem, Oregon), Hall wrote this: "I have confined my operations so far to the Williamette & Columbia rivers & the Cascade Mountains — including Mount Hood. I have now about 600 species, the exact number not known." Gray's protologue: "Resembles *Pyrrocoma racemosa* and *paniculata*, Torr. & Gray; but achenia densely silky-canescent and shorter. Stems slender, strict, leafy, bearing 3 to 10 rather distinct spicate heads." The identity of the collection places it from the Willamette region.

Stems erect to ascending-erect, 20–70 cm long, sparsely short-villous-tomentose, eglandular. **Leaves**: basal lanceolate-spatulate, 10–15 cm long, petiolar region ca. 1/3 the leaf length, blades 5–10 mm wide, glabrous, eglandular, margins evenly serrate to serrulate, cauline sometimes little reduced in size distally until the inflorescence, oblong-oblanceolate, not clasping. **Heads** in a spike or subspike, sometimes with a closely subtending bract, inflorescence 10–20 cm long. **Involucres** 15–25 mm wide (pressed), glabrous, eglandular; phyllaries oblong-lanceolate, in (3–)4–5 series graduate in length, inner 10–14 mm long, distal green patch about 1/3 the phyllary length. **Ray florets** ca. 14–24, sterile, corollas 12–16 mm long. Figures 1-3. See in situ photographs from Lane County (G.D. Carr 2021, Oregon Flora Image Project).

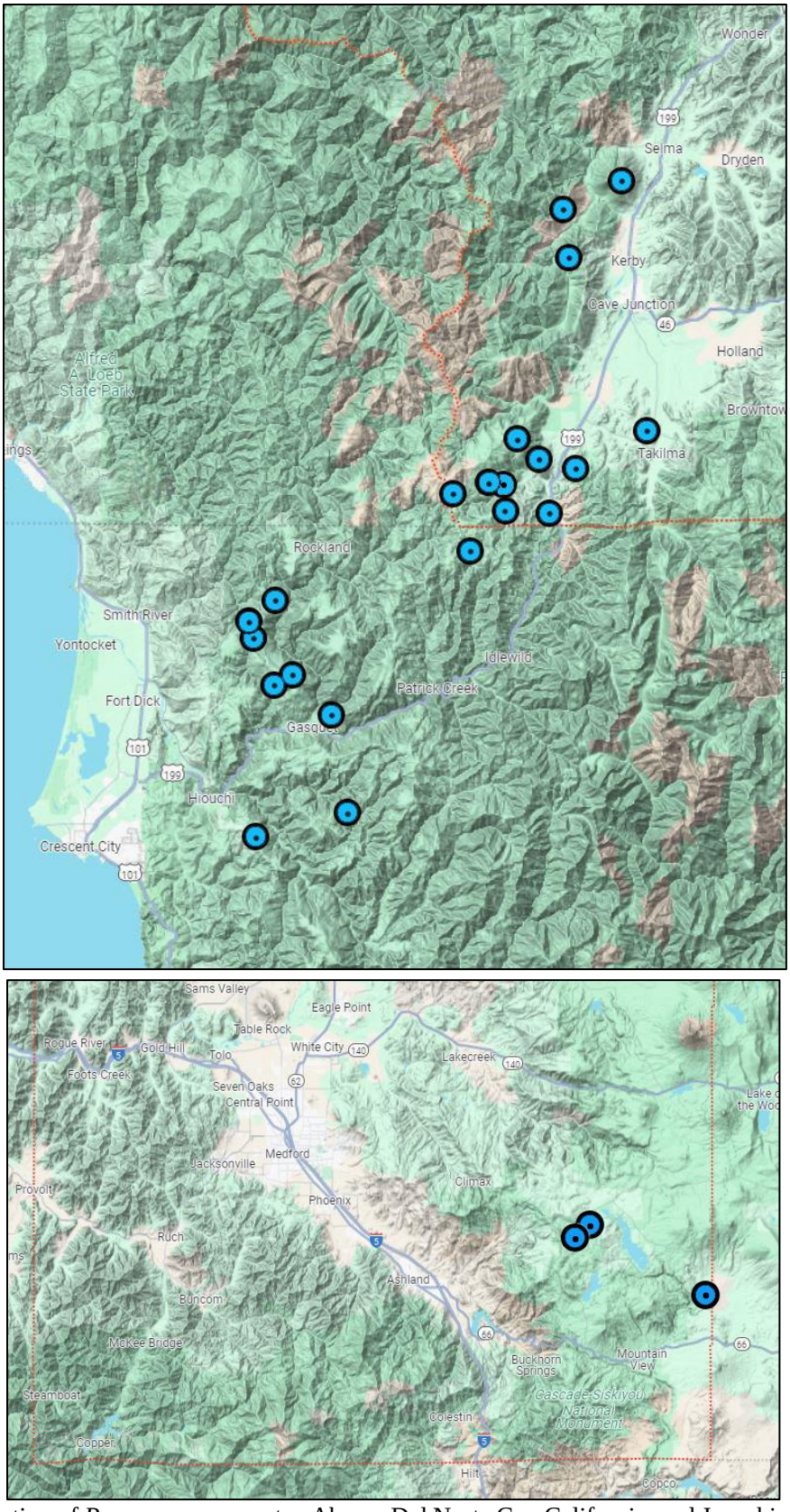
Additional collections. **Oregon**. Benton Co.: 1951, *Dolezal* (OSC). Marion Co.: Woodburn, 22 Aug 1922, *Gilkey* (OSC). Lane Co.: 1933, *Brown* (OSC); 3 mi SW of Eugene, 1934, *Constance 943* (MO, WS); 1871, *E. Hall 256* (GH, MO, PH); Spencer Butte, 20 Jul 1924, *H.M. Hall 256* (WS); ca 10 km by air ENE of Veneta, NE of Fern Ridge Reservoir, 3-acre remnant prairie, 7 Aug 2002, *Messinger 814* (BRY-Fig 3, KANU, OSC); 1915, *Nelson 370* (OSC, WS); 1920, *Nelson s.n.* (OSC).

Pyrrocoma racemosa is justifiably regarded as a rare species. Except for the type and two collections, the rest are from the vicinity of Eugene in Lane County. There is one record from Marion County and one from Benton County. There is no record of a collection of any *Pyrrocoma* species from Linn County. Nuttall's type collection was made in Clackamas County, but there has been no subsequent record from there. In situ photos from Lane County taken by Gerald Carr in 2008 are shown on the Oregon Flora website.

The sterile ray florets are marked by an absence of stigma and style and lack of fruit development. Sterile rays also are characteristic of *Pyrrocoma congesta*, *P. pinetorum*, *P. nivis*, and *P. ebulliens*. Rays of *P. elata*, *P longifolia*, and *P. benitoana* are fertile although the stigmatic branches are barely if at all exserted from the corolla tube. Fertile rays of these three southern species seems likely to be the primitive condition, with sterility perhaps identifying a northern clade.



Map 1. Distribution of the *Pyrrocoma racemosa* group and *P. benitoana*. Plants in Tehama County (= ?) need to be further investigated (see text, p. 8).



Map 2. Distribution of *Pyrrocoma congesta*. Above: Del Norte Co., California, and Josephine Co., Oregon. The Josephine County boundary is outlined in red. Below: Outliers in Jackson Co., Oregon.

2. PYRROCOMA CONGESTA Greene, Pittonia 3: 23. 1896. *Haplopappus racemosus* subsp. *congestus* (Greene) Hall, Publ. Carnegie Inst. Wash. 389: 128. 1928. *Pyrrocoma racemosa* var. *congesta* (Greene) Mayes ex Brown & Keil, Phytologia. 73: 58. 1992. **LECTOTYPE** (designated here): **Oregon**. [Josephine Co.]: Near Waldo, western base of Coast Mountains, Sep 1892, *T. Howell 1438* (NDG 00517; isolectotypes: NDG 00518, NDG 00519, NY, OSC, P-2 sheets). Only the lectotype label is in Greene's handwriting. As the type, Hall (1928) cited "Howell 1438 (Greene, NY)."

Pyrrocoma balsamitae Greene, Leafl. Bot. Observ. Crit. 2: 15. 1909. **TYPE**: **Oregon**. Jackson Co.: Dead Indian Valley, summit of the Cascade Mts, wet meadows, 12 Aug 1902, W.C. *Cusick 2947* (holotype: US: isotypes: BRU, CAS, DH, E, F, GH-2 sheets, MO, NY, OSC-3 sheets, P, POM, UC, US, UTC, WSC). Figures 9-11.

Stems ascending-erect, 25–75 cm long, glabrous to sparsely tomentose. **Leaves**: basal spatulate-elliptic, 12–20 cm long, petiole 1/3–1/2 the leaf length, blade elliptic to elliptic-oblanceolate, 8–28 mm wide, glabrous or the cauline sparsely tomentose near the stem insertion, margins entire to shallowly serrulate, cauline often abruptly reduced in size from the basal, narrowly lanceolate to linear-lanceolate, not clasping. **Heads** in a spike or subspike or sometimes subracemoid when peduncles 4–8 mm long or longer, sometimes in glomerules of 2–3, inflorescence 15–28 cm long. **Involucres** 8–12 mm wide (pressed), cobwebby at the base; phyllaries oblong with a rounded-deltate apex, in 3–4 series graduate in length, inner 5–7 mm long, margins scarious on the proximal 1/2–1/3, green patch on the deltate apex. **Ray florets** sterile, 8–12, corollas 8–11 mm long, 1.5 mm wide. **Disc corollas** 4.5–5 mm long. **Achenes** (fertile) 4–4.5 mm long sericeous-strigose. See in situ photographs from Josephine County (G.D. Carr 2021, Oregon Flora Image Project). Figures 4-13.

Flowering late July-September. Dry flats, rocky slopes, pine savannas, soil or alluvium, exclusively over serpentine or peridotite; 1250–1500(–4500) feet. Map 2.

Jackson County outliers (*Pyrrocoma balsamitae*): Dead Indan Valley, *Pinus ponderosa-Pseudotsuga* belt, dry slope along meadow borders (S side of road only), with *Festuca*, *Potentilla grandis*, *Senecion lugens*, *Fragaria platypetala*, *Geum*, etc., dark caked volcanic soil, common over a few acres only, 15 Jul 1924, *Hall 11966* (US); Johnson Prairie [42.178° N, 122.297° W, ca. 5 mi SE of Howard Prairie Lake], wet meadows, 5250 ft, 31 Jul 1899, *Leiberg 4331* (OSC).

Pyrrocoma balsamitae Greene was treated as a synonym of *P. congesta* by Hall (1928) and Mayes (1976), as also here, although it is from a different habitat and eastward from the main range of the species. Hall's comments indicate that his collection (*11966*) was not from a serpentine substrate, in contrast to the collections from Josephine and Del Norte counties. In Jackson County, collections of taxa in various families have been made from serpentine from Big Red Mountain and Observation Point, but both localities are considerably southwest of those for *P. congesta*.

3. PYRROCOMA PINETORUM (Keck) Nesom, **comb. et stat. nov.** *Haplopappus racemosus* subsp. *pinetorum* Keck, Madrono 5: 166. 1940. *Pyrrocoma racemosa* var. *pinetorum* (Keck) Kartesz & Gandhi, Phytologia 71: 61. 1991. **TYPE**: **California**. Siskyou Co.: Scott Mts, 3 mi SE of Scott Mtn Lodge, ridge between Mill and Mule creeks, non-alkaline soil among lava rock under *Pinus ponderosa*, 4400 ft, 8 Aug 1938, *D.D. Keck 4862* (holotype: CAS; isotypes: DS, RSA, UC, US-2 sheets).

Haplopappus racemosus (Nutt.) Torr. var. *praticola* J.T. Howell, Leafl. W. Bot. 6: 86. 1950. **TYPE**: **California**. Trinity Co.: Summit of Scott Mts N of Carrville, 24 Aug 1936, *J.T. Howell 12752* (holotype: CAS).

Stems erect, 20–60 cm long, lightly tomentose. **Leaves**: basal lanceolate, 6–20 cm long, 5–16 mm wide, margins entire or denticulate-spinulose, sparsely tomentose. **Heads** in spikes or sometimes

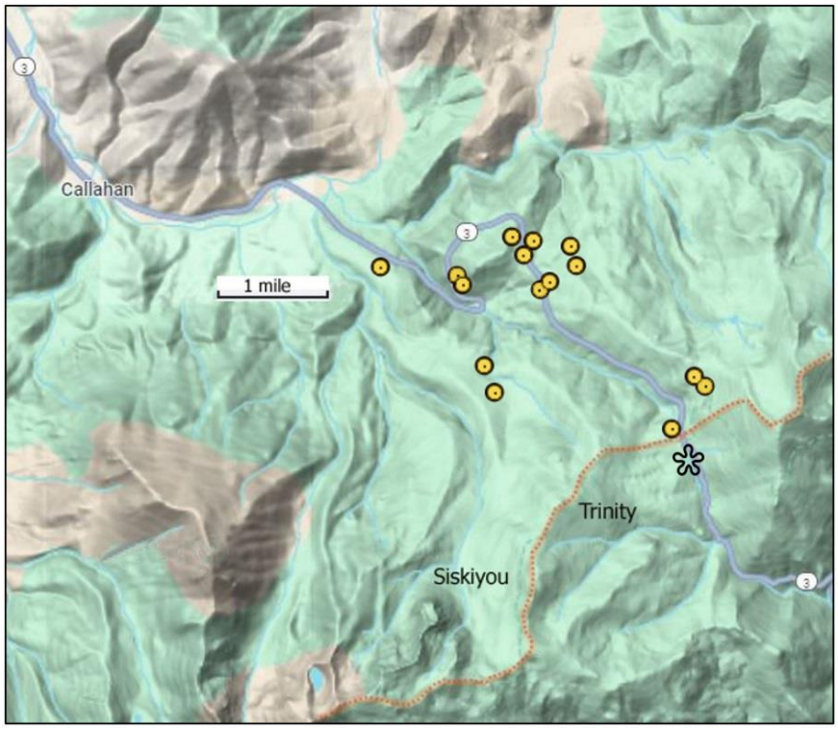
becoming subcorymoid when peduncles lengthening, inflorescence 8-40 cm long. **Involucres** 12–15 mm wide (pressed), tomentose; phyllaries oblong with a deltate-short-acuminate apex, in 4-5 series graduate in length, inner 8–11 mm long, densely tomentose, green patch on distal 1/3. **Ray florets** 12–20, sterile, corollas 11–14 mm long, 1–1.5 mm wide, not coiling. **Disc corollas** 7–8 mm long. **Achenes** 5–7 mm long. Figures 14-17.

Flowering July–September. Ridges, rocky sites, consistently over serpentine, non-alkaline but sometimes in wet meadows or drying edges, ponderosa pine, Jeffrey pine with *Calocedrus* and *Ceanothus*, mixed conifer woods; 4100-5400 ft; Siskiyou Co., California.

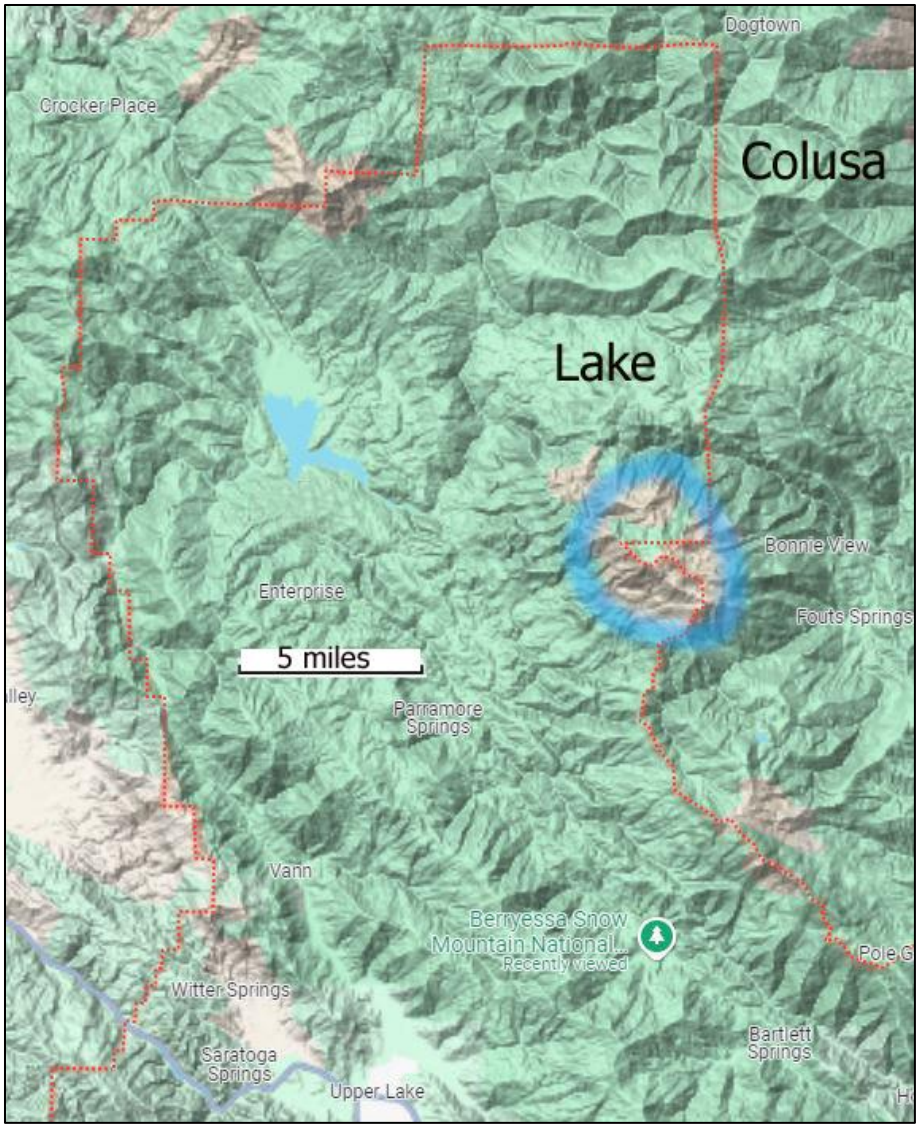
Pyrrocoma pinetorum is recognized by its prominently tomentose-pubescent stems and involucres and large heads usually in spikes. Other collections in Siskiyou County have been identified as *Pyrrocoma pinetorum*, but these are different species (Nesom, in prep.).

The total range of *Pyrrocoma pinetorum* is less than 5 square miles — Map 3 shows localities of all collections. Most label data note the occurrence over a serpentine substrate — the species appears to be essentially an ultramafic obligate, although *Keck 4862* and *Bacigalupi 6868* are exceptional in noting that the collection was made from a habitat with "lava rocks." Several other narrowly endemic species in the Scott Mountain area are restricted to serpentine habitats: *Phacelia greenei*, *Galium serpenticum* subsp. *scotticum*, and *Ivesia pickeringii*, and *Minuartia stolonifera*.

Additional collections. Siskiyou Co.: *Bacigalupi 4799* (JEPS, US), *6868* (JEPS); *Clifton s.n.*, 9 Aug 1970 (PUA); *Ertter 7328* (UC); *Greene 980* (GH); *Howell 1546* (CAS); *Howell 14858* (US); *Keck 4862* (US); *Keil 23514* (OBI), *23519* (OBI), *23572* (OBI-2); *Kellogg 119* (UC, US), *Nelson 6314* (HSC); *Oswald 9960* (CHSC); *Smith 8971* (HSC), *8967* (HSC), *10344* (HSC), *10347* (HSC), *10349* (HSC); *Taylor 15821* (JEPS); *Williams 228* (KNFSC).



Map 3. Distribution of *Pyrrocoma pinetorum*. The type of *Haplopappus racemosus* var. *praticola* was collected at the Scott Mountains summit on Hwy 3, at the boundary of Siskiyou and Trinity counties. The type collection of var. *praticola* is labeled as "Trinity County," at the Scott Mt. summit, indicating that Howell figured he was over the county line. A 2020 iNaturalist observation and photos by Joaquin Hale [asterisk on the map] also puts the species in Trinity County, beside Hwy 3 at the Scott Mountain Summit, about 200 feet south of the county line. Calflora records this as documentation for the occurrence in Trinity County.



Map 4. Distribution of *Pyrrocoma nivis*. The blue circle outlines the Snow Mountain area, where the type was collected. The highest points are East Peak (7060 feet) and West Peak (7050 feet). Lake County is outlined in red.

4. PYRROCOMA NIVIS Nesom, **sp. nov.** **TYPE**: **California**. Lake Co.: Snow Mountain, 25 Aug 1892, *K. Brandegee* (holotype: UC).

Similar to *Pyrrocoma ebulliens* in its clasping cauline leaves, very small heads, phyllaries with a short green patch at the very apex, sterile ray florets; different in its smaller basal leaves, ovate cauline leaves with serrate margins, and corymboid-paniculate inflorescence of few heads on long, slender peduncles.

Stems ascending erect, (8–)25–40 cm, glabrous. **Leaves**: basal obovate, 3–8 cm long, epetiolate, blades 6–12 mm wide, margins serrate with 4–5 pairs of sharp, shallow teeth, glabrous, cauline ovate, clasping, margins serrate. **Heads** 1 or usually 5–10 on long, slender peduncles in a loose, corymboid-paniculate array, without immediately subtending bracts. **Involucres** 10–12 mm wide (pressed); phyllaries oblong with an abruptly deltate apex, in 3(–4) series of unequal length, inner 8–10 mm long, glabrous, green patch within the deltate apex. **Ray florets** 12–16, sterile, corollas 8–0 mm long, 1–1.5 mm wide. **Disc corollas** ca. 7 mm long. **Achenes** ca. 3-4 mm long, sparsely strigose. Figures 18-20.

Pyrrocoma nivis is unambiguously distinct in morphology among the species of the *P. racemosa* group and it is the only collection of *Pyrrocoma* from Lake County (Map 4). Given the probability that it is closely related to *P. ebulliens*, it also seems probable that *P. nivis* occurs in an ultramafic habitat. Serpentine outcrops are abundant in the Snow Mountain area and such habitats presumably now have greater protection with the recent establishment of the Berryessa Snow Mountain National Monument.

T.S. and K. Brandegee made numerous collections at Snow Mountain in June and August of 1892 (Heckard & Hickman 1984). The only more specific localities among the specimen labels (CAS, UC) for Snow Mountain are "near the Monument" on 24 August and "Colusa" on 23 June. The only two elevations given among all the collections are 6000 and 6600 feet. K. Brandegee (1893) listed the collection simply as "Aplopappus apargioides Gray. Snow Mountain." Despite focused floristic study in the Snow Mountain area (Heckard & Hickman 1985), *Pyrrocoma nivis* has not been rediscovered.

A collection of *Pyrrocoma* from Tehama County includes only a short branch with 3, non-clasping, entire-margined cauline leaves and a single very amall head with 8, short, linear, erect rays. It does not appear to be conspecific with *P. nivis* and it probably is undescribed.

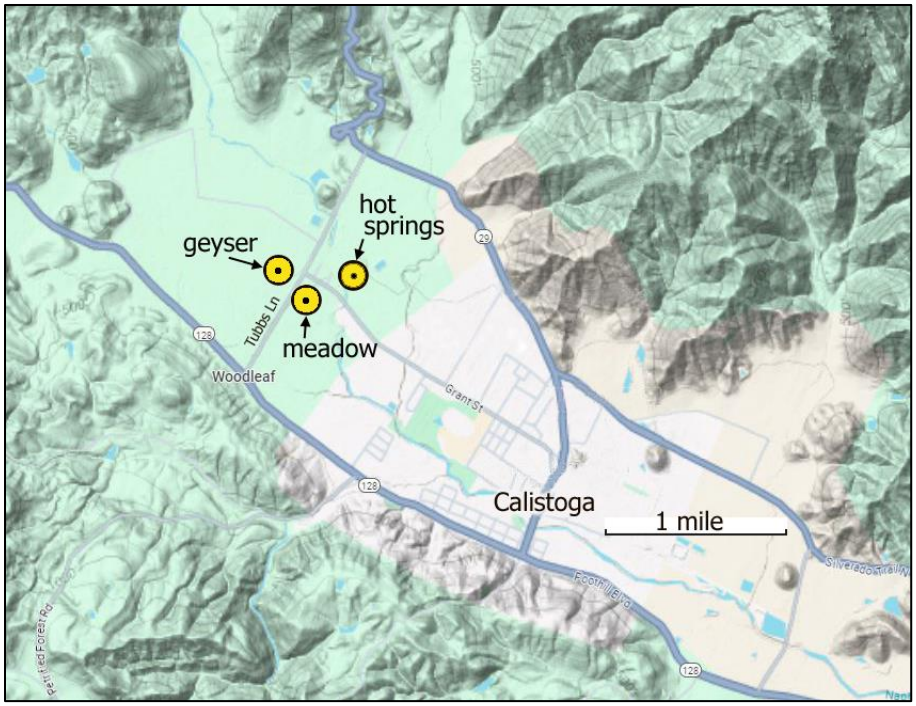
Tehama Co.: Yolla Bolly Mountains, ca. 0.25 mi W of Johnson's Headquarters, dry, rocky meadow in red fir forest, 6700 ft, 1 Sep 1973, *Todd 538* (JEPS). The relationships of this plant suggest that it occurs on ultramafic substrate.

5. PYRROCOMA ELATA Greene, Man. Bot. Bay Region, 173. 1894. **LECTOTYPE** (Hall 1928): **California**. Napa Co.: Calistoga, Oct 1881, *C.C. Parry s.n.* (NDG; isolectotypes: GH, NY, UC). Figures 17-18.

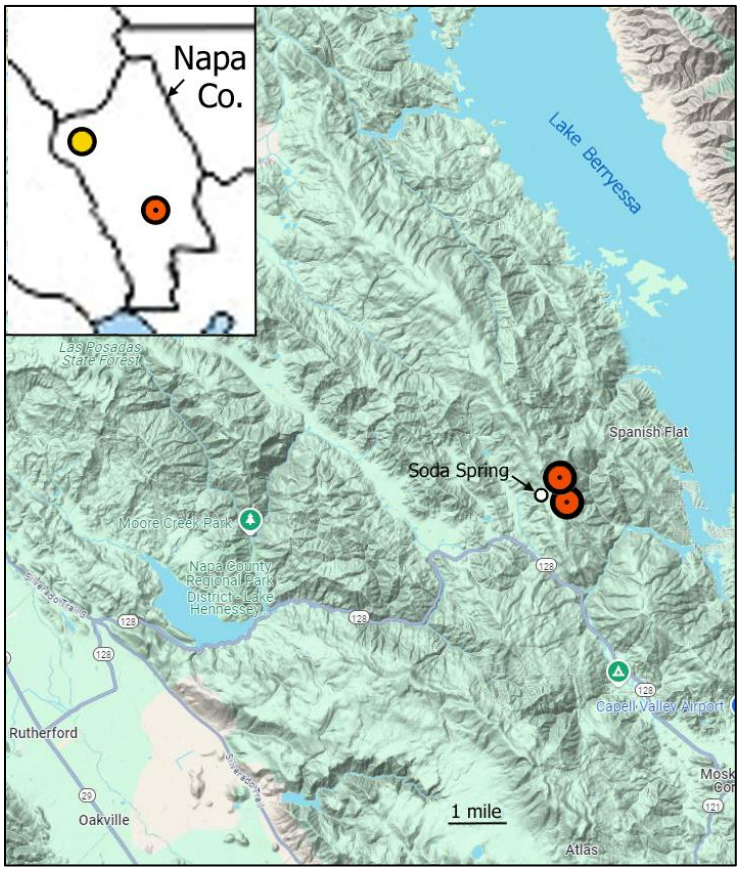
Stems erect to ascending-erect, (15–)30–60(–90) cm, sparsely pubescent and glabrate to glabrous. **Leaves**: basal narrowly oblanceolate, 6–14 cm long, 4–9 mm wide, long-attenuate into a petiolar region ca. 1/4 the leaf length, margins entire, cauline reduced in size from the basal, not clasping or subclasping, margins entire or with a few shallow serrations. **Heads** in a subspike on peduncles 2–6 mm long or usually in a narrow raceme on peduncles 2–8 cm long, sometimes narrowly paniculate, without an immediately subtending bract, inflorescence 18–40 cm long. **Involucres** 12–15 mm wide (pressed); phyllaries oblong-obovate with a deltate apex, in 3–4(–5) series of unequal length, inner 7–8.5 mm long, glabrous, indurate proximally, apical green patch 1/3 the length, margins (below the green patch) narrowly scarious. **Ray florets** 10–14, fertile, corollas 8–10 mm long, 0.5–1 mm wide, not coiling. **Disc corollas** 4–6 mm long. **Achenes** 3.5–4 mm long, sericeous-strigose. Figures 21-28.

Flowering August–October. Around a geyer and hot spring area, alkali flats, open moist meadow, roadsides; ca. 400 feet. Known only from a small area northwest of Calistoga; perhaps the only remaining habitat is a wet meadow on the south side of the corner of Tubbs Lane and Myrtledale Road. Hall (1928, p. 138), however, noted that he found populations at Calistoga separated by 2 kilometers. Map 5.

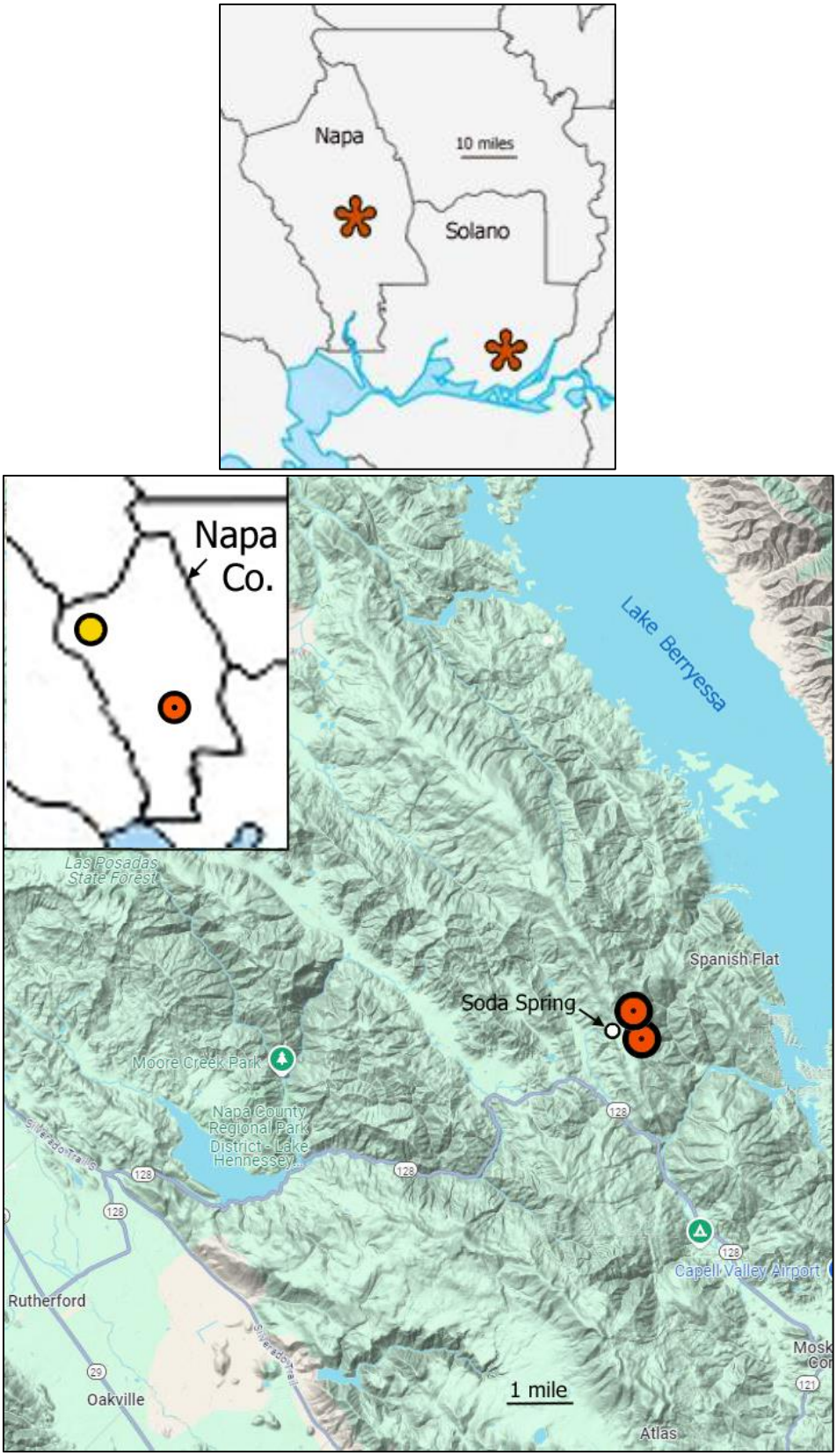
Additional collections. **California**. Napa Co.: Near Calistoga Geyser, alkaline flat, 9 Sep 1933, *Baker 7535* (CAS); Tubbs Lane [near Calistoga], hot springs 122 m, 13 Aug 1980, *Callizo s.n.* (PUA); Tubbs Lane [near Calistoga], open meadow, high water table, 121 m, 26 Aug 1982, *Callizo s.n.* (PUA); 2 mi N of Calistoga, Myrtledale Hot Springs area, Tubbs Lane, roadside, with *Distichlis*, 18 Aug 1964, *Crampton 7154* (DAV); Calistoga, 3 Sep 1918, *Eastwood 7961* (CAS, UC, US); Calistoga, alkali flat by the spring, heavy soil, 15 Oct 1923, *Hall 11949* (UC); near Calistoga, [Myrtledale] Spring, moist meadow, soil less alkaline, 15 Oct 1923, *Hall 11949a* (UC); Calistoga, one of the hot springs, stiff alkali clay soil, 26 Aug 1927, *Heller 14466* (PH, UC, UTC); near Calistoga, Myrtledale Hot Springs, 24 Aug 1941, *Hoover 5579* (JEPS, UC); Calistogar, Aug 1887, *Parry 87* (MO); Calistoga, Myrtledale Hot Springs, saline moist flats, 400 ft, 14 Oct 1939, *Tracy 16508* (UC, WTU).



Map 5. *Pyrrocoma elata* in Napa Co., California. All known collections are from localities indicated by the three symbols.



Map 6. Distribution of *Pyrrocoma ebulliens* in Napa Co., California. Inset shows Napa County and the location of *P. ebulliens* (red) and *P. elata* (gold).



Map 7. Distribution of *Pyrrocoma ebulliens*. Above: Localities in Napa and Solano cos., California. Below: Large-scale distribution in Napa County; inset shows *P. elata* (yellow) and *P. ebulliens* (red).

6. PYRROCOMA EBULLIENS Nesom, **sp. nov. TYPE**: **California**. Napa Co.: Soda Spring, E of Soda Valley, T8N, R4W, Sec. p25, W1/2 or NW 1/4, [38.51517 N, 122.25405 W], chaparral community on serpentine rock, rock apron washed by carbonate spring, 1150 ft, beginning to flower, 13 Jul 1996, *J. Ruygt 3767b* (holotype: DAV). Figures 25-27.

Distinct from *Pyrrocoma elata* in its shorter leaves, sessile heads in a strict spike (vs. raceme), smaller involucres (6–10 mm wide vs. 12–15 mm wide) with fewer and shorter phyllaries (in 3–4 series, inner 4.5–6 mm long vs. 4–5 series, inner 7–8.5 mm long), and its clasping cauline leaves.

Stems erect to ascending-erect, 20–45 cm, sparsely pubescent to glabrate. **Leaves**: basal narrowly oblong–oblanceolate, 5–10 cm long, blades 3–9 mm wide, margins entire or shallowly serrate-apiculate proximally, cauline quickly reduced in size from the basal, relatively even-sized, distinctly clasping to subclasping but not auriculate, margins minutely denticulate to ciliolate. **Heads** sessile in a spike or narrow panicle of the main spike and short lateral spikes, each usually with a subtending bract (not phyllary-like), inflorescence 10–38 cm long. **Involucres** 6–10 mm wide (pressed); phyllaries oblong-obovate with a deltate apex, in 3–4 series of unequal length, inner 4.5–6 mm long, glabrous, indurate proximally, apical green patch 1/3 the length, margins (below the green patch) narrowly scarious. **Ray florets** 10–14, sterile, corollas 10–12 mm long. **Achenes** 3.5 mm long, strigose. Figures 29-36.

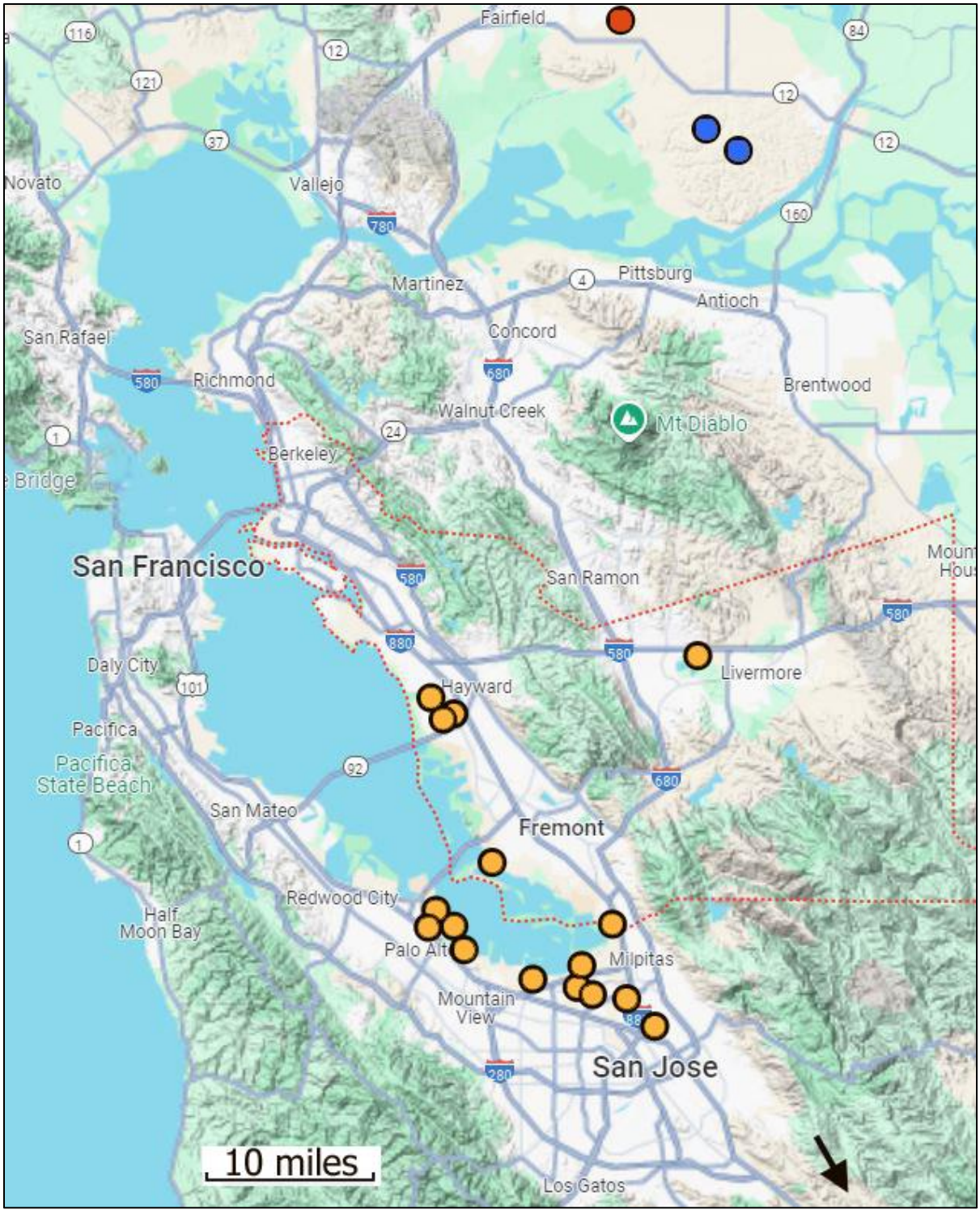
Additional collections. **California**. Napa Co.: White Cliff Springs, on slope E of Soda Valley, 38.5101 N, 122.2538 W, serpentine rocks or soil, moist slope or flat of springs, chaparral, 1110 ft, full flower, 14 Sep 1996, *Ruygt 4266* (JEPS). Solano Co.: Montezuma, dry clay hills, [ca. 200 ft], 17 Sep 1933, *Rose 33371* (IND, KHD); Montezuma Hills, 17 Sep 1933, *Howell 11688* (CAS, RSA-2 sheets). Maps 6, 7.

Morphologically unusual plants. **California**. Solano Co.: 1.5 mi NNE of Denverton, 1.8 mi W of Creed Station, [ca. 30 ft], dry slopes above large alkaline intermittent lake, with *Distichlis*, 12 Oct 1965, *B. Crampton 7542* (CAS, DAV, GA, UC). Crampton collected at least 5 plants slightly northwest of the Montezuma Hills and presumably from a different geology, but the involucres are distinct from typical *Pyrrocoma ebulliens* — 12–15 mm wide and with 4-5 series of phyllaries, the inner 7–9 mm long. Otherwise, including the distinctively clasping leaves, the plants fit with *P. ebulliens*. Hopefully the population can be relocated for further study. Figures 28-32 show plants from Solano County.

Pyrrocoma ebulliens is most similar to *P. elata* and is its geographically closest congener, but discontinuities in morphology and habitat are rationale for their taxonomic separation. The serpentine habitat of the Soda Valley plants points to parallelism/common ancestry with *P. congesta*, *P. pinetorum*, *P.. nivis*, and *P. benitoana*.

The Montezuma Formation in Solano County consists of early Pleistocene alluvial deposits (Wikipedia and references cited there). There is no serpentine in the Montezuma Hills, and a case might be made for recognizing those plants as distinct from the Soda Valley ones, especially as they clearly are physiologically differentiated, even though morphological differences seem negligible. Especially in view of the Crampton collection from alkaline slopes near Creed Station, these populations need further study.

The nature of the Montezuma *Pyrrocoma* habit is not known — small wetland areas exist there. Even their continued existence may be improbable, as the Montenzuma Hills now are heavily used by agriculture and wind farms. Howell and Rose were companions on that 17 September foray, thus both probably collected from the same population.



Map 8. Distribution of *Pyrrocoma longifolia* (San Mateo, Santa Clara, and Alameda cos. — gold), *P. ebulliens* (Solano Co. — blue), and an unusual collection, aff. *ebulliens* (Solano Co. — red. No collections of any *Pyrrocoma* are known from Contra Costa County. Arrow points to the disjunct locality of *P. longifolia* in northern San Benito County — see Map 9.

7. PYRROCOMA LONGIFOLIA Greene, Pittonia 3: 183. 1898. *Haplopappus longifolius* (Greene) Jeps., Man. Flowering Pl. California, 1027. 1925. *Haplopappus racemosus* subsp. *longifolius* (Greene) Hall, Publ. Carnegie Inst. Wash. 389: 130. 1928. **TYPE**: **California**. Alameda Co.: Mount Eden, May 1891, *K. Brandegee s.n.* (holotype: CAS, fragment-UC).

Stems erect to ascending, 30–50(–70) cm, glabrous. **Leaves**: basal mostly narrowly oblanceolate, 8–40 cm long, attenuate to a petiolar region 1/5–1/3 the leaf length, blades (10–)30–50 mm wide, glabrous, margins entire, cauline immediately reduced in size above the basal, most linear-oblanceolate, not clasping. **Heads** in a spike or raceme up to 30 cm long or commonly in a loose panicle with peduncles elongating up to 12 cm long, the heads appearing solitary. **Involucres** 20–30 mm wide (pressed); phyllaries oblong with a rounded triangular-deltate, sharply acute apex, in 3–4(–5) series of unequal length, inner 9–12 mm long. green patch on the distal 1/3–1/2, glabrous, margins narrowly scarious. **Ray florets** 18–30, fertile (stigma barely exserted), corollas 11–16 mm long, 1–2 mm wide, not coiling. **Disc corollas** 6–7 mm long. **Achenes** 4–5 mm long, sericeous-strigose. Figures 37-41.

Flowering (June, July–) August–October (–November). Low, alkaline fields and flats, edges of intermittent lakes, "swampy ground," salt marsh edges, clay soil just above tide level, sometimes with *Distichlis* and *Salicornia*, roadsides and roadbanks; 5–50 (–100, –350 at Livermore) feet. Map 8.

Pyrrocoma longifolia is documented in four California counties but the collections are from areas now heavily urbanized. Around the San Francisco Bay, most collections were made before 1930 --- collections from near the type locality were made in 1958 and 1959 (*Robbins 3953*, *3956*, *4120*) and a collection from the Fremont vicinity was made in 1966 (*George s.n.*). The collections from near Livermore (Alameda Co.) and south of Gilroy (San Benito Co.) are out of range and slightly higher in elevation, but morphology places them with *P. longifolia*.

Additional collections. **California**. Alameda Co.: Mount Eden, "from the original locality by the original collector along the sides of the railroad," 1907, *K. Brandegee s.n.* (UC); near railway below Newark, subsaline soil, 1 May 1897, *Dudley s.n.* (DS); Mt. Eden, 11 June 1926, *Eastwood 13919* (CAS, RSA, US); Livermore Valley, 4 mi W of Livermore, subsaline field, [ca. 350 ft], 11 Oct 1930, *Howell 5547* (CAS, LA, NO, RSA); along First Avenue at the W edge of Russell City, ca. 3 mi W of Hayward and ca. 1 mi E of the shore of San Francisco Bay, low field dominated by *Distichlis*, some *Salicornia*, a few dozen plants, mostly now in fruit, 19 Oct 1958, *Robbins 3953* (CAS, JEPS, OBI); along Depot Road, ca. 0.7 mi W of Mt. Eden Station and opposite Hayward Motorcycle Club, low, fallow field with *Distichlis*, 25 Oct 1958, *Robbins 3956* (CAS, UC); ca. 1/4 mi N of the W end of Depot Road, just E of the American Salt Co. evaporating ponds along the shore of San Francisco Bay, ca. 1.75 mi NW of Mt. Eden, ca. 3/4 mi S of Russell, alkaline field, 5 ft, 2 Aug 1959, *Robbins 4120* (CAS, JEPS, OBI, OSC). San Benito Co.: Los Bolsa Road between Gilroy and Hollister, 100 ft, 14 Aug 1917, *Abrams 6687* (CAS). Santa Clara Co.: Between Mt. View and Alviso, low ground, 20 Oct 1906, *Abrams s.n.* (DS); Agnews, 19 Oct 1902, *Abrams 3087* (DS); Alviso, occasional along roadsides, 16 Aug 1902, *Baker 1703* (RSA); road between Lawrence and Agnew along Calabasas Creek, edge of salt marsh, Oct 1914, *Cooper s.n.* (DS); N of Alviso Road, just E of the road that comes in from Santa Clara, subsaline soil, 17 Sep 1904, *Dudley s.n.* (DS); Palo Alto, Cooley's Landing, 14 Sep 1901, *Dudley s.n.* (DS); San Jose, vacant lot, Sept 1922, *Duncan s.n.* (CAS, DS); Mt View-Alviso road, roadside, 12 Sept 1920, *Ferris 2056* (DS); Durham Road [George also made collections at Alviso and "Leslie Salt Marsh near Coyote Hills" on 15 Sep], 15 Sep 1966, *George s.n.* (DAV); Palo Alto, salt marsh, 30 Nov 1908, *Halsey s.n.* (DS); between San Jose and Milpitas, swampy ground, plentiful, 9 Sep 1920, *Heller 13528* (US); 3 mi S of Milpitas, saline situations, 50 ft, with *Distichlis spicata*, *Hemizonia pungens*, etc., frequent, plants 3-6 dm high, 28 Sep 1928, *Keck 456* (DS-2 sheets); roadsides near Alviso, 20 Oct 1906, *Richardson s.n.* (DS); Cooley Landing, San Francisco Bay, near Palo Alto, 19 Aug 1921, *Wolf 732* (RSA, SD, US); San Jose, Jul 1887, collector unspecified s.n. (UC). San Mateo Co. (all at Cooley's Landing): Sep 1901,

Abrams 2211 (RSA); 29 Sep 1906, *Abrams s.n.* (CAS, UC); 19 Sep 1927, *Blake 10329* (US); 4 Sep 1901, *Dudley s.n.* (RSA); 15 Sep 1908, *Halsey s.n.* (JEPS); 29 Sep 1906, *McGregor s.n.* (CAS).

A collection from "Los Angeles Co., Cal.", as labeled, by Mrs. E.A. Bush in 1880 (US) is typical *Pyrrocoma longifolia*, but it is so far out of range that it surely is mislabeled. Mrs. Bush made other collections in Los Angeles County in 1878-1880 but she also collected in Santa Clara County in 1879 and 1880 (fide her collections at GH, UC, US).

8. PYRROCOMA BENITOANA Nesom, **sp. nov. TYPE**: **California**. San Benito Co.: Clear Creek, wet highly serpentinized soil, chaparral, 3000 ft, common, much browsed by deer, 4 Oct 1966, *E.C. Twisselmann 12855* (holotype: CAS 362351; isotypes: CAS, JEPS).

Distinct in its narrow, non-clasping cauline leaves, very small and usually solitary heads on long branches, glandular-viscid phyllaries, and serpentine habitat.

Stems ascending-erect to decumbent-ascending, 20–60(–80) cm, glabrous to sparsely tomentose/glabrate, eglandular. **Leaves**: basal linear- to narrowly oblanceolate, 2–8(–15) cm long, attenuate to a weakly differentiated petiolar region, blades 4–10 mm wide, glabrous, margins entire, cauline abruptly reduced in size from the basal, linear- to narrowly lanceolate, strictly ascending to nearly appressed, not clasping, eglandular, margins entire or rarely (inflorescence bracts) serrate. **Heads** rarely in a spike or short-pedunculate raceme (*Ferris 13077*), usually in a loose, subcorymboid panicle on subbracteate branches 3–20 cm long, with subtending bracts, peduncles sometimes minutely glandular immediately below the head. **Involucres** 8–10 mm wide (pressed); phyllaries oblong, with a shallowly rounded-deltate apex, in 3(–4) series of unequal length, inner 5–6 mm long, mostly indurate-stramineous with a green midline and narrow scarious margins, green patch in the distal 1/4 or only in the deltate apex, thickened and with imbedded glands, sometimes viscid. **Ray florets** 12–16, fertile, corollas 6–7 mm long, 1.5–2.5 mm wide, coiling. **Disc corollas** 5–5.5 mm long. **Achenes** 3 mm long, strigose. Figures 42-48.

Chromosome number, 2n = 12 (Semple et al. 2001, for *Semple 9350*). Chromosome numbers have not been reported from other species of the *Pyrrocoma racemosa* group.

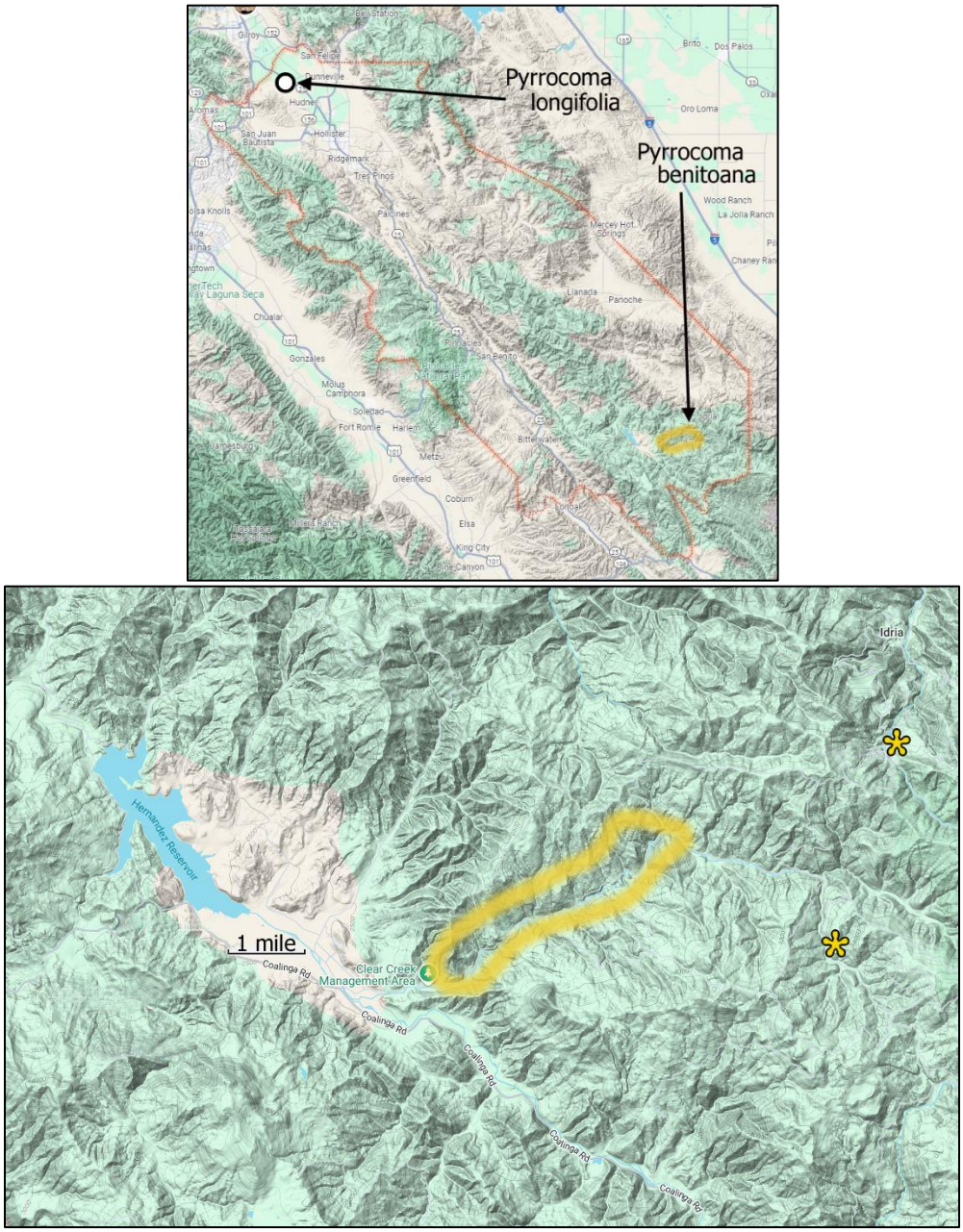
Flowering (July–) August–October. Serpentine slopes, serpentine soil and mud at creek margin and dry bed, serpentinized soil in chaparral; 2600–3100 feet. All collections are from an area along Spring Creek Road, paralleling Spring Creek — iNaturalist observations have been made from a few miles east and southeast (Maps 9 and 10).

Additional collections. **California**. San Benito Co.: Clear Creek Road, Clear Creek Canyon, 5 mi E of Coalinga Road, 36.3843° N, 120.71901° W, serpentine side canyon with small creek running through, 29 Oct 1958, *Chisaki 2817* (ID, UC, WS); Clear Creek, ca. 3.3 mi. SW of Idria, streambed, 36.38437 N, 120.71431 W, 3200 ft, 22 Oct 1956, *Ferris 13077* (CAS-2 sheets, JEPS, RSA, WS); 3.3 mi E of Coalinga (Clear Creek road), 36.371777° N, 120.73804° W, 2600 ft, 20 Jul 1965, *Hesse 3309* (JEPS); Hernandez [Clear Creek area], 20 Sep 1902, *Lathrop s.n.* (CAS); along Clear Creek, 18.8 mi from jct N of Bitterwater on road to New Idria, serpentine slopes, 1 Sep 1955, *Raven 8818* (CAS, JEPS); Clear Creek Rd., 4.6 km of jct of Coalinga Road, along margins of Clear Creek in dry bed, common locally, 17 Aug 1990, *Semple 9350*, 2n = 6II from buds (CAS, MO, MT, UC, WAT); San Benito Mountain, Clear Creek Drainage, 5.3 road mi upstream from the crossing of the San Benito River, 36.376268 N, 120.716894 W, moist serpentine-derived mud at edge of active channel of creek, 3100 ft, with *Salix breweri*, 16 Sep 1988, *Taylor 9347* (RSA, UCR); Clear Creek, wet heavily serpentinized soil, chaparral, 2700 ft, 4 Oct 1966, *Twisselmann 12850* (CAS, SBBG).

iNaturalist observations and photos: ashley_vs, 15 Aug 2022; Gena Bentall, 8 Oct 2016; Cat Chang, 12 Sep 2021; Paul G. Johnson, 24 Aug 2016 and 14 Sep 2024.

Typical *Pyrrocoma longifolia* in San Benito Co.: Los Bolsa Road between Gilroy and Hollister, 100 ft, 14 Aug 1917, *Abrams 6687* (CAS).

The first collection of *Pyrrocoma benitoana* was made in 1902, followed by others in the 1950s. Their continued identification as *P. racemosa* (beginning with Hall in 1928) perhaps reflects just their near-Pacific locality, as a racemoid or spicate inflorescence is not characteristic of them. The phyllaries have a green patch with imbedded glands (vs. eglandular in the *P. racemosa* group) — the species is included here because of their long association with *P. racemosa*, but its evolutionary relationship may be elsewhere.



Maps 9 and 10. Above: San Benito Co., California (outlined in red) with locality of *Pyrrocoma longifolia* (*Abrams 6687*) and area of *P. benitoana*. Below: iNaturalist observations and all cited collections area from the area of Spring Creek Canyon. Asterisks are outlying iNaturalist observations (see text).

Unresolved report for Pyrrocoma racemosa in California

A report of *Pyrrocoma racemosa* for Mendocino County is based on its inclusion in a 1987 checklist for Sinkyone Wilderness State Park (see Calflora) — there is no voucher and the record probably is a misidentification.

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Figure 1. *Pyrrocoma racemosa*. Holotype (BM), *Nuttall s.n.* from Oregon.

Figure 2. *Pyrrocoma racemosa*. Detail from holotype (BM).

Figure 3. *Pyrrocoma racemosa*. Lane Co., Oregon. *Messinger 814* (BRY).

Figure 4. *Pyrrocoma congesta*. Josephine Co., Oregon. Holotype, *Howell 1438* (NY).

Figure 5. *Pyrrocoma congesta*. Josephine Co., Oregon. Isotype: *Howell 1438* (NDG).

Figure 6. *Pyrrocoma congesta*. Josephine Co., Oregon. *Kruckeberg 2911* (WTU).

Figure 7. *Pyrrocoma congesta*. Josephine Co., Oregon. *Chambers 2286* (WTU).

Figure 8. *Pyrrocoma congesta*. Josephine Co., Oregon. *Cusick 2939* (P). Uncommon racemoid inflorescence.

Figure 9. *Pyrrocoma congesta*. Jackson Co., Oregon. *Cusick 2947* (US). Holotype of *Pyrrocoma balsamitae* Greene.

Figure 10. *Pyrrocoma congesta*. Jackson Co., Oregon. Detail from *Cusick 2947* (US).

Figure 11. *Pyrrocoma congesta*. Jackson Co., Oregon. *Cusick 2947* (GH). Isotype.

Figure 12. *Pyrrocoma congesta*. Jackson Co., Oregon. *Hall 11966* (US).

Figure 13. *Pyrrocoma congesta*. Del Norte Co., California. *Chambers 2966* (OSC). The narrow leaves are unsual.

Figure 14. *Pyrrocoma pinetorum*. Siskiyou Co., California. *Howell 1546* (CAS).

Figure 15. *Pyrrocoma pinetorum*. Siskiyou Co., California. Holotype of *Aplopappus racemosus* var. *praticola, Howell 12752* (CAS).

Figure 16. *Pyrrocoma pinetorum*. Siskiyou Co., California. *Keck 4862* (DS).

Figure 17. *Pyrrocoma pinetorum*. Siskiyou Co., California. *Kellogg 119* (US).

Figure 18. *Pyrrocoma nivis*. Snow Mountain, *Brandegee s.n.*, holotype.

Figure 19. *Pyrrocoma nivis*. Details from holotype.

Figure 20. *Pyrrocoma nivis*. Details from holotype.

Figure 21. *Pyrrocoma elata*. Isolectotype (NY), *Parry s.n.* from Calistoga, Napa Co., California.

Figure 22. *Pyrrocoma elata*. Details from isolectotype (GH). Napa Co., *Parry s.n.*

Figure 23. *Pyrrocoma elata*. Calistoga, *Baker 7535* (CAS).

Figure 24. *Pyrrocoma elata*. Calistoga, *Eastwood 7961* (US).

Figure 25. *Pyrrocoma elata*. Calistoga, *Eastwood 7961* (CAS).

Figure 26. *Pyrrocoma elata*. Detail from Figure 16.

Figure 27. *Pyrrocoma elata*. Calistoga, *Crampton 7154* (DAV-AHUC).

Figure 28. *Pyrrocoma elata*. Calistoga, *Heller 14466* (UTC).

Figure 29. *Pyrrocoma ebulliens*. Napa Co., California. *Ruygt 3767b* (DAV).

Figure 30. *Pyrrocoma ebulliens*. Napa Co., California. *Ruygt 3767b* (DAV).

Figure 31. *Pyrrocoma ebulliens*. Detail from *Ruygt 3767b* (DAV).

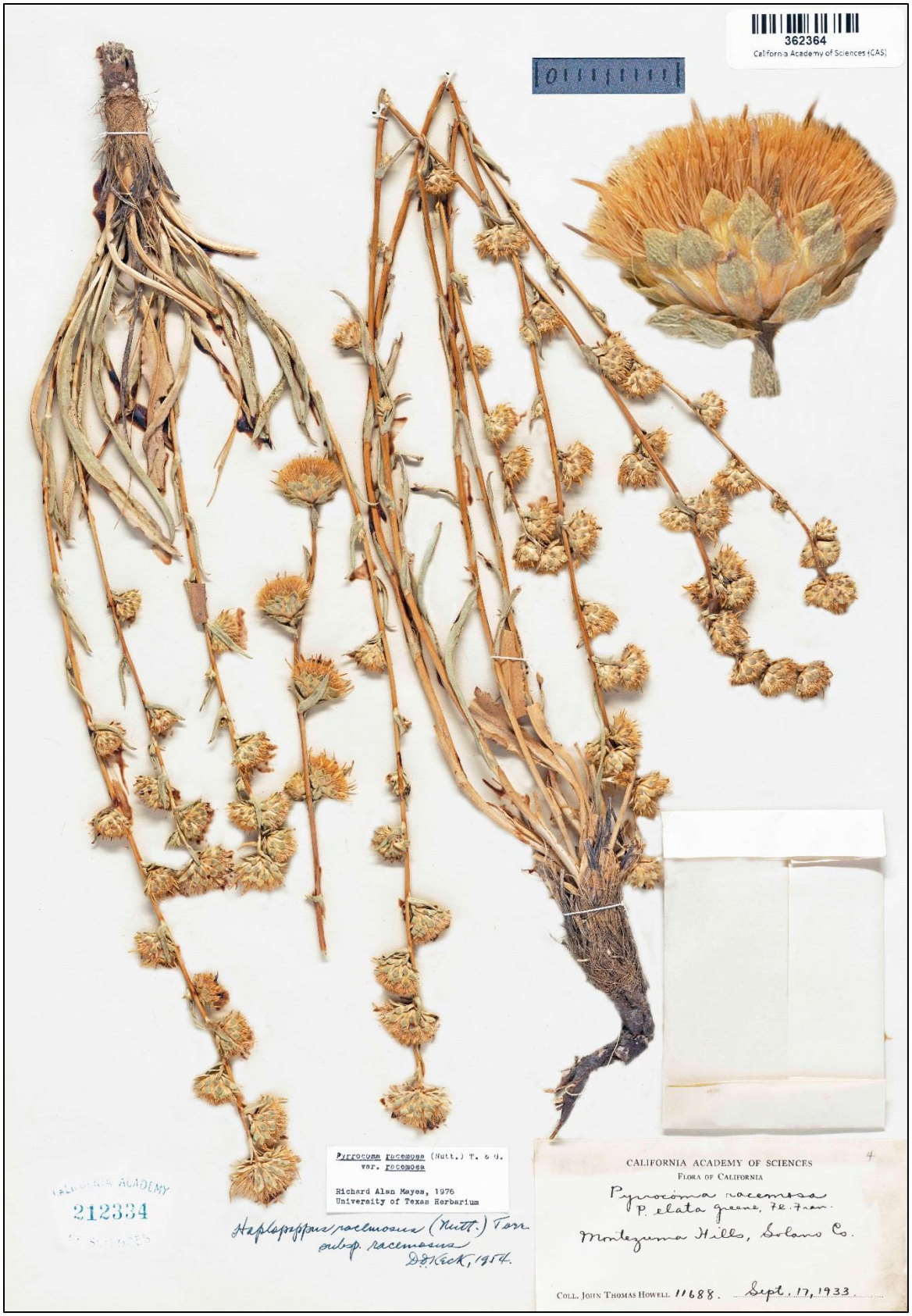

Figure 32. *Pyrrocoma ebulliens*. Solano Co., California. *Howell 11688* (CAS).

Figure 33. *Pyrrocoma ebulliens*. Solano Co., California. *Rose 33371* (IND).

Figure 34. *Pyrrocoma ebulliens*. Solano Co., California. *Rose 33371* (KHD).

Figure 35. *Pyrrocoma aff. ebulliens*. Near Creed Station, Solano Co., *Crampton 7542* (DAV-AHUC).

Figure 36. *Pyrrocoma aff ebulliens*. Near Creed Station, Solano Co., *Crampton 7542* (CAS).

Figure 37. *Pyrrocoma longifolia*. Santa Clara Co., California. *Wolf 732* (US).

Figure 38. *Pyrrocoma longifolia*. San Mateo Co., California. *Blake 10329* (US).

Figure 39. *Pyrrocoma longifolia*. Santa Clara Co., California. *Dudley s.n.* (DS).

Figure 40. *Pyrrocoma longifolia*. Santa Clara Co., California. *Heller 13528* (US).

Figure 41. *Pyrrocoma longifolia*. Santa Clara Co., California. *Keck 456* (DS).

Figure 42. *Pyrrocoma benitoana*. San Benito Co., California. *Ferris 13077* (WS).

Figure 43. *Pyrrocoma benitoana*. San Benito Co., California. *Chisaki 2817* (WS).

Figure 44. *Pyrrocoma benitoana*. San Benito Co., California. *Twisselman 12855* (CAS).

Figure 45. *Pyrrocoma benitoana*. San Benito Co., California. *Twisselman 12850* (CAS).

Figure 46. *Pyrrocoma benitoana*. iNaturalist photo by Cat Chang, 12 September 2021 <https://www.inaturalist.org/observations/94704945?

Figure 47. *Pyrrocoma benitoana*. iNaturalist photo by Paul G. Johnson, 24 August 2016 <https://www.inaturalist.org/observations/4016674>

Figure 48. *Pyrrocoma benitoana*. iNaturalist photo by Paul G. Johnson, 24 August 2016 <https://www.inaturalist.org/observations/4016674> Minute glandularity on the peduncle and outer phyllaries.