linear, subglabrous on the back but conspicuously villous-ciliate on the margins; rays white or pale creamy, often drying more yellowish, commonly about 13, or occasionally about 21 or up to 25, 2.5–4.5 cm long.

Moist or wet meadows in the foothills and at moderate (up to 2600 m) elev. in the mts.; c. and e. Oregon to sw. Mont., Yellowstone Natl. Park, sw. Idaho, and Elko Co., Nev. Late Apr–June, a little earlier, under similar conditions, than *W. amplexicaulis*.

4. Wyethia amplexicaulis (Nutt.) Nutt.

Espeletia amplexicaulis Nutt. J. Acad. Nat. Sci. Philadelphia 7: 38. 1834. *Wyethia amplexicaulis* Nutt. Trans. Amer. Philos. Soc. II. 7: 352. 1841. (*Wyeth*, about Flathead River [possibly actually taken farther w., since the species would not have been likely to be in bloom when Wyeth was there in late Apr and early May, and the specimen bears the date 16 June 1833], Mont.; holotype at BM!)

Mule's-ears.

Plants with a stout, woody taproot and simple or nearly simple crown; stems 1–few, stout but lax, 3–8 dm long or tall; herbage and involucre wholly glabrous, resinous-varnished, the plant more strongly aromatic than its congeners; leaves firm, entire or (especially the basal ones) sometimes denticulate, the basal ones enlarged, with elliptic or lance-ovate blade 2–6 dm long and 5–16 cm wide, tapering to the short petiole; cauline leaves several, smaller, mostly sessile, the upper mostly ovate or lance-ovate, broad-based, and clasping, only rarely more tapering and short-petiolate; heads several or occasionally solitary, the central one large and hemispheric, the axillary ones smaller and more turbinate; involucral bracts broad and herbaceous, often surpassing the disk; rays sunflower-yellow, 2.5–6 cm long, commonly about 13 to about 21 (up to 25) on the terminal head, often only 8 on the lateral; $2n = 38$.

Open, not too dry hillsides and dry meadows, in the foothills and at moderate elev. (up to 2600 m) in the mts.; c. Wash. to w. Mont., s. to Nev. (Humboldt, Pershing, Lander, Eureka, and White Pine cos.), Utah (Sevier Co.), and c. Colo., largely allopatric with the more southeastern *W. arizonica*. Mostly May, June.

W. A. Weber's record of an outlying station in Washington Co., Utah, is based on *Deming 48* at UTC. The data for this specimen may be incorrect.

At the limits of its ecological tolerance, where *W. amplexicaulis* grows with the more moisture-demanding *W. helianthoides*, hybrids are often produced. These are at least partly fertile, but do not swamp the parents, which remain readily distinguishable. The name *W. ovata* Piper was based on such hybrids from northeastern Oregon.

5. Wyethia arizonica A. Gray

Wyethia arizonica A. Gray, Proc. Amer. Acad. Arts 8: 635. 1873. (*Palmer s.n.*, Bear Springs, Coconino Co., Ariz., in 1869; holotype at GH!)

Arizona mule's-ears.

Plants with a stout, woody taproot, surmounted by a simple crown or sometimes few-branched caudex; stems 1–few, stout but lax, 2–10 dm long or tall; herbage evidently villous or hirsute, varying to rather inconspicuously so, or even virtually glabrous, rarely the peduncles merely stipitate-glandular, but in any case the plant not appearing resinous-varnished; leaves all entire, the basal ones enlarged, with elliptic (or lance-elliptic) blade mostly 12–30 cm long and (2) 3–10 cm wide, tapering or seldom more abruptly contracted to a petiole of up to about equal length; cauline leaves several, smaller, mostly tapering to a short petiole, the upper or uppermost ones sometimes rounded at the base but still short-petiolate, or rarely sessile and clasping as in *W. amplexicaulis*; heads much as in *W. amplexicaulis*, but often solitary; $2n = 38$.

Open slopes, often with oak or pine, seldom extending up to the spruce-fir zone, 700–3000 m elev.; w. Colo. to s. Utah, nw. N.M. and c. Ariz.; in Utah common in and about the Abajo and La Sal mts. (San Juan and s. Grand cos.), and extending w. as far as Washington Co. June–Aug.

This species is reputed to hybridize with *W. amplexicaulis* where their ranges adjoin in the Rocky Mountains of Colorado. On the other hand, the glabrous or subglabrous individuals or colonies of *W. arizonica* in Utah bear no relation to present hybridization.

2. BALSAMORHIZA Nutt. Balsamroot

Taprooted perennial herbs; leaves entire to pinnately dissected, all basal, or 1–several much reduced, often bract-like leaves present on the stout, scapiform, usually lax stems; heads large, solitary or sometimes (but not in our species) several, radiate, the rays pistillate and fertile, yellow (roseate in one extralimital species); involucre of several series of subequal or imbricate, more or less herbaceous bracts, or the outer bracts sometimes enlarged and foliaceous; receptacle broadly convex, chaffy throughout, its bracts clasping the achenes; disk-flowers numerous, perfect and fertile, mostly yellow; anthers sagittate; style-branches slender, smooth below, the introrsely submarginal stigmatic lines fading away into the elongate, hispidulous terminal portion, or hispidulous throughout and the stigmatic lines obscure; disk-achenes radially compressed-quadrangular; pappus ordinarily wanting.

Eight species, native to w. N. Amer. (Name from the Greek *balsamon*, balsam, and *rhiza*, root.)

If *B. hookeri* is taken in the broad sense here proposed, all the species are well defined. Hybrids involving *B. macrophylla* are unknown, but otherwise the species frequently produce a few readily recognizable hybrids and hybrid progeny when they grow together, just as in *Wyethia*. The name *B. terebinthacea* (Hook.) Nutt., sometimes misapplied to plants of our region, was evidently based on a hybrid of *B. hookeri* with the western species *B. deltoidea* Nutt.

References:
Ownbey, M., and W. A. Weber. 1943. Natural hybridization in the genus *Balsamorhiza*. Amer. J. Bot. 30: 179–187.
Sharp, W. M. 1935. A critical study of certain epappose genera of the Heliantheae—Verbesininae of the natural family Compositae. Ann. Missouri Bot. Gard. 22: 51–152.

1 Leaves entire, triangular-hastate or with more cordate base; taproot surmounted by a multicipital caudex ..... 1. *B. sagittata*

1 Leaves toothed to pinnatifid or pinnately dissected.

2 Well developed plants with a large taproot from which several erect branches arise, thus somewhat

cespitose and transitional in this respect between *B. sagittata* and our other species; plants robust, the leaves mostly 3–6 dm long, with broad, mostly entire or few-toothed segments commonly 5–12 cm long; n. Utah to e. Idaho, w. Wyo., and sw. Mont. ..... 2. *B. macrophylla*

2 Plants with a smaller, somewhat carrot-like taproot surmounted by a simple or seldom few-branched crown; leaves either smaller, or more dissected, or both.

3 Leaves varying from merely toothed to deeply pinnatifid, even on the same plant, but generally at least some of them merely toothed; leaves scabrous, strongly reticulate; nw. Nev., n. to s. Wash. ..... 3. *B. serrata*

3 Leaves deeply pinnatifid, less scabrous and less reticulate; widespread in our range ... 4. *B. hookeri*

1. **Balsamorhiza sagittata** (Pursh) Nutt.

Buphthalmum sagittatum Pursh, Fl. Amer. Sept. 564. 1814. *Espeletia sagittata* Nutt. J. Acad. Nat. Sci. Philadelphia 7: 38. 1834. *Balsamorhiza sagittata* Nutt. Trans. Amer. Philos. Soc. II. 7: 350. 1841. (*Lewis s.n.*, on dry barren hills, in the Rocky Mts., 7 July 1806; holotype at PH!)

Espeletia helianthoides Nutt. J. Acad. Nat. Sci. Philadelphia 7: 39. 1834. *Balsamorhiza helianthoides* Nutt. Trans. Amer. Philos. Soc. II. 7: 351. 1841. (*Wyeth*, borders of the Flathead River, Mont.; an original specimen at BM!)

Arrowleaf balsamroot.

Perennial with a deep-seated, woody taproot and multicipital caudex; basal leaves long-petiolate, the blade mostly triangular-hastate, or with more cordate base, up to 30 cm long and 15 cm wide, entire, silvery, especially beneath, with a fine close, felt-like tomentum of short hairs when young, greener and often glabrate in age; stems 2–8 dm tall, scapiform, but usually with several strongly reduced narrow leaves; heads solitary; top of the peduncle and lower part of the involucre generally lanate-tomentose, rarely nearly glabrous; rays 8–25, commonly about 13 or about 21, 2.5–4 cm long; achenes glabrous; $2n = 38$.

Open hillsides and flats, usually in fairly deep soil, in the valleys and foothills and up to middle elev. (seldom as much as 3000 m) in the mts., typically with big sagebrush, sometimes in forest-openings or open woods; s. B.C. to ec. Calif., mainly e. of the Cascade-Sierran summits, e. to Alta., N.D., the Black Hills of S.D., Colo., and the Kaibab Plateau in n. Ariz., but absent from the White Mts. of Calif., most of s. Nev., the Dixie-Corridor, and most parts of the Canyonlands Sect. of Utah. Apr–July.

The more western species *B. deltoidea* Nutt. approaches our range near Susanville, California. It is more sparsely hairy, with the involucre only slightly or scarcely woolly.

2. **Balsamorhiza macrophylla** Nutt.

Balsamorhiza macrophylla Nutt. Trans. Amer. Philos. Soc. II. 7: 350. 1841. (*Nuttall*, toward the sources of the Colorado of the West, in the Rocky Mts.; holotype at BM!)

Bigleaf balsamroot.

Robust perennial; well developed plants with a large taproot from which several branches arise underground; leaves large, 3–6 dm long, pinnatifid, with broad, generally entire or coarsely few-toothed segments mostly 5–12 cm long, glandular at least beneath; stems lax, 3–10 dm tall, leafless or often with a pair of much reduced, coarsely toothed or few-pinnatifid leaves toward the base; pubescence relatively long and often sparse; heads large, with long, somewhat leafy bracts that may surpass the disk; rays (8) 10–16 or up to 21, 3.5–6 cm long; achenes glabrous.

Open places from the foothills to about 2400 m elev. in the mts., often in slightly moister sites or at higher elev. than *B. hookeri*, frequently with *B. sagittata* and *Wyethia amplexicaulis*; mts. of n. Utah, n. through the montane part of e. Idaho and w. Wyo. to sw. Mont.; in our range mainly in the Wasatch Mts. Division, but also extending as far nw. as the Black Pine Mts. of Cassia Co., Idaho. May–July.

This species appears to be absolutely sharply limited.

3. **Balsamorhiza serrata** A. Nelson & J. F. Macbr.

Balsamorhiza serrata A. Nelson and J. F. Macbr. Bot. Gaz. 56: 479. 1913. (*Leiberg 83*, rocky hills near Rock Creek, Morrow Co., Oregon; holotype at RM!)

Serrate-leaved balsamroot.

Perennial with a simple, unbranched crown surmounting a somewhat carrot-like taproot; leaves green, scabrous, and strongly reticulate-veiny, petiolate, the blade 4–20 cm long and 2–8 cm wide, varying from deltoid-ovate and merely sharply serrate, to evidently pinnatifid, often even on the same plant, but nearly all plants with some merely toothed leaves; stems 1–4 dm tall, often with a pair of much-reduced leaves near the base; heads solitary; involucre nearly smooth to strongly woolly, its bracts lanceolate or nearly linear; rays most commonly 10–16 (averaging 13), but sometimes up to about 21 or as few as 8, mostly 2–4 cm long; achenes glabrous; $2n = 38$.

Dry, rocky knolls and outcrops, up to about 2000 m elev.; e. of the Cascade Mts. from s. Wash. through e. Oregon to the Sheldon Natl. Wildlife Refuge in n. Washoe and nw. Humboldt cos., Nev. May, early June.

4. **Balsamorhiza hookeri** Nutt.

Heliopsis (?) *balsamorhiza* Hook. Fl. Boreali-Amer. 1: 310. 1833. *Balsamorhiza hookerii* Nutt. Trans. Amer. Philos. Soc. II. 7: 349. 1841. *B. balsamorhiza* A. Heller, Cat. N. Amer. Pl. 7. 1898. (*Douglas s.n.*, gravelly banks of the Columbia, near Ft. Vancouver, in 1825; holotype at K!)

B. hirsuta Nutt. Trans. Amer. Philos. Soc. II. 7: 349. 1841. *B. hookeri* (var.) *hirsuta* A. Nelson in J. M. Coult. & A. Nelson, New Man. Bot. Centr. Rocky Mts. 546. 1909. (*Nuttall*, "Dry plains east of Walla-Walla, near the Blue Mountains, and in the Grand Ronde prairie" [probably taken in the vicinity of Hot Lake, in Union Co., Oregon, the second of the two localities cited; not known from the vicinity of Walla Walla]; holotype at BM!)

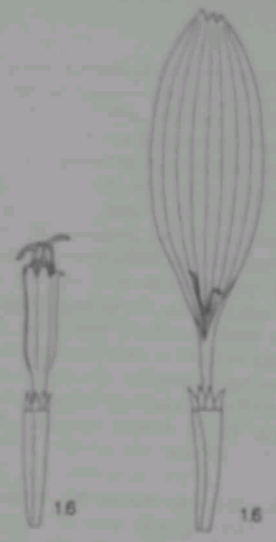
Balsamorhiza hookeri var. **platylepis** (W. M. Sharp) Cronquist, comb. nov. *B. platylepis* W. M. Sharp, Ann. Missouri Bot. Gard. 22: 131. 1935. *B. macrolepis* var. *platylepis* Ferris, Contr. Dudley Herb. 5: 99. 1958. (*P. B. Kennedy 1859*, Marmol Station, Washoe Co., Nev.; holotype at F!)

B. macrophylla var. *idahoensis* W. M. Sharp, Ann. Missouri Bot. Gard. 22: 136. 1935. *B. hookeri* var. *idahoensis* Cronquist, Univ. Wash. Publ. Biol. 17(5): 103. 1955. (*Macbride 820*, Squaw Creek, Boise [now Gem] Co., Idaho; holotype at MO!)

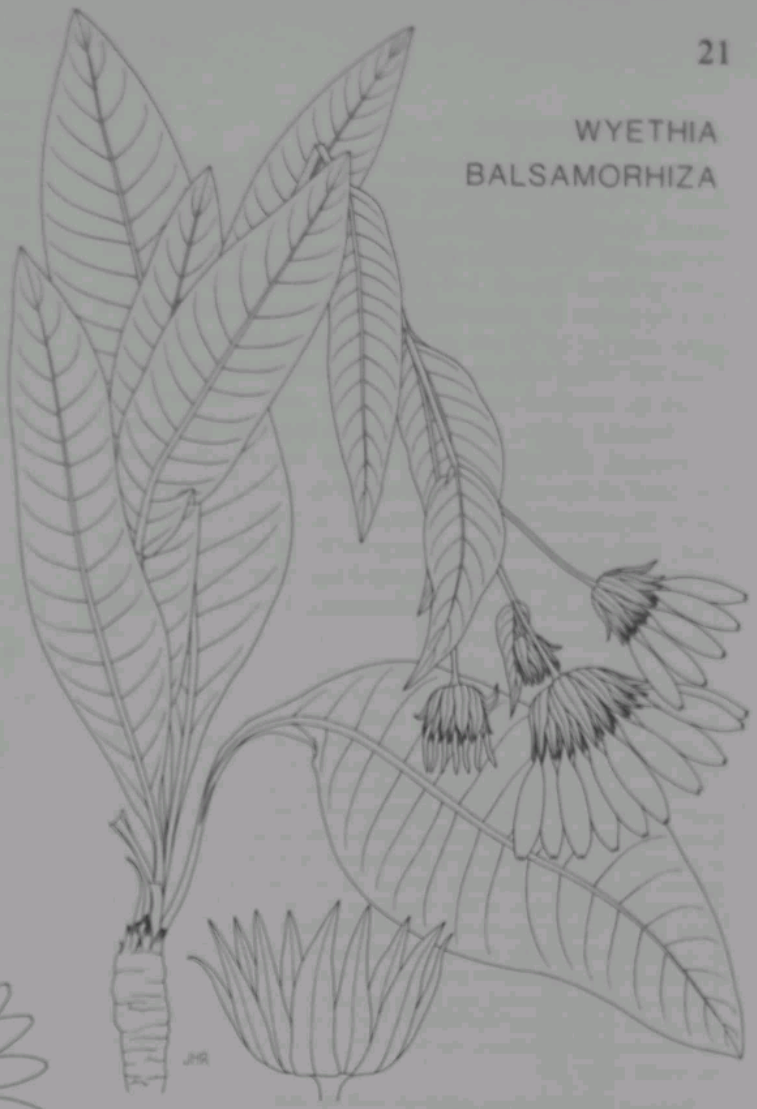
B. hispidula W. M. Sharp, Ann. Missouri Bot. Gard. 22: 137. 1935. *B. hookeri* var. *hispidula* Cronquist, Univ. Wash. Publ. Biol. 17(5): 103. 1955. (*M. E. Jones 1727*, Lake Point, Tooele Co., Utah; holotype at UC!)

B. hirsuta var. *neglecta* W. M. Sharp, Ann. Missouri Bot. Gard. 22: 139. 1935. *B. hookeri* var. *neglecta* Cronquist, Univ. Wash. Publ. Biol. 17(5): 103. 1955. (*A. A. Heller 9592*, Truckee Pass, Washoe Co., Nev.; holotype at F!)

WYETHIA
BALSAMORHIZA



Wyethia amplexicaulis



Balsamorhiza sagittata

Wyethia arizonica

Hooker-balsamroot.

Perennial with a carrot-like taproot and simple (seldom few-branched) crown, often also producing deep-seated, slender, shortly creeping roots from which new plants arise, so that the separate rosettes are connected underground; leaves 1–4 dm long, pinnatifid, the divisions entire to pinnatisect or even bipinnatisect, 1–5 cm long (or to 10 cm in var. *hirsuta*); stems lax, 0.6–5 dm tall, often with one or more inconspicuous, linear, entire or toothed-pinnatifid bracts near the base (in var. *hirsuta* with a pair of reduced but still fairly well developed, pinnatifid leaves borne several cm above the base of the otherwise scapiform stem); heads solitary; involucral bracts subequal or somewhat imbricate, long-hairy at least marginally, sometimes more or less woolly, especially toward the base; rays mostly 10–16 (or to 21 in var. *idahoensis*), 1.5–4.5 cm long; achenes glabrous; $2n = 38$.

Dry, rocky outcrops and dry meadows, mainly in the foothills and lowlands, but sometimes up to 2700 or even (on Wheeler Peak in Nev.) 2900 m elev.; c. Wash. to c. Calif., e. to wc. and sc. Idaho, sw. Wyo., nw. Colo., the Uinta Basin, the Wasatch and related mts., the Utah Plateaus, s. Nev., and the nw. corner of Ariz. Late Apr–July.

The species consists of about nine ill-defined varieties, these seemingly distinctive in their most characteristic forms, but morphologically confluent and geographically only very imperfectly segregated. In a previous (1955) treatment I maintained *B. hirsuta* as a separate species, but after further study both in the field and in the herbarium I am convinced that it is best treated as a variety of *B. hookeri*. In 1984 W. A. Weber annotated some Uinta Basin specimens at UTC as a new species, using the epithet *uintahensis*. In my opinion these constitute a woolly-bracted phase of var. *neglecta*. Status as a separate variety might be defended, but is not here proposed. Our four varieties, plus a fifth (*idahoensis*) that borders our range in western Idaho, may be characterized as follows, but not every specimen will fit nicely into its proper place:

1 Reduced cauline leaves relatively well developed and conspicuous, pinnatifid or bipinnatifid; principal leaves strongly dissected, with small ultimate segments, the primary segments sometimes as much as 10 cm long; middle and outer involucral bracts tending to have a more or less ovate base narrowed to an elongate, slender, usually reflexed tip; heads relatively large, the rays mostly 2.5–4.5 cm long; pubescence of var. *hispidula*, varying to nearly that of var. *neglecta*; e. Oregon (the *only* var. in ne. Oregon) to w. Nev. (Washoe Co., w. Humboldt Co., and the Wassuk Range in Mineral Co.) and adj. Lassen Co., Calif. ..... var. *hirsuta* (Nutt.) A. Nelson

1 Reduced cauline leaves smaller and inconspicuous, generally mere linear bracts, sometimes toothed or subpinnatifid, or wanting; leaves variously dissected, often more coarsely so than in var. *hirsuta*, the primary segments rarely more than 6 (7) cm long; involucral bracts variously shaped, often narrower and without a clear distinction between body and tip; heads averaging smaller, the rays mostly 1.5–3.5 cm long.

2 Involucral bracts relatively broad, more or less ovate or ovate-oblong; leaves mostly sericeous-strigose, not much dissected; involucre not woolly; Harney Co., Oregon, to s. Washoe Co., Nev., e. to Elko Co., Nev., and w. to Siskiyou Co., Calif.; only marginally distinct from var. *neglecta*, with which it shares most of its range ..... var. *platylepis* (W. M. Sharp) Cronquist

2 Involucral bracts narrower, more lanceolate or nearly linear.

3 Involucre conspicuously woolly, especially toward the base; plants relatively large and robust, with relatively broad, mostly uncut leaf-segments up to about 6 (7) cm long, thus somewhat approaching *B. macrophylla*, but intergradient with the vars. of *B. hookeri* and not with *B. macrophylla*; w. Idaho, bordering our range on the north ..... var. *idahoensis* (W. M. Sharp) Cronquist

3 Involucre usually not woolly (except most notably in the phase of var. *neglecta* that occurs in the Uinta Basin); plants mostly smaller and with more dissected leaves.

4 Leaves strigose-puberulent to scabrous-puberulent, only inconspicuously or not at all glandular; se. Oregon to wc. Nev. (vicinity of Reno and Carson City), e. across n. Nev. and adj. Idaho to nw. Utah; disjunct in the Uinta Basin, where more common than var. *hispidula*, and there often with an evidently woolly involucre ..... var. *neglecta* (W. M. Sharp) Cronquist

4 Leaves glandular and hispidulous in varying proportions, the hairs more or less spreading; Snake River Plains of Idaho (and overlapping into n. Nev. and se. Oregon), e. to se. Idaho, sw. Wyo., nw. Colo., and the Uinta Basin of Utah, s. along the Wasatch front, and in w. Utah and adj. Nev. to sw. Utah, nw. Ariz., and s. Nev. ..... var. *hispidula* (W. M. Sharp) Cronquist

3. VIGUIERA Humb., Bonpl. & Kunth

Herbs (all ours) or shrubs or even small trees; leaves simple, the lower opposite, the upper generally alternate at least in well developed plants; heads radiate, the rays yellow, neutral; involucral bracts obscurely to evidently 2- to several-seriate, subequal to evidently imbricate, generally green and more or less herbaceous, at least distally; receptacle convex, varying to low-conic or nearly flat, chaffy throughout, its bracts clasping the achenes; disk-flowers perfect and fertile; anthers sagittate at the base; style-branches flattened, varying from hispidulous on both sides and without a distinct appendage to sometimes (as in our species) virtually glabrous except for the well marked, short, externally short-hairy appendage, the stigmatic lines in either case obscure; achenes glabrous (as in our species) or often hairy; pappus usually of 2 awns and several shorter, distinct or connate scales, all generally persistent, or in some species (including ours) the pappus wanting. (*Heliomeris*; *Gymnolomia*, misapplied)

About 150 species, native from w. U.S. to S. Amer., one species in se. U.S. (Named for Alexandre L. G. Viguier, 1790–1867, physician and botanist of Montpellier.)

Our species belong to the small section *Heliomeris*, marked by its narrow, wholly herbaceous, only obscurely 2- or 3-seriate involucral bracts and glabrous achenes without a pappus. These features can be found also in other species of *Viguiera*, but mostly not in combination.

Heiser and his student W. F. Yates propose to revive the genus *Heliomeris* Nutt. for a few epappose species of *Viguiera* with a basic chromosome-number (in the three species counted) of $x = 8$. The status of *Heliomeris* as an integral part of *Viguiera* on morphological grounds was fully expounded by S. F. Blake, who pointed out that a number of other species of *Viguiera* also lack a pappus. Contrary to the statement by Yates and Heiser, there is nothing distinctive about the involucre of *Heliomeris* in the context of the genus *Viguiera* as a whole. It is true that most species of *Viguiera* have a more imbricate involucre with the bracts basally firmer and less herbaceous, but not all of them do. Compare, for example, the Mexican species *V. hypargyrea* Greenm. and the Brazilian species *V. aspilioides* Baker.

The position of the southeastern species *Viguiera porteri* (A. Gray) S. F. Blake bears on the status of *Heliomeris*. This species was included in the section *Heliomeris* by Blake, and in the genus *Heliomeris* by Yates in his thesis. It certainly has the aspect and technical morphological characters of *Heliomeris*. Unlike other species of the *Heliomeris* group, however, *Viguiera porteri* has $2n = 34$ chromosomes, as in typical

BALSAMORHIZA