

REVISION OF *ERIGERON* SECT. *LINEARIFOLII* (ASTERACEAE:
ASTEREAE)

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ABSTRACT

In a taxonomic study of *Erigeron foliosus* and its close relatives (sect. *Linearifolii*), fourteen species are recognized: *E. aequifolius*, *E. angustatus*, *E. biolettii*, *E. blochmaniae*, *E. breweri*, *E. elmeri*, *E. foliosus*, *E. inornatus*, *E. mariposanus*, *E. miser*, *E. oxyphyllus*, *E. petrophilus*, *E. reductus* comb. et stat. nov., and *E. serpentinus* sp. nov. Seven varieties are recognized in *E. breweri*: var. *bisanctus* var. nov., var. *breweri*, var. *covillei* comb. nov., var. *ensenadensis* var. nov., var. *jacinteus*, var. *porphyreticus*, and var. *klamathensis* var. nov. Five varieties are recognized in *E. foliosus*: var. *confinis*, var. *foliosus*, var. *franciscensis* var. nov., var. *hartwegii*, and var. *mendocinus* comb. et stat. nov. Three varieties are recognized in *E. inornatus*: var. *calidipetris*, var. nov., var. *keilii* var. nov., and var. *inornatus*. Three varieties are recognized in *E. petrophilus*: var. *petrophilus*, var. *viscidulus* comb. nov., and var. *sierrensis* var. nov. Most of these have the greatest part of their range in California, from there extending eastward into Nevada, southward into Baja California, and northward to Washington. *Erigeron oxyphyllus* E. Greene is restricted to southern Arizona and adjacent Sonora. A detailed taxonomic treatment, including nomenclature and distribution maps, is provided for these taxa. Five other species peripherally related to the *E. foliosus* group are more briefly treated: *Erigeron hyssopifolius* of the northeastern United States and adjacent Canada; *E. chiangii* and *E. scoparioides* from northeastern México; and *E. rhizomatus* and *E. lepidopodus* from northwestern México and the southwestern United States.

KEY WORDS: *Erigeron*, Astereae, Asteraceae, California

The group of taxa including *Erigeron foliosus* Nutt., *E. breweri* A. Gray, and *E. inornatus* (A. Gray) A. Gray has long been known to show complex

patterns of variation. Compton (1934) published a short study of the *E. foliosus* complex in a narrow sense, but the group was treated in full by Cronquist (1947) in his revision of the 133 North American species known at that time. A partial summary of Cronquist's view of the taxonomy of this group is seen in his comment (1947, p. 281) that "The *E. foliosus*-*E. breweri* complex presents some of the most difficult problems in the genus *Erigeron*. There are a multitude of recognizable forms, often with relatively strong morphological characters, but these interlock and intergrade in such a way that taxonomic segregation becomes difficult, and a completely satisfactory treatment seems impossible." With respect to the group at hand, Cronquist recognized six species, and his delimitations of the taxa have been essentially the only ones in use since then, because he contributed treatments of *Erigeron* consistent with the concepts of his revision to virtually all of the major floristic studies of the Pacific coast since 1947.

The taxonomy presented here differs considerably from that of Cronquist (1947), and this is the first study to include detailed mapping of the geographic ranges of these taxa (Maps 1-9), which provides evidence significant in directing the taxonomic decisions. All taxa recognized by Cronquist, except one, are recognized in the present study, and apart from eight previously unrecognized taxa, the other differences in treatment in large part reflect the recognition of new taxa and the elevation of varietal taxa to the rank of species. Such shifts have resulted from the observation that, in many cases, the taxa involved have discrete morphological and geographical ranges, they are broadly or completely sympatric with putatively conspecific taxa, and intergradation among these taxa is less than previously supposed. As regarded here, a large component of the confusing variation has resulted from previously unrecognized entities as well as parallel tendencies of variability among some of the taxa. Even with this seemingly less conservative approach, it is clear, as also seen by Cronquist, that several of the most widespread species are complex and comprise a number of varieties (e.g., as treated here, *E. foliosus* with five varieties and *E. breweri* with seven varieties).

In previous studies (e.g., Nesom 1990), I have tried to be consistent in the application of names at the varietal rank, referring these to closely similar taxa that are geographically contiguous and intergrading at their zone of contact. In the *Erigeron foliosus* group, however, some of the species comprise sets of allopatric taxa separated by relatively small differences; some of these are intergrading, but the intergradation is more likely the reflection of parallel variability resulting from common ancestry rather than gene flow. A similar pattern of variability has been observed among some of taxa of the *E. eatonii* A. Gray group (Strother & Ferlatte 1989). As has been the trend in the present study, an alternative treatment might consider some of these allopatric population systems with small but distinctive differences as separate species, requiring higher rank for some of the taxa recognized here as varieties (as

noted below).

The present study treats in detail only the taxa of the *Erigeron foliosus* group, which are clearly closely related among themselves. Putatively related species (Nesom 1989) that are geographically and morphologically widely peripheral are briefly included, but these need to be investigated in more detail to determine their degree of relationship. Although the major patterns of variation within the *E. foliosus* group seem to be fairly clear, problems remain in two areas: (1) the definition of some of the taxa (particularly within *E. breweri* and *E. petrophilus* E. Greene), for which field work in specific geographic areas will be critical in future studies, and (2) the pattern of phylogenetic relationships among the taxa. I have more confidence that the taxa recognized here are real entities in nature than I do that they are related as proposed. With further detailed examination, the taxonomy advanced here will almost certainly be modified.

The concepts presented in this study are derived from examination of more than 2000 specimens, representing the whole geographic range of the group, although the taxa are primarily centered in California. Using the keys and distribution maps, identifications can be made with relative confidence. The nature of the characters that delimit the varietal taxa, however, will be easier to interpret with reference specimens for comparison.

Chromosome counts have been made for eleven of the taxa included here (as documented below; all recorded here in "gametophytic" form, regardless of how they were reported). All of the taxa counted, except one of the peripheral species, are diploid. The discovery that polyploids were more common would not be unexpected, since they are known to be common in *Erigeron* even within single species without taxonomic subdivision. Their presence, however, in whatever pattern, would probably not alter the taxonomic structure presented here.

The taxa are treated alphabetically. Authorships for all names mentioned in the text can be found in the formal nomenclature. Designations of geographic provinces in California follow Hickman (1989). Specimens are cited for new or rare taxa and elsewhere when necessary to clarify critical differences with previous taxonomic treatments. Taxa that are more common and more easily recognized are documented by detailed mapping; a single symbol may represent numerous collections for commonly collected taxa.

Erigeron sect. *Linearifolii* (G. Don) Nesom, *Phytologia* 67:79. 1989.

Erigeron sect. *Linearifolii* (G. Don) Nesom, *Phytologia* 67:79. 1989. BASIONYM: *Aster* sect. *Linearifolii* G. Don in Loudon, *Hort. Brit.* 346. 1830. LECTOTYPE (Sundberg & Jones 1987): *Aster graminifolius* Banks ex Pursh (= *Erigeron hyssopifolius* Michx.). Sundberg & Jones (1987) lectotypified *Aster* sect. *Linearifolii* with *A. graminifolius*. Their

choice of a type was apparently intended solely to preserve an established name within the genus *Aster*. Without an understanding of the taxonomy of *Erigeron*, however, they merely transferred the problem from one genus to another (*Aster* to *Erigeron*). See comments below regarding the relationship of *E. hyssopifolius* to the *E. foliosus* group).

Erigeron sect. *Pycnophyllum* Cronq., Brittonia 6:141. 1947. TYPE: *Erigeron foliosus* Nutt. (see additional comments following *E. hyssopifolius* regarding *Erigeron* sect. *Linearifolii*).

Perennial herbs, glandular or eglandular, with or without eglandular vestiture, the stems prostrate or sprawling to decumbent ascending or erect, arising from fibrous rooted rhizomes or a woody taproot. Leaves all cauline, filiform to oblanceolate, entire, usually densely arranged and markedly longer than the internodes, not reduced upwards. Heads solitary or few in corymboid clusters; phyllaries strongly graduated in 3-5 series, usually with a strongly orange resinous midrib, rarely with 3 parallel veins; receptacles smooth to shallowly foveolate. Ray flowers absent or present in a single series, the corollas white or drying bluish, at maturity often slightly coiling at the tips. Disc corollas numerous, narrowly funnellform, the lower half sometimes slightly indurated; style branches with shallowly triangular collecting appendages ca. 0.1 mm long. Achenes compressed, with 2(-4) strongly orange resinous ribs, the surfaces usually shiny; pappus mostly of 20-35(-50) bristles, usually with a few, outer setae. Chromosome numbers, $n=9, 18$.

Plants of this section are recognized particularly by the long, ascending, decumbent, or prostrate basal portions of their stems, the narrow (usually), entire, and densely arranged cauline leaves, lack of persistent basal leaves, graduated phyllaries, minute collecting appendages of the disc style branches, and achenes with shiny surfaces and strongly orange resinous ribs. Further, the heads are solitary in some taxa, but they typically are more numerous and occur at the tips of branches arising near the apex of the stems, strongly reminiscent of the capitular arrangement in *Heterotheca* and *Chrysopsis*. Sect. *Linearifolii* has radiated almost exclusively within the boundaries of California; only two of the taxa lie completely outside of the state (one in Arizona and one in northwest México); several extend to the south into Baja California, east into Nevada, and north into Oregon and Washington.

KEY TO THE SPECIES OF THE *ERIGERON FOLIOSUS* GROUP OF
SECT. *LINEARIFOLII*

- 1. Ray flowers absent. (9)
- 1. Ray flowers present. (2)

2. Stem vestiture a mixture of eglandular and minutely but distinctly stipitate glandular hairs. *E. aequifolius*
2. Stem vestiture various, but without stipitate glandular hairs. . . (3)
3. Stems essentially glabrous to sparsely strigose with short, straight, ascending-appressed hairs. (5)
3. Stem vestiture pubescence short villous or hirsute to hirsutulous, often densely so, with spreading to spreading-deflexed hairs. (4)
4. Stem vestiture puberulous to closely villosulous with crinkly hairs; achenes glabrous. *E. blochmaniae*
4. Stem vestiture densely hirsutulous with straight, stiffly spreading, usually slightly deflexed hairs; achenes strigose. *E. breweri*
5. Stems with axillary tufts of small leaves at most nodes; phyllaries with prominent, broad, scarious margins. *E. mariposanus*
5. Stems without axillary tufts of small leaves; phyllaries without prominent scarious margins. (6)
6. Stems prostrate to decumbent trailing, arising from slender, fibrous rooted rhizomes. *E. elmeri*
6. Stems basally ascending but essentially erect, arising from a woody taproot. (7)
7. Middle and upper leaves much shorter than the internodes, eciliate.
. *E. oxyphyllus*
7. Middle and upper leaves much longer than the internodes, ciliate with ascending-appressed hairs. (8)
8. Leaves ciliate with thick based hairs; phyllaries usually with conspicuous eglandular hairs, rarely glandular; ray flowers 15-50.
. *E. foliosus*
8. Leaves ciliate with thin based hairs; phyllaries with barely perceptible eglandular hairs, densely granular glandular; ray flowers 9-13.
. *E. serpentinus*
9. Leaves oblanceolate; stems with long ascending basal portions arising from a woody taproot. (11)
9. Leaves linear; stems erect from the base, arising directly from a multicipital rootcrown, or arising from slender, rhizomelike caudex branches. . (10)

- 10. Stems 30-90 cm tall, basally erect, numerous, arising directly from a strongly woody rootcrown. *E. angustatus*
- 10. Stems 8-20(-30) cm tall, basally erect or ascending, usually few and arising singly from thin, rhizomelike, caudex branches. *E. reductus*
- 11. Phyllaries eglandular. *E. inornatus*
- 11. Phyllaries glandular. (12)
 - 12. Eglandular hairs on at least the lower half of the stems spreading. (14)
 - 12. Eglandular hairs of the stems sparse and antrorsely appressed or completely absent. (13)
- 13. Upper stems and leaves glandular. *E. biolettii*
- 13. Upper stems and leaves eglandular. *E. inornatus*
 - 14. Stems and leaves eglandular. (15)
 - 14. At least the upper stems and leaves distinctly glandular, sparsely to densely hirsute-villous with long, somewhat crinkly spreading hairs. (16)
- 15. Stems densely hirsutulous with short, slightly deflexed hairs of even length, or the hairs sometimes loosely antrorsely ascending. *E. inornatus* var. *keilii*
- 15. Stems sparsely hispid-pilose with long, stiffly spreading hairs, or the hairs sometimes antrorsely ascending-appressed. *E. petrophilus* var. *viscidulus*
 - 16. Stems 30-90 cm tall, erect; leaves 20-40 mm long; heads 12-15 mm wide. *E. biolettii*
 - 16. Stems 5-20(-30) cm tall, basally ascending or decumbent; leaves 7-25 mm long; heads 7-12 mm wide. (17)
- 17. Inner phyllaries (3.5-)4.0-5.0 mm long. *E. miser*
- 17. Inner phyllaries 5.5-7.0 mm long. *E. petrophilus*

1. *Erigeron aequifolius* H.M. Hall

Erigeron aequifolius H.M. Hall, Univ. Calif. Publ. Bot. 6:174. 1915. TYPE: UNITED STATES. California: Tulare Co., ridges at Trout Meadows, Transition Zone, 6200 ft, 16 Jul 1908, H.M. & G.R. Hall 8386 (HOLOTYPE: UC!; Isotypes: GH!, UC!, US!).

Stems ascending-erect, 10-20 cm long, from slender, woody, rhizomelike caudex branches. Stems and leaves minutely granular glandular, sparsely short villous. Leaves narrowly elliptic to oblanceolate, 6-20 mm long, 1.5-3.0 mm wide. Heads 7-10 mm wide; phyllaries minutely glandular, sometimes with a few other nonglandular hairs at the base, inner phyllaries 3.5-4.0 mm long. Ray flowers 14-24(-30), the corollas 5-8 mm long, drying blue. Disc corollas (2.8-)3.8-4.5 mm long. Achenes 2.2-2.5 mm long; pappus bristles 20-35. Chromosome number, $n=9$ (Semple 1985).

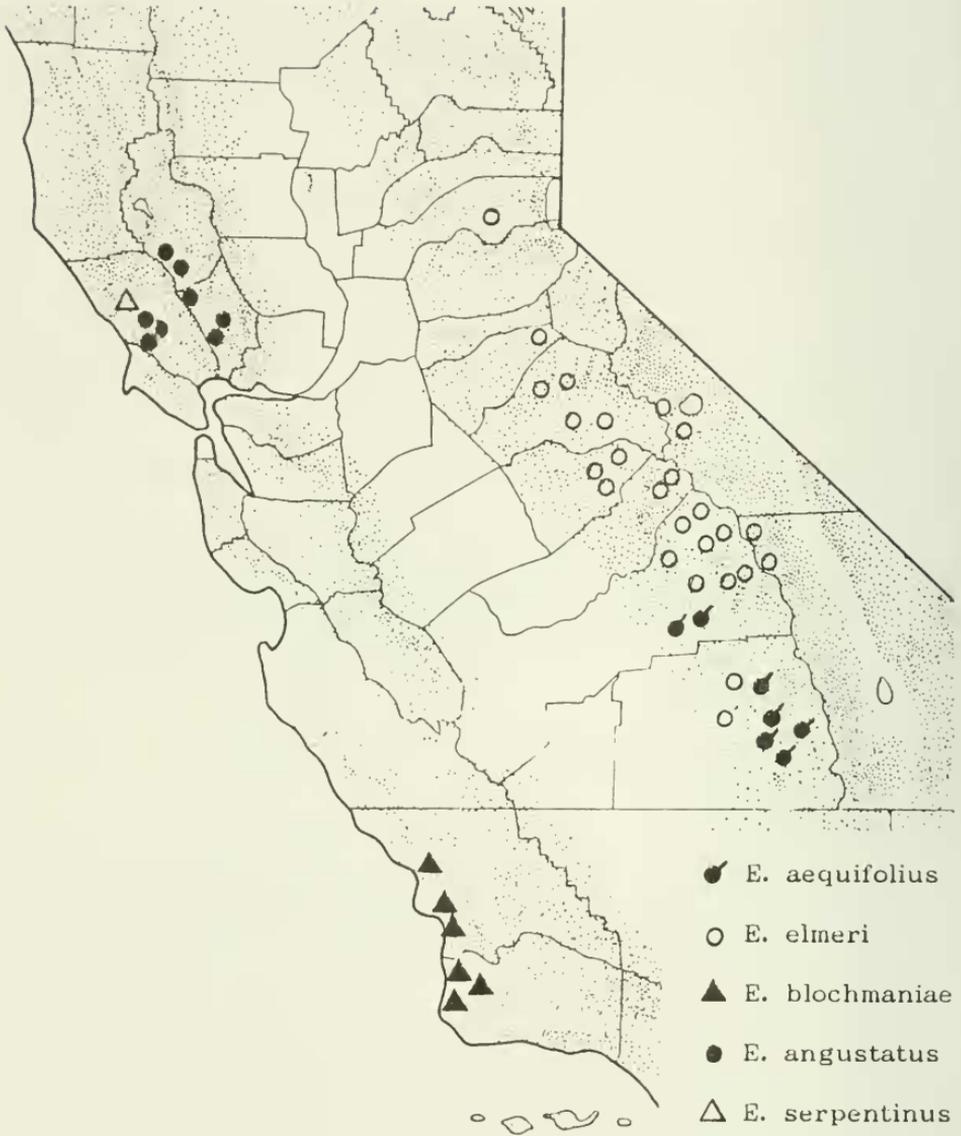
California endemic, southern High Sierra Nevada (Map 1); ledges, crevices, 1560-2010 m; Jul-Aug.

Cronquist's prophecy regarding the potential validity of *Erigeron aequifolius* (1947) has held true. The species is now known by a number of collections of morphologically consistent plants, none of which show intermediacy with any other species. It probably is most closely related to *E. breweri*, with which it is completely sympatric, and to *E. elmeri* (E. Greene) E. Greene, with which it is partially sympatric.

2. *Erigeron angustatus* E. Greene

Erigeron angustatus E. Greene, Bull. Calif. Acad. Sci. 1:88. 1885. TYPE: UNITED STATES. California: Napa Co., "dry hills on either side of Napa Valley, Jul-Oct" [Napa, 13 Aug 1874], E. Greene 339 (not located; probable duplicate: GH!). Although the type of *E. angustatus* is the same as one of the syntypes of *E. inornatus* A. Gray var. *angustatus* A. Gray (= *E. reductus* [Cronq]. Nesom var. *angustatus* [A. Gray] Nesom in the present study), there is no indication that Greene intended his name as a new combination based on Gray's earlier one. None of the sheets of this taxon at ND-G (cited below), all identified by Greene as *E. angustatus*, appear to be type material. I have not designated the GH specimen as lectotype, because I believe Greene's original collection eventually will be located.

Stems 3-9 dm tall, erect, arising directly from the crown of a thick taproot. Stems and leaves mostly glabrous, the margins widely and sparsely ciliate. Leaves linear, 1-6 cm long, 0.5-1.0(-2.0) mm wide. Heads 8-12 mm wide; phyllaries granular-glandular, without other vestiture, the inner 5.5-7.5 mm



Map 1. *Erigeron aequifolius*, *E. elmeri*, *E. blochmaniae*, *E. angustatus*, and *E. serpentinus*.

long, usually purple at the apex. Ray flowers absent. Disc corollas 4.2-6.0 mm long. Achenes 2.4-2.8 mm long; pappus bristles 26-38.

California endemic, southern Outer North Coast Ranges (Map 1); serpentine areas, often in loose rocks, usually in brushy vegetation, ca. 90-150 m; May-Sep.

Additional collections examined: UNITED STATES. California: Lake Co., no other locality data, 15 May 1893, *Blankenship* s.n. (UC); Whispering Pines Resort, 30 Jun 1940, *Baker 9749* (CAS,UC); foot of "Rabbit Hill," just SW of center of Middletown, 17 Aug 1971, *Hamann & Dearing* s.n. (JEPS). Napa Co.: St. Helena, 10 Jul 1891, *E.L. Greene* s.n. (ND-G 4 sheets); E side of Mt. St. Helena, 24 Aug 1941, *Hoover 5572* (JEPS); Sage Canyon, Napa Range, 27 Aug 1933, *Howell 11625* (CAS); Soda Creek Canyon, Napa Valley between Napa City and Yountville, 7 Aug 1938, *Tracy 16089* (DS,LL,UC). Sonoma Co.: Cazadero, side of stream, 24 Jun 1943, *Cooke* s.n. (UC); Dutch Bill Creek, 5 Sep 1947, *Hoffman 1249* (UC); between Occidental and Graton, 26 Jul 1936, *Howell 12669* (CAS); 2 mi E of Occidental, 5 Jul 1946, *Mason & Grant 12898* (UC).

This narrowly endemic species has not been recognized since its original description by Greene, but it is distinctive in morphology and habitat. It was included by Cronquist (1947) with *Erigeron inornatus* var. *angustatus* (*E. reductus* var. *angustatus* in the current study), which produces stems that are stolonlike and nearly filiform at the base, with no well developed root crown. *Erigeron angustatus* also has been confused with *E. biolettii* E. Greene, which is eradiate and somewhat similar in habit, though different in vestiture and habitat. The stems and leaves of *E. angustatus* are glabrous (vs. glandular), the leaves narrower (mostly linear and 0.5-1.0 mm vs. narrowly oblanceolate and 2-4 mm wide), and the stems arise directly and erect from the crown, in contrast to the long, ascending basal portions that are characteristic of *E. biolettii*. The two taxa are partially sympatric, and no intermediates have been seen in this study. Additional comments are given following *E. reductus* and *E. serpentinus* Nesom.

3. *Erigeron biolettii* E. Greene

Erigeron biolettii E. Greene, *Man. San Franc. Bay Region* 181. 1894. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Sonoma Co., base of Hood's Peak, 8 Jul 1892, *F.T. Bioletti* s.n. (ND-G!). *Erigeron inornatus* (A. Gray) A. Gray var. *biolettii* (E. Greene) Jeps., *Fl. W. Mid. Calif.* 569. 1901. Greene also cited a collection from Howell Mt. (Napa Co.) by Jepson.

Stems 3-9 dm tall, erect or the basal portions usually long, ascending, and somewhat caudexlike, usually purplish at the base. Stems and leaves

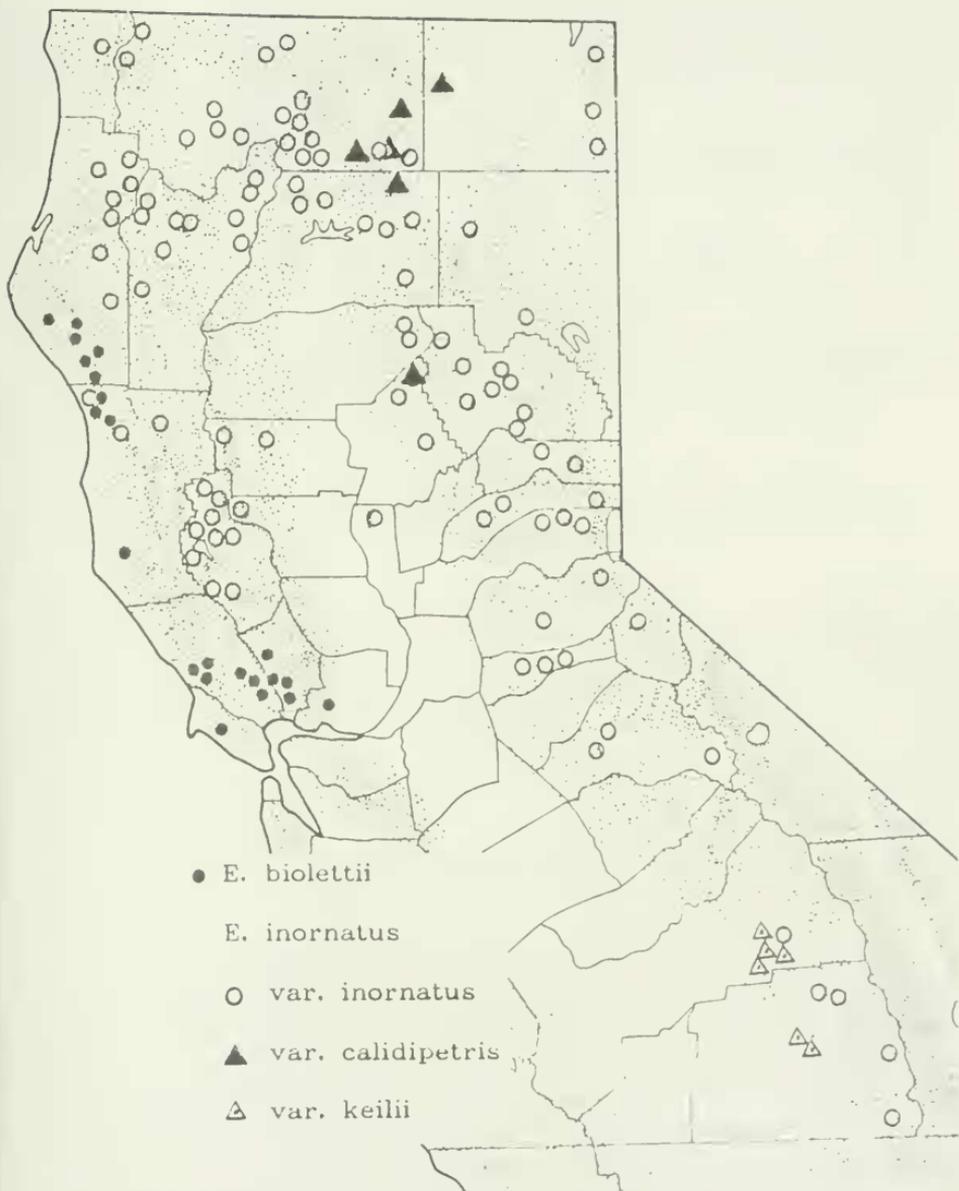
densely glandular, often also sparsely hispid or hispid-pilose. Leaves narrowly oblanceolate, 2-4 cm long, 2-4(-5) mm wide. Heads 12-15 mm wide; phyllaries densely glandular, the inner 6.0-8.0 mm long, usually purple at the apex. Ray flowers absent. Disc corollas 4.5-6.5 mm long. Achenes 2.0-2.5 mm long; pappus bristles 22-38.

California endemic, Outer North Coast Ranges (Map 2); dry slopes, rocks and ledges along rivers, 30-700(-1030) m; Jun-Sep.

Representative collections examined: UNITED STATES. California: Humboldt Co.: Mattole River at Union Mattole, 4 Aug 1929, *Kildale 8777* (DS-2 sheets); 5 mi N of Mendocino-Humboldt county line, S. Fork of Eel River, 9 Aug 1936, *Munz 14931* (UC); Humboldt Co. State Park, Eel River, 9 Jul 1923, *Peirson 3877* (UC); along S. Fork Eel River, 3-5 mi above its mouth, 23 Jul 1912, *Tracy 3797* (UC); near Garberville, along S. Fork Eel River, 9 Sep 1933, *Tracy 13076* (UC). Marin Co.: Pt. Reyes P.O., Jul 1903, *Elmer 4649* (DS,MO). Mendocino Co.: Red Mt., 15 Jul 1969, *Gankin et al. 2666* (CAS); along Eel River at Richardson (redwood) grove, 26 Jul 1924, *Heller 13887* (DS,MO); Hale's Camp, near Redwood Highway, 14 Jul 1931, *Jones 29145* (UC); Navarro River near Philo, 11 Jul 1909, *McMurphy 512* (DS); Red Mountain Creek Bluff, on S. Fork Eel River, 8 mi S of north county boundary, 7 Aug 1938, *Tracy 16100* (DS,UC). Napa Co.: near St. Helena Sanitarium, 2 Jul 1916, *Abrams 5750* (DS); Howell Mountain, Aug 1888, *T. Brandegee s.n.* (UC); Alta Loma Ranch, 7-14 Sep 1906, *Chandler 7134* (UC); Howell Mt., Napa River Basin, 1893, *Jepson s.n.* (JEPS); ridge SE of Mt. Veeder, 21 Aug 1951, *Raven 3867* (CAS). Solano Co.: Cordelia, 17 Aug 1920, *Campbell s.n.* (CAS); Stone Quarry Hill, Cordelia, 7 Aug 1901, *Jepson 1743* (JEPS). Sonoma Co.: near summit of Mt. Hood, 27 Jul 1948, *Baker 12079* (CAS); Hope Val at summit above Coleman's Ranch, near Kenwood, Aug 1950, *Baker 12309* (UC); Russian River, below Guerneville, 22 Jul 1896, *Davy 4147* (UC); Guerneville Park, 25 Jun 1909, *Hall 8518* (DS-2 sheets,MO,UC); Sonoma Creek Canyon near Kenwood Springs, 9 Oct 1932, *Howell 10811* (CAS); dry hills near Agua Caliente, 1 Aug 1933, *Jepson 16551* (JEPS); Duncan's Mills, 17 Jul 1882, *Jones 3620* (CAS,DS-2 sheets,MO,UC).

Plants of the northern segment of the range of *Erigeron biolettii* (Map 2) produce slightly broader leaves more densely arranged on the stems than those of the southern segment. The differentiation appears to be so slight, however, that there is no justification for applying more than a single name. Collections identified by Cronquist (1947) as *E. biolettii* from Tuolumne and Fresno counties are slightly glandular plants of *E. inornatus*.

Of the varieties of *Erigeron inornatus* maintained by Cronquist (1947), *E. biolettii* might be held at that rank more justifiably than the others. The few collections, however, that might be interpreted as intermediate between *E. inornatus* and *E. biolettii* (e.g., *Tracy 16100*) occur where they apparently are closely sympatric in a small area of northern Mendocino Co., in contrast to



Map 2. *Erigeron inornatus* and *E. biolettii*. The range of var. *inornatus* extends through Oregon into southcentral and southeastern Washington, and into immediately adjacent Nevada.

their otherwise relatively wide geographic ranges.

The stems and leaves of *Erigeron biolettii* are always glandular, but eglandular hairs range from absent to present in variable densities. The vestiture of plants of a few collections even appears to approach that of *E. petrophilus*, but the two species are distinct in habit. *Erigeron biolettii* is also similar to *E. angustatus* and partly sympatric with it, but the latter has linear leaves and is glabrous or nearly so.

4. *Erigeron blochmaniae* E. Greene

Erigeron blochmaniae E. Greene, Pittonia 3:25. 1896. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Santa Barbara Co., Santa Maria, beach and sand a few miles inland, "summer," *I.M. Blochman s.n.* (ND-G!). *Erigeron foliosus* Nutt. var. *blochmaniae* (E. Greene) H.M. Hall, Univ. Calif. Publ. Bot. 3:91. 1907. Greene cited no specimens in the original description, but the ND-G sheet selected fits the protologue and was marked "Type" by Greene.

Stems 4-8 dm tall, erect or usually ascending and caudexlike at the base (some labels note a "rhizomatous" habit). Stems and leaves densely and closely puberulous to villosulous with minute, stiffly crisped hairs. Leaves linear to narrowly oblanceolate, 1.5-3.0 cm long, 1-3 mm wide. Heads 9-14 mm wide; phyllaries densely glandular and densely canescent-hirsutulous, linear-lanceolate, with a broad orange middle area and thick, white lateral zones, the inner 4.5-6.0 mm long. Ray flowers 45-72, the corollas 8-11 mm long, drying white to blue. Disc corollas 4.6-5.0 mm long. Achenes 2.2-2.8 mm long; pappus bristles 21-36. Chromosome number, $n=9$ (Keil *et al.* 1988).

California endemic, Central Coast in San Luis Obispo and Santa Barbara cos. (Map 1); sand dunes and hills, 3-30 m; Jul-Oct.

Cronquist (1947) observed that this taxon might justifiably be treated as a separate species but kept it within *Erigeron foliosus* because of putative intergradation with var. *foliosus*. The specimens that may have been regarded as intermediates were perhaps those treated here as *E. foliosus* var. *franciscensis* Nesom (discussed further following the latter), which among the varieties of *E. foliosus* is most similar to *E. blochmaniae*, but these two taxa do not intergrade. *Erigeron blochmaniae* is restricted to the coastal sands of Santa Barbara and San Luis Obispo counties and is recognized particularly by its large heads, distinctive stem vestiture, and completely glabrous achenes.

5. *Erigeron breweri* A. Gray

Erigeron breweri A. Gray, Proc. Amer. Acad. Arts 6:541. 1865. LECTOTYPE (designated here): UNITED STATES. California: Mariposa Co.,

Yosemite Valley, 4000 ft, 1863, *W.H. Brewer 1651* (GH; Isolectotypes: UC!,US!; Probable isolectotypes: UC-2 sheets). Gray also cited in the protologue a collection from Nevada (*C.L. Anderson 94192*-GH). Cronquist (1947) cited only the Brewer collection but apparently saw only the US specimen.

Stems ascending-erect, 20-75 cm long, arising from slender, rhizomelike or caudexlike branches, usually densely invested (sparsely in var. *klamathensis*) with short, even length, spreading-deflexed hairs, eglandular. Leaves linear to narrowly oblanceolate or oblanceolate, entire, 5-40 mm long. Heads 8-15 mm wide, in a terminal cluster; phyllaries glandular, sometimes also with nonglandular hairs. Ray flowers 12-45, the corollas 4-7 mm, drying blue, less commonly white to pink. Disc corollas 3.5-6.0 mm long. Achenes 2.2-2.8 mm long; pappus bristles 22-46.

Key to the varieties of *E. breweri*

1. Phyllaries densely glandular, nonglandular hairs lacking or very sparse. (2)
1. Phyllaries slightly glandular to eglandular, with prominent nonglandular hairs. (4)
 2. Stems prostrate to procumbent or decumbent, 7-15 cm; leaves 5-12 mm long. var. *jacinteus*
 2. Stems commonly basally ascending but the upper portions erect, usually longer than 20 cm; leaves mostly longer than 15 mm. . (3)
3. Hairs of stems and leaves 0.1-0.2 mm long; inner phyllaries with green, *Aster*-like apical areas; stems arising from slender, fibrous rooted, rhizomelike bases, without a strongly developed woody root. . var. *breweri*
3. Hairs of stems and leaves 0.5-1.0 mm long; inner phyllaries with broad, white thickened margins, lacking a distinctly demarcated, green apical area; stems arising from slender but woody basal offsets, these from a strongly developed, woody root. var. *klamathensis*
 4. Stems 20-30 cm, distinctly wiry and brittle; phyllaries with long, thick based, stiffly spreading, translucent hairs, distinctly glandular as well. var. *porphyreticus*
 4. Stems (30-)40-75 cm, thickening toward the base, not wiry or brittle; phyllaries with short, white, ascending to appressed hairs, eglandular. (5)

- 5. Hairs of stems and phyllaries barely longer than broad; plants of Baja California Norte. var. *ensenadensis*
- 5. Hairs of stems and phyllaries longer; plants of California.(6)
 - 6. Phyllaries with thick based, ascending hairs, the hairs dense on the outermost, sharply reduced in density on the middle and inner. var. *covillei*
 - 6. Phyllaries with thin based, appressed-ascending hairs, the hairs gradually and slightly reduced in density from the outer toward the inner. var. *bisanctus*

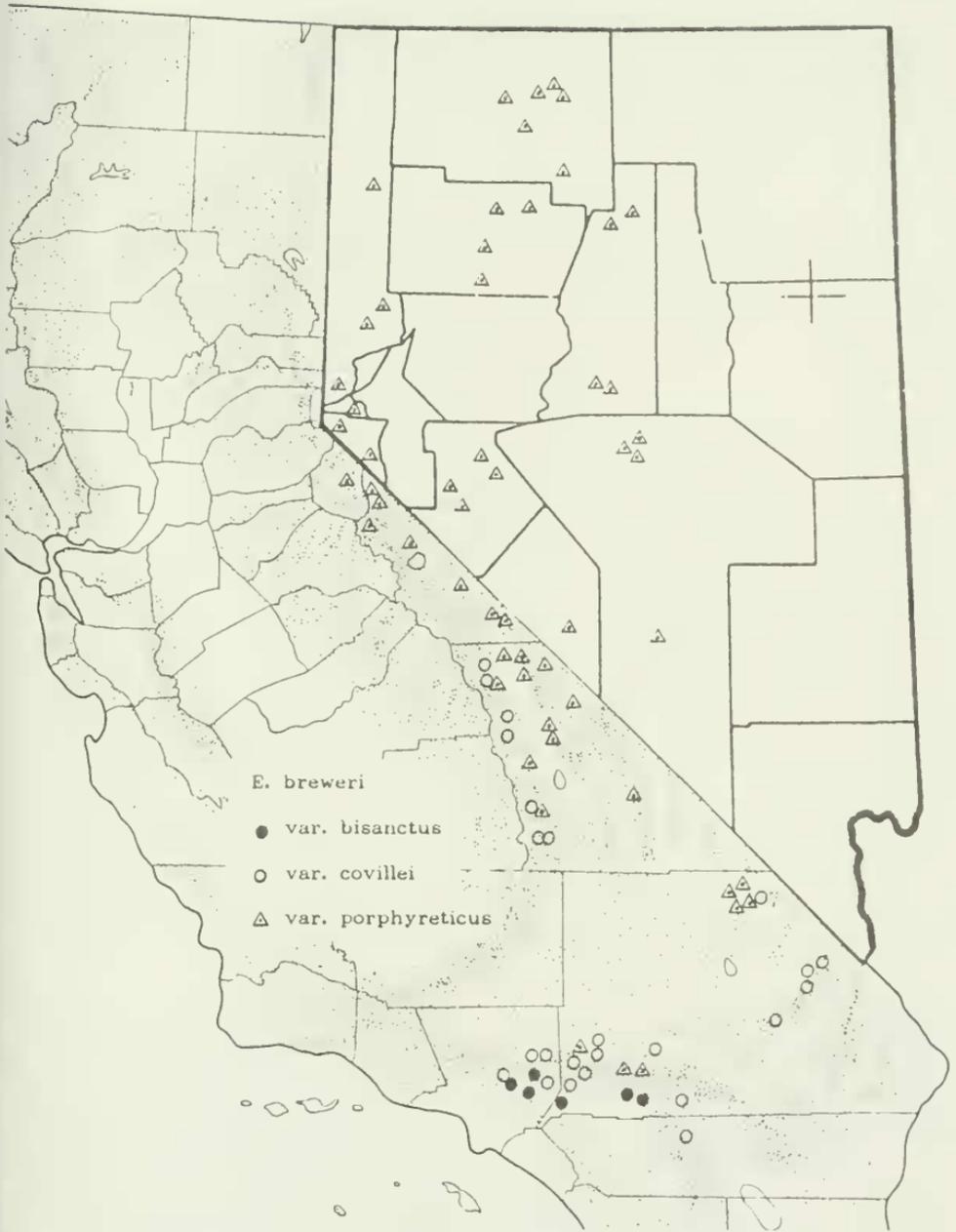
a. **Erigeron breweri** A. Gray var. *bisanctus* Nesom, var. nov. TYPE: UNITED STATES. California: Los Angeles Co., San Antonio Canyon near Claremont, 2 Aug 1903, *C.F. Baker 3451* (HOLOTYPE: LL!; Isotypes: CAS!, UC!). These specimens were distributed as a new species proposed by E.L. Greene, using the epithet "*antoninus*," which was apparently never validly published. An additional sheet of *Baker 3451* (CAS) bears a plant of *E. foliosus* var. *foliosus*.

Erigeronti breweri A. Gray var. *covillei* (E. Greene) Nesom similis sed phyllariis trichomatibus appressis ad basim tenuibus vestitis differt.

California endemic, San Gabriel and San Bernardino Mts. (Map 3); open, dry slopes and washes, 370-1520 m; May-Sep.

Additional collections examined: UNITED STATES. California: Los Angeles Co.: San Antonio Canyon, 2 Aug 1903, *Baker 3658* (LL, UC); San Dimas and San Gabriel Divide, Cucamonga Quad., 20 Sep 1935, *Horton 248* (UC); San Gabriel Canyon, 28 Jun 1892, *Hutchinson s.n.* (JEPS). San Bernardino Co.: 5 mi NE of Upland, 14 Jun 1927, *Blake 9867* (LL); E fork of the Santa Ana River, 3 mi below CA Hwy 38, 9 Jul 1974, *Helmkamp s.n.* (UCR); Santa Ana River, 28 Aug 1922, *Munz 6332* (UC-2 sheets); San Gabriel Mts., Big Dalton Canyon, chaparral, 10 Jun 1984, *Swinney s.n.* (UCR); 2 mi E of Claremont, 28 May 1933, *Wheeler 1748* (LL); Santa Ana River drainage, Forest Service Road 1N64, between the 2 forks of Deer Creek, 18 Jul 1990, *White s.n.* (TEX, UCR).

These plants have tall, thick, and relatively unbranched (until the capitulolescence, near the apex) stems similar to var. *covillei*, but the phyllaries are densely invested with thin based, appressed hairs distributed somewhat differently. The two apparently grow in close proximity (e.g., *Baker 3658* [MO] from the San Antonio Canyon, the type locality of var. *bisanctus*, is var. *covillei*).



Map 3. *Erigeron breweri* (var. *porphyreticus*, var. *covillei*, and var. *bisanctus*).

Some plants of *Erigeron foliosus* in the the same region have phyllaries with vestiture nearly identical to var. *bisanctus*, and seems probable that gene flow occurs between these two taxa.

b. *Erigeron breweri* A. Gray var. *breweri*

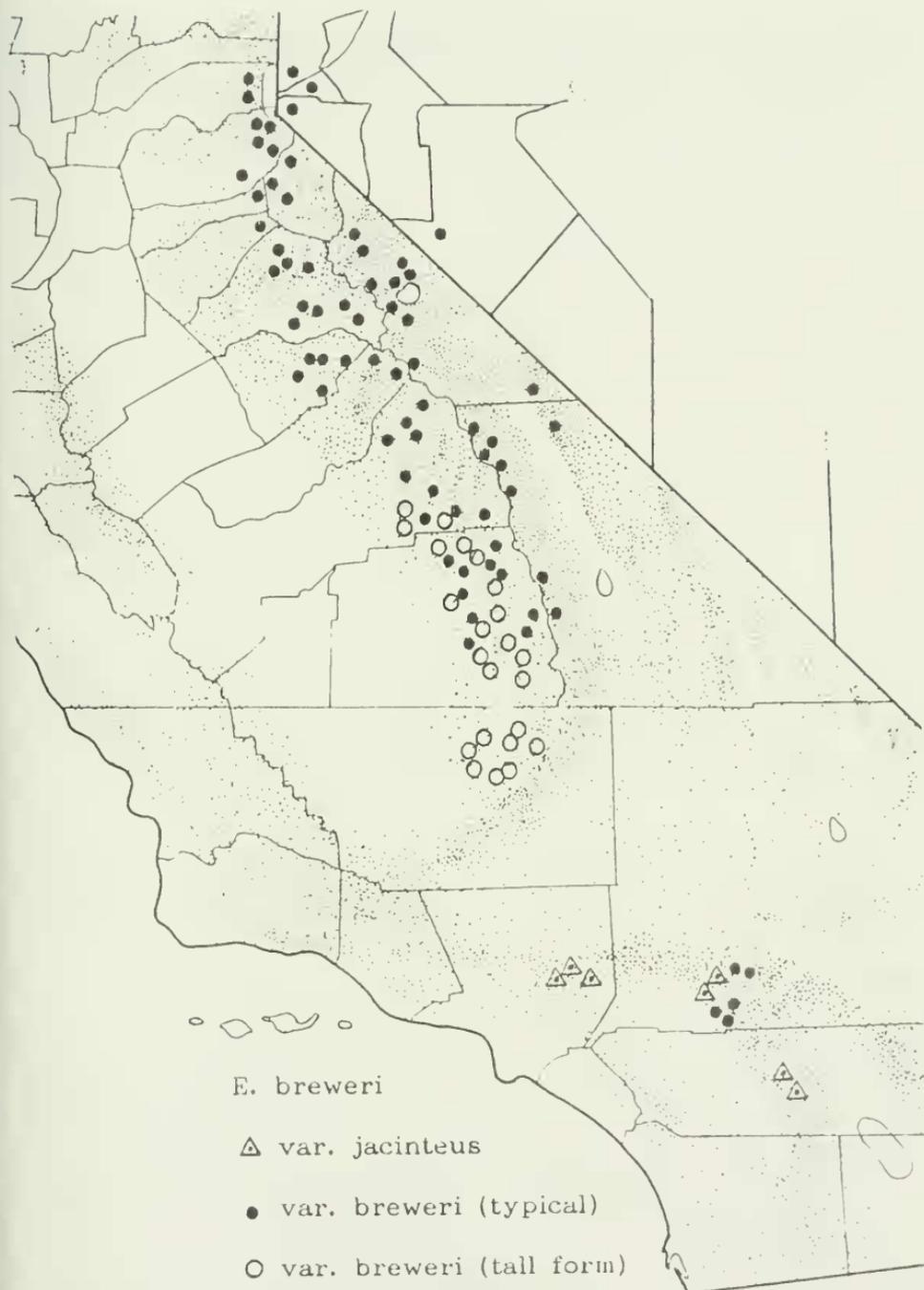
Chromosome number, $n=9$ (Solbrig *et al.* 1969; Semple *et al.* 1989).

California, northern to southern High Sierra Nevada, Nevada in the Lake Tahoe region, apparently disjunct in the San Bernardino Mts. (Map 4); open, rocky sites in a variety of vegetation types, (1220-)1800-2930(-3050) m; Jun-Sep.

As interpreted here, var. *breweri* has a discrete geographic distribution in the eastcentral Sierra Nevada, with an outlying segment to the southwest in the San Bernardino Mountains. It remains one of the most complex taxa of the section, deserving further study and perhaps ultimately better treated as two varieties rather than one. Plants of the typical form produce thin, woody rhizomes with relatively short (12-40 cm), ascending stems and the leaves are distinctly oblanceolate. In Fresno and Tulare cos., many of the plants produce thicker stem bases, taller (30-60 cm) and more erect stems, and more linear leaves; only the tall form is present at the southern extremity of the range in Kern Co. The two forms are mapped with different symbols (Map 4), although many of the determinations are arbitrary in Fresno and Tulare cos., where the intergradation seems to be gradual. The taller plants were included by Cronquist (1947) in var. *covillei*, but while they have its habit, perhaps reflecting the genetic influence of that variety, they produce the relatively shorter, merely glandular phyllaries distinctive of var. *breweri*. Further, their sierran habitats and range, together with their apparent complete intergradation with the typical form, make it difficult to virtually impossible to recognize more than a single taxon.

The plants identified as var. *breweri* from the San Bernardino Mountains are most like the typical form, apparently long disjunct from the main range. They apparently occur in several localities, but a number of collections have been made from along the South Fork of the Santa Ana River and in the vicinity of Bear Valley. A collection of typical var. *breweri* (CAS, on the label: Mt. Eddy, Jul 1880, *Lemmon s.n.*) is almost certainly mislabeled, as no other collection of that taxon has been made anywhere near Siskiyou County. This collection of var. *breweri* may have been made in the vicinity of Mt. Lassen (see additional comments following var. *klamathensis*).

- c. **Erigeron breweri** A. Gray var. *covillei* (E. Greene) Nesom, *comb. nov.*
BASIONYM: *Erigeron covillei* E. Greene, *Erythea* 3:20. 1895. LECTOTYPE (designated here): UNITED STATES. California: Inyo Co.,



Map 4. *Erigeron breweri* (var. *breweri* - the typical form and the "tall form" are mapped with different symbols - and var. *jacinteus*).

near Crystal Spring, Coso Mountains, 12 Jun 1891, *F.V. Coville & F. Funston 991* (ND-G!; Isolectotypes: UC-fragment [as cited by Cronquist 1947], US!). *Erigeron foliosus* Nutt. var. *covillei* (E. Greene) Compton, Bull. So. Calif. Acad. Sci. 33:51. 1934.

California endemic, eastern margin of the Sierra Nevada, Mojave Desert, San Gabriel Mts., San Bernardino Mts., San Jacinto Mts. (Map 3); open, rocky sites in sagebrush, chaparral, and juniper, 980-1830 m; May-Sep.

In the view of the present treatment, the dense, spreading-deflexed stem pubescence of these plants places them with *Erigeron breweri* rather than *E. foliosus*. Further, they are broadly sympatric with *E. foliosus* var. *foliosus* and few if any unequivocal intermediates have been seen. Two collections from the area of Independence in Inyo County, otherwise similar to var. *covillei*, are unusual in their *foliosus*-like, antrorsely appressed-ascending stem pubescence: *Raven 9946* (JEPS) and *Alexander & Kellogg 2974* (LL-3 sheets, MO,UC). Intergrades between var. *covillei* and *E. breweri* var. *breweri*, however, were noted by Cronquist (1947) as well as in the present study. Var. *covillei* is strictly a taxon of the Mojave Desert, forming a southern segment of the range of *E. breweri* (Map 3). It is clearly separated from the southern end of the range of var. *breweri*, but intermediates appear to occur with the "tall form" in the Independence Creek area of Inyo County. The possible influence of var. *covillei* on var. *breweri* is discussed following the latter. In addition, where the range of var. *covillei* meets that of var. *porphyreticus* in San Bernardino Co., there are apparent intermediates between them.

- d. *Erigeron breweri* A. Gray var. *ensenadensis* Nesom, var. nov. TYPE: MEXICO. Baja California Norte: Cañon 10 mi N of San Vicente, near Mpio. Ensenada, 3 May 1969, *D. Wilken & W. Werner 7432* (HOLOTYPE: UC!).

Differt a *Erigeronte breweri* A. Gray var. *covillei* (E. Greene) Nesom caulibus ac phyllariis scabridiusculis.

Northwestern Baja California Norte, México (not mapped); chaparral, desert scrub, ca. 150-300 m; May-Jul.

Additional collections examined: MEXICO. Baja California Norte: Guadalupe, 2 Jun 1893, *Brandege s.n.* (UC); ca. 7 mi N of Santo Tomás along road to Ensenada, 29 Jun 1962, *Wiggins & Thomas 415* (DS).

These plants are similar to those of var. *covillei*, but the hairs of the stems and phyllaries are extremely short, barely longer than broad, and they are long disjunct (ca. 120 miles) from the southernmost populations of var. *covillei* in Riverside Co., California.

- e. *Erigeron breweri* A. Gray var. *jacinteus* (H.M. Hall) Cronq., Brittonia 6:284. 1947. BASIONYM: *Erigeron jacinteus* H.M. Hall, Univ. Calif. Publ. Bot. 1:127. 1902. TYPE: UNITED STATES. California: Riverside Co., San Jacinto Mountains, rocky ridges and peaks near Tauquitz, 8826 ft, Jun 1901, *H.M. Hall 2322* (HOLOTYPE: UC!; Isotype: JEPS).

California endemic, San Jacinto, San Bernardino, and San Gabriel, Mts. (Map 4); open, rocky crests and slopes, 2680-2900 m; Jun-Sep.

Var. *jacinteus* is recognized by the dense vestiture of the stems and leaves, very small leaves, and short, nearly prostrate stems. It is very similar to var. *breweri*, but in the San Bernardino Mountains, where they both occur, var. *jacinteus* occurs at higher elevations (var. *breweri* is found at 1210-2580 meters). In a sense, var. *jacinteus* is related to the rest of *E. breweri* as *E. miser* A. Gray is to *E. petrophilus*; further study might show that var. *jacinteus* is distinct as a species and deserves coordinate taxonomic rank with *E. breweri*.

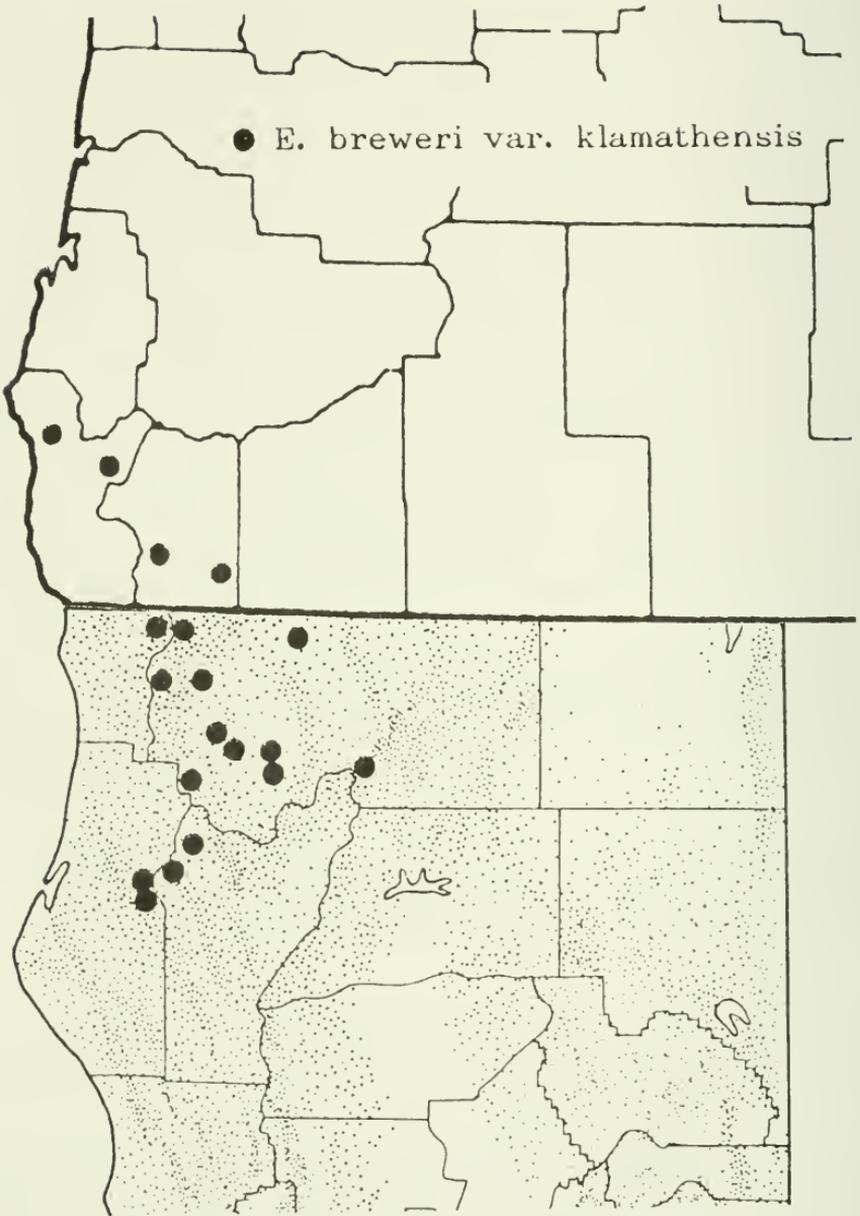
Five varieties of *Erigeron breweri* occur in the San Bernardino Mountains. These taxa appear to be altitudinally segregated, from highest to lowest as follows: var. *jacinteus*, var. *breweri*, var. *porphyreticus*, and var. *covillei* and var. *bisanctus*, the lowermost, which occur at roughly similar elevations.

- f. *Erigeron breweri* A. Gray var. *klamathensis* Nesom, var. nov. TYPE: UNITED STATES. California: Humboldt Co., Trinity Summit, 2 mi SE of Devil's Hole, exposed rocky points in woods, westerly exposure, 26 Jul 1935, *J.P. Tracy 15515* (HOLOTYPE: UC!; Isotypes: JEPS!, MO!, TEX!).

Differt a *Erigeronte folioso* Nutt. var. *confini* (Howell) Jeps. trichomatibus patentibus caulium ac foliorum, et foliis oblanceolatis brevioribusque. Differt a *Erigeronte breweri* A. Gray var. *breweri* radice lignea, trichomatibus longioribus, et phyllariis sine apicibus viridis.

California, primarily Klamath Ranges in Siskiyou, Trinity, and Shasta cos., adjacent Oregon in Curry and Josephine cos. (Map 5); open, rocky slopes, rock crevices, 1580-2140 m; Jun-Sep.

Additional collections examined: UNITED STATES. California: Del Norte-Siskiyou Co. line, Little Grayback, 14 Aug 1934, *Lee 1109* (UC). Humboldt Co.: Trinity Summit, 25 Sep 1919, *Tracy 5299* (UC); Trinity Summit at Water Dog Lakes, 26 Jul 1935, *Tracy 14271* (UC); Trinity Summit, Devil's Hole, 17 Jul 1932, *Tracy 10696* (UC). Siskiyou Co.: top of grade between Sawyer's Bar and Etna, 8 Sep 1948, *Alexander & Kellogg 5602* (UC); slopes SE of White Mt., 1 Jul 1961, *Dempster 1832* (UC); Baldy Mt., 13 Jul 1950, *Hoffman 3552* (UC); Marble Mts., Elk Mt., 6 Aug 1939, *Howell 15101* (CAS,LL); Devil's Backbone, 17 Jul 1902, *Jepson 2071* (JEPS), 22 Jul 1902, *Jepson 2101*



Map 5. *Erigeron breweri* var. *klamathensis*.

(JEPS); trail from English Lake to Hancock Lake toward Marble Mt., 19 Aug 1928, *Kildale 6527* (DS); at Del Norte Co. line, Little Grayback, 14 Aug 1934, *Lee 1109* (DS); Mt. Eddy, near Shasta, Jul 1880, *Lemmon s.n.* (UC); Salmon Mts., high lake basins, vicinity of English Peak, 19 Aug 1968, *Oettinger 588* (UC). Trinity Co.: Trinity Summit, near Ranger Station, 24 Jul 1935, *Tracy 14204* (DS,JEPS,MO,UC); Siskyou Mts., Rock Gulch off Jaynes Canyon, 6 Aug 1934, *Wheeler 3055* (DS-2 sheets, UCR). Oregon. Curry Co.: banks of Rogue River at Brushy Bar, 27 Apr 1947, *Baker 3819* (UC); Rocky Peak, 12 mi SE of Port Orford, 25 Jul 1919, *Peck 8932* (MO). Josephine Co.: Mt. Grayback, Siskyou Mts., 2 Aug 1935, *Tracy 12460* (MO); Baby Foot Lake area near Cave Junction, 23 Jul 1980, *Vale s.n.* (CAS).

These plants form the northernmost segment of the range of *Erigeron breweri*. Cronquist (1947) included a Lemmon collection of var. *klamathensis* (Shasta Co.: Lassen's Peak, 1870's, *Lemmon s.n.* [JEPS,UC]) in var. *breweri*, but he did not recognize *E. breweri* from any localities further north. It is likely that the label of these plants was interchanged with a collection by Lemmon (of typical var. *breweri*, said on the label to be from Mt. Eddy, but far out of range for that taxon).

Var. *klamathensis* is similar to var. *breweri* in its merely glandular phyllaries but more like var. *porphyreticus* in its strongly woody bases. The relatively sparse, stiffly hirsute vestiture of long hairs in var. *klamathensis* is not encountered in any of the other varieties of the species. Many collections of var. *klamathensis* have been identified previously as *E. foliosus* var. *confinis*, which usually is nearly glabrous to sparsely strigose and produces longer, linear leaves. Some plants of the two taxa, however, are very similar in habit, and they may prove to be closely related (see additional comments following var. *confinis*).

- g. *Erigeron breweri* A. Gray var. *porphyreticus* (M.E. Jones) Cronq., Brittonia 6:283. 1947. BASIONYM: *Erigeron porphyreticus* M.E. Jones, Contr. West. Bot. 8:33. 1898. TYPE: UNITED STATES. Nevada: Mineral Co., Hawthorne, Big Indian Canyon, 27 May 1897, *M.E. Jones s.n.* (HOLOTYPE: POM; Isotypes: MO,US!). *Erigeron foliosus* Nutt. var. *porphyreticus* (M.E. Jones) Compton, Bull. So. Calif. Acad. Sci. 33:53. 1934.

Erigeron petrocallis E. Greene, Erythea 3:21. 1895. LECTOTYPE (designated here): UNITED STATES. Nevada: Humboldt Co., West Humboldt Mountains, Jul 1894, *E.L. Greene s.n.* (ND-G!). A different collection by Greene has been annotated by previous workers as type material, but the specimen cited here is the only one that agrees with the protologue.

Chromosome number, $n=9$ (Montgomery & Yang 1960, the voucher apparently cultivated from "Rancho Santa Ana").

Western half of Nevada to the eastern edge of the Sierra Nevada in California, Mono Co. south into the Mojave Desert (Map 3); open, rocky sites in sagebrush to ponderosa pine, (1220-)1520-2530 m; May-Aug(-Sep).

Duplicates of a collection of typical *Erigeron breweri* var. *porphyreticus* were distributed and identified by Munz with the varietal name "roosii;" the specimens were marked as types, but the name apparently was never published.

Var. *porphyreticus* is similar to var. *breweri* in the production of slender, rhizomatous branches, spreading-deflexed stem vestiture, and blue ligules; it differs in its wirier stems, generally greater development of flowering branches, larger heads, and hirsute-hispid phyllaries with broad stramineous-indurated margins, lacking green, *Aster*-like tips. For the most part, the ranges of the two taxa are separate (Maps 3 and 4), but they are sympatric in Mono Co. and northern Inyo Co. and adjacent Nevada, as well as in the San Bernardino Mountains, and they appear to intergrade at least in Mono and Inyo cos. In the Kingston Range of San Bernardino Co., where numerous collections of *Erigeron breweri* have been made, most of the plants can be referred to var. *porphyreticus*, as identified here, but some have smaller heads and have relatively few nonglandular hairs. Were these not in populations of other typical var. *porphyreticus*, they would be best identified as var. *breweri*.

Some of the plants included here with var. *porphyreticus* (cited below) from San Bernardino Co. were identified by Cronquist (1947) as var. *covillei*. Var. *porphyreticus* in this southwestern portion of this county occurs at 1220-2440 meters elevation, higher for the most part than var. *covillei*.

Specimens of var. *porphyreticus* examined from southwestern San Bernardino Co.: San Bernardino Mts.: Bear Valley, 5 Aug 1902, *Abrams 2886* (UC), Jul 1909, *Davidson 2169* (JEPS); Bear Lake, 8 Jul 1931, *Clokey 5317* (UC); San Gorgonio Wilderness Area, Lower South Fork Meadow, 15 Aug 1976, *Davidson & Thorne 4716* (UC); Hesperia, 14 Jun 1895, *Parish 3603* (JEPS, UC-2 sheets).

6. *Erigeron elmeri* (E. Greene) E. Greene

Erigeron elmeri (E. Greene) E. Greene, *Fl. Franc.*, part IV, p. 393. 1897. BASIONYM: *Aster elmeri* E. Greene, *Pittonia* 2:170. 1891. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Tuolumne Co., Grand Canyon of the Tuolumne River, summer [1891, as on the label], *V. Chesnut & E. Drew s.n.* (ND-G!). *Erigeron breweri* A. Gray var. *elmeri* (E. Greene) Cronq., *Brittonia* 6:284. 1947. The protologue notes that the type collection was made in "summer 1890," but I have seen no other specimen that might be the one referred to by Greene, nor is

there any other such in ND-G (*vide* B. Hellenthal). Both the protologue and collection label note that the specimen was collected in the "Grand Canyon of the Tuolumne" by Chesnut & Drew, the only difference being that of one year in date. Although it is not annotated in any way, this is evidently the specimen that Cronquist (1947) referred to as the type, and his choice is accepted here. It seems most likely that either the label or the publication of *Aster elmeri* was inadvertently supplied with the wrong date.

Stems prostrate-ascending to nearly erect, 6-20 cm long, from slender, woody rhizomes or rhizomelike caudex branches. Stems and leaves eglandular, sparsely to moderately strigose with thin-based, closely appressed to ascending-appressed hairs. Leaves narrowly oblanceolate or oblong, 5-20 mm long, 1-2 mm wide. Heads 7-10 mm wide; phyllaries minutely glandular, without other vestiture, inner phyllaries 3.5-5.0 mm long, often purple-tipped. Ray flowers 12-21, the corollas 6-9 mm long, drying bluish. Disc corollas 3.5-4.0 mm long. Achenes 1.6-2.5 mm long; pappus bristles 18-26.

California endemic, central High Sierra Nevada (Map 1); ledges, crevices, cracks, talus, 1300-3300 m; Jun-Sep.

Erigeron elmeri is distinguished by its low habit with wiry, trailing to ascending stems, very small leaves, sparsely strigose vestiture, small heads, and pink to lavender ligules. It has been treated as a variety of *E. breweri* because of putative intergradation between the two, but the occurrence of intermediates has not been confirmed in the present study. In contrast, among the 30 separate collections of *E. elmeri* examined, only a single one has stem vestiture that might be considered to approach that of *E. breweri* (Lake Tenaya, Yosemite, *Eastwood 462-UC*). On some branches of this collection, the stem hairs are ascending-appressed; on others, there is a mixture of spreading and ascending hairs. This atypical variation may reflect an influx of genes from *E. breweri*, but the two taxa are sympatric and, with the possible exception of a few plants, they retain their integrity, providing convincing evidence of genetic isolation. A specimen cited by Cronquist as var. *elmeri* from Tulare Co. (*Hall & Babcock 5697-UC*), which has spreading stem pubescence, also is stipitate-glandular and clearly is a collection of *E. aequifolius*.

7. *Erigeron foliosus* Nutt.

Erigeron foliosus Nutt., Trans. Amer. Philos. Soc. 2, 7:309. 1840. TYPE: UNITED STATES. California: Santa Barbara Co., near Santa Barbara, [1836], *T. Nuttall s.n.* (Possible isotype: PH *vide* Cronquist 1947).

Stems 20-100 cm long, often arising from thin, rhizomelike or caudexlike branches, erect but commonly basally ascending, branched near the apex;

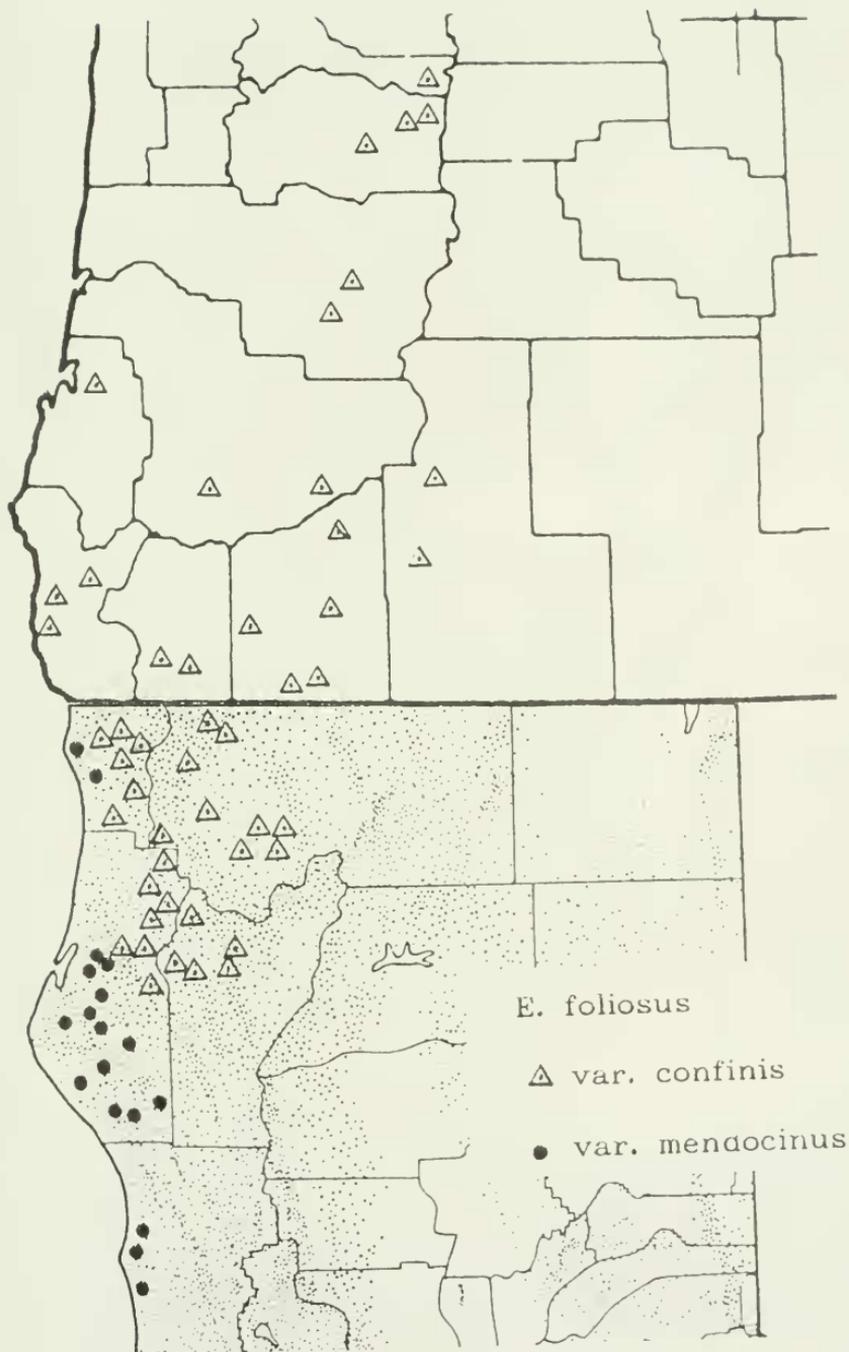
stems, leaves and phyllaries glabrate to sparsely invested with appressed hairs. Leaves linear to oblanceolate, entire, 10-65 mm long, 1-5(-10) mm wide. Heads 10-16 mm wide, in a loose terminal cluster, rarely solitary; phyllaries glabrous to moderately hairy, sometimes glandular. Ray flowers 15-60, the corollas 5-15 mm long, usually blue. Disc corollas 3.5-5.5 mm long. Achenes (1.8-)2.4-3.0 mm long; pappus bristles 20-34.

In the present treatment, *Erigeron foliosus* is distinguished from the other taxonomically complex, radiate species of the section, *E. breweri*, by its glabrate to sparsely strigose stems, as contrasted with the densely hispidulous stems of the latter. It is perhaps an oversimplified hypothesis, but the radiate *E. elmeri* and *E. oxyphyllus* are similar to *E. foliosus* in stem vestiture and may be most closely related to it.

The varieties of *Erigeron foliosus* are separated primarily by relatively small differences in vestiture. For the most part, the taxa are represented by a series of essentially allopatric population systems (Maps 6 and 7). Var. *mendocinus* (E. Greene) Nesom and var. *confinis* as well as var. *foliosus* and var. *franciscensis* have slightly overlapping or at least parapatric distributions and form intermediates in the areas where they meet.

Key to the varieties of *E. foliosus*

1. Phyllaries densely and prominently glandular, 0.8-1.0 mm wide, the margins usually with a broad scarious rim.(3)
1. Phyllaries eglandular or sparsely and obscurely glandular, 0.5-0.8 mm wide, the margins usually thick or with only a narrow scarious rim. (2)
 2. Leaves (3-)4-6 cm long usually with acute apices, often mostly oriented in one direction to one side of the stem; inner phyllaries (4.0-) 5.0-6.0 mm long. var. *hartwegii*
 2. Leaves 2-4(-5) cm long usually with rounded apices, without a prominent unidirectional orientation; inner phyllaries 3.2-4.5 mm long. var. *foliosus*
3. Phyllaries without eglandular hairs; leaves mostly 1-2 mm wide. var. *confinis*
3. Phyllaries moderately to densely strigose-hirsute; leaves mostly 2-4 mm wide.(4)
 4. Leaf lamina sparsely to moderately strigose; phyllaries with a prominent, raised, orange resinous midvein; ray corollas 7-10 mm long. var. *franciscensis*



Map 6. *Erigeron foliosus* (var. *mendocinus* and var. *confinis*).



Map 7. *Erigeron foliosus* (var. *foliosus*, var. *hartwegii*, and var. *franciscensis*). For var. *foliosus*, the broad leaved forms and narrow leaved forms are mapped separately to show their nearly complete sympatry; many of the symbols were assigned arbitrarily where intermediates in leaf width were involved. The range of var. *foliosus* extends into northwestern Baja California Norte.

4. Leaf lamina glabrous or glabrate, margins and midvein ascending ciliate; phyllaries usually without a distinct, orange resinous midvein; ray corollas 10-15 mm long. var. *mendocinus*

- a. *Erigeron foliosus* Nutt. var. *confinis* (Howell) Jeps., *Man. Fl. Pl. Calif.* 1056. 1925. BASIONYM: *Erigeron confinis* Howell, *Erythea* 3:35. 1895. LECTOTYPE (designated here): UNITED STATES. Oregon: Josephine Co., Siskyou Mts., near Waldo, Jul 1887, *T.J. Howell 1507* (WS; Isolectotypes: MO!, MI, NY, UC!, US!). The protologue says "On high rocky ridges of the S. Mts., July 1886" but specimens matching the locality description are "1887." The sheets so cited (Cronquist marked the MO and UC sheets as "isotype") were distributed by Howell with the unpublished epithet "siskyouensis."

Inner phyllaries 4.0-5.0 mm long. Ray corollas 9-12 mm long. Disc corollas 3.5-5.0 mm long.

Klamath Ranges of California and adjacent southwestern Oregon (Map 6); rocky sites, chaparral to fir woods, over a variety of soils but often on serpentine, (rarely to 15-)(150-)750-2000(-2200) m; May-Aug.

Plants of *Erigeron foliosus* var. *confinis* typically are low (1-2 dm tall), linear leaved, and have densely glandular phyllaries without other vestiture. There are apparent intermediates with var. *mendocinus* where their ranges meet, particularly in the region of the Smith River in Del Norte Co. and the Klamath River in Humboldt Co. Some plants identified as var. *confinis* are very similar in habit to *E. breweri* var. *klamathensis* (particularly in Siskyou and Trinity cos., e.g., *Tracy 19196-UC*), and the possibility of gene flow or very recent common ancestry between them should be investigated. The two taxa are sympatric over a considerable part of their ranges (Maps 5 and 6).

- b. *Erigeron foliosus* Nutt. var. *foliosus*

Erigeron stenophyllus Nutt., *J. Acad. Nat. Sci. Philad.* 2, 1 (Pl. Gamb.): 176. 1847. TYPE: UNITED STATES. California: Monterey Co., near Monterey, [1842], *W. Gambel s.n.* (Probable isotype: GH!); not Hook. & Arn. 1836; not A. Gray 1857; not D.C. Eaton 1871. *Erigeron foliosus* Nutt. var. *stenophyllus* (Nutt.) A. Gray, *Bot. Calif.* 330. 1876. *Erigeron nuttallii* Heller, *nom. nov.* *Bull. Torrey Bot. Club* 25:628. 1898.

Diplopappus occidentalis Hook. & Arn., *Bot. Beechey's Voy.*, Suppl. 350. 1839. TYPE: UNITED STATES. California: [ca. 1830], *D. Douglas s.n.* (not seen). *Erigeron douglasii* Torr. & Gray, *nom.*

nov., *Fl. N. Amer.* 2:177. 1841. Not *Erigeron occidentalis* Nutt., 1840. Torrey & Gray were unaware that *Erigeron foliosus* Nutt., the earliest available name for this species but which they treated as a "Species unknown to us," was the same as *Diplopappus occidentalis*. They indicated that they had seen the original specimen collected by Douglas. The identity of *E. occidentalis* Nutt. has not been ascertained, but with "very numerous, red" rays and "subserrulate" leaves, it clearly is not part of the *E. foliosus* group. Based on the description, albeit relatively generalized, and the information regarding the collecting localities of Douglas (Jepson 1933), it seems clear that the plants of his collection are *E. foliosus* var. *foliosus*, in the sense of the present study. Gray (*Synopt. Fl. N. Amer.* 1[2]:215. 1884) recognized the synonymy of *E. douglasii* with *E. foliosus*.

Erigeron foliosus Nutt. var. *tenuissimus* A. Gray, *Synopt. Fl. N. Amer.* 1(2):215. 1884. LECTOTYPE (designated here): MEXICO. Baja California Norte. Hanson's Ranch, 30 Jul 1883, *C.R. Orcutt 1000* (GH!; Isolectotype: UC!). In the original description, Gray's citation was "San Diego Co., on the Mexican border and within lower California, Parry, Palmer, Orcutt."

Erigeron tenuissimus E. Greene, *Pittonia* 3:25. 1896. LECTOTYPE (designated here): UNITED STATES. California: Ventura Co., near Ventura, Jun 1893, *Miss A. Symes s.n.* (ND-G!; Isolectotype: UC, as cited by Cronquist, but not located in the present study).

Erigeron striatus E. Greene, *Bull. So. Calif. Acad. Sci.* 1:39. 1902. LECTOTYPE (designated here): UNITED STATES. California: San Bernardino Co., Huston Flat, Transition Zone of the San Bernardino Mts., Aug 1900, *W.R. Shaw 36* (ND-G!; Isolectotype: DS!).

Erigeron setchellii Jeps., *Fl. W. Mid. Calif.* (ed. 1) 568. 1901. LECTOTYPE (designated here): UNITED STATES. California: [San Joaquin Co.], "arid plains of the Lower San Joaquin" [somewhere between Mossdale (near present day Manteca) and Oakdale], 27 Jun 1896, *W.A. Setchell & W.L. Jepson s.n.* (JEPS!; Isolectotype: JEPS!). Locality information from Jepson's field notebook was supplied by Mrs. A.Q. Howard.

Erigeron fragilis E. Greene, *Bull. So. Calif. Acad. Sci.* 1:39. 1902. LECTOTYPE (designated here): UNITED STATES. California: Orange Co., Trabuco Canyon, 16 Jun 1901, *L. Abrams 1801* (ND-G!; Isolectotype: DS!).

Erigeron foliosus Nutt. forma *grinnellii* Cronq., *Brittonia* 6:279. 1947. TYPE: UNITED STATES. California: Los Angeles Co., Mt. Wilson, 4 Jul 1904, *F. Grinnell s.n.* (HOLOTYPE: CAS!).

Inner phyllaries 3.2-4.5 mm long. Ray flowers 15-49, 6-10 mm long. Disc corollas 3.5-4.0(-5.0) mm long. Chromosome number, $n=9$ (Semple 1985; Strother 1972; Solbrig *et al.* 1964; Raven *et al.* 1960).

California, widespread in the southwestern part of the state, adjacent Baja California Norte, México (Map 7); dry, open, rocky or grassy slopes, chaparral, oak to pine or pine-fir woodlands, (40-)300-2250(-2900) m; May-Aug(-Sep).

Plants of *Erigeron foliosus* with linear leaves (var. *stenophyllus*) have traditionally been separated from those with much broader, oblanceolate leaves (var. *foliosus*), but when confronted with a large number of specimens, the correspondingly large number of intermediates and the nearly exact congruence of the geographic ranges of the two putative varieties makes it impossible to separate them in an unarbitrary taxonomy. In the view here, var. *foliosus* comprises a series of plants with leaves varying from filiform to oblanceolate and broadly oblanceolate (the latter in extreme form in forma *grinnellii*).

The habit of *Erigeron foliosus* var. *foliosus* is somewhat variable, but it is most commonly similar to that of *E. breweri* var. *covillei*, with stems basally ascending and gradually thickened towards the base. Complete root systems have been collected only rarely. Some plants identified here as var. *foliosus*, particularly in Tulare and Kern counties (e.g., S. Fork King's River, *Jepson 773A-JEPS*), have stems densely invested with minute, slightly spreading-ascending hairs and phyllaries densely glandular. These may have originated as hybrids between var. *foliosus* and *Erigeron breweri*. See other comments following var. *franciscensis* regarding variability in var. *foliosus*.

- c. ***Erigeron foliosus* Nutt. var. *franciscensis* Nesom, var. nov.** TYPE: UNITED STATES. California: San Mateo Co., Lake Merced, Jun 1908, *K. Brandegee s.n.* (HOLOTYPE: UC!).

A *Erigeronte folioso* Nutt. var. *folioso* phyllariis longioribus glandulosis sed trichomatibus non glandulosis densioribus.

Inner phyllaries (4.0-)5.0-6.0 mm long. Ray flowers 28-48, 7-10 mm long. Disc corollas 4.5-5.0 mm long.

California endemic, primarily the San Francisco Bay Area (Map 7); grassy dunes, chaparral, oak woodlands, 2-800 m; May-Oct.

Representative collections examined: UNITED STATES. California: Alameda Co.: Oakland, 9 Jul 1881, *Jones 2374* (CAS,DS); 25 mi N of Cedar Mts, 13 Oct 1929, *Mason 5511* (UC). Contra Costa Co.: Mount Diablo, Inner Black Hills E of the meridian, 5 Sep 1932, *Bowerman 1550* (UC); hills between Antioch and Marsh Creek, 16 Jan 1907, *K. Brandegee s.n.* (UC); Walnut Creek, 20 Jun 1892, *Greene s.n.* (UC). Marin Co.: San Francisco, Jul 1908, *K. Brandegee s.n.* (UC-2 sheets); near Chinese Camp, 25 Jun 1944,

Howell 19663 (CAS,UC); Tiburon Peninsula, Paradise Drive, 2.4 mi NW of road to Naval Net Depot, 29 Jun 1961, *Penalosa 1871* (CAS,UC). Monterey Co., Pajaro Hills, Jun-Jul 1899, *Chandler 437* (UC); Pt. Lobos, 6 Aug 1912, *Eastwood 1568* (CAS); mt. above Carmel Valley, 7 Jul 1962, *Howitt 1874* (CAS). San Joaquin Co., Lower San Joaquin River, 27 Jun 1896, *Jepson s.n.* (JEPS). San Mateo Co.: N end of Sawyer Ridge, San Francisco Watershed Reserve, 23 Jul 1983, *Buck 448* (UC); Belmont, 17 Jun 1893, *Davy 804* (UC); near Searsville Dam, 14 Jun 1895, *Dudley s.n.* (DS); E-W canyon draining into Lake Merced, just N of the San Francisco Golf and Country Club golf course, 17 Jul 1950, *Raven 2608* (CAS,UC). Santa Clara Co.: Saratoga, Sep 1893, *Davy 329* (UC); Black Mountain, Jul 1903, *Elmer 4589* (CAS,DS,MO,UC). Santa Cruz Co.: Bear Creek Canyon, ca. 4 mi from Boulder Creek, 6 Aug 1953, *Hesse 1178* (JEPS); Empire Grade, Ben Lomond Mt., 15 Jul 1953, *Thomas 3479* (DS,JEPS). Solano Co., S end of basalt hill at Thomasson, 16 Jun 1937, *Jepson 18415* (JEPS). Stanislaus Co., Oakdale, 30 Jun 1896, *Jepson s.n.* (JEPS).

Var. *franciscensis* is closely similar to var. *foliosus*, but for the most part the two taxa are geographically well separated. A few collections that technically would be identified as var. *franciscensis* are well within the range of var. *foliosus* (e.g., Los Angeles Co., Leona, *Michener & Bioletti s.n.*-UC; San Luis Obispo Co., Paso Robles country, *Blochman s.n.*-UC); other scattered collections identified and mapped as var. *foliosus* have densely glandular phyllaries, but the phyllaries are shorter (3.2-4.5 mm long vs. [4.0-]5.0-6.0 mm long in var. *franciscensis*), generally more sparsely invested with non glandular hairs, without prominently scarious margins, and the plants appear to be closely linked to the variability in others of more typical morphology. The two varieties appear to be sympatric in northern Monterey County, and intermediates occur there.

In both var. *foliosus* and var. *franciscensis*, the midvein of each phyllary is prominently raised and orange-resinous, but the midvein is low and barely discernible as orange in var. *mendocinus*; in var. *hartwegii* and var. *confinis* it is more variable, sometimes prominently orange, but often not.

- d. *Erigeron foliosus* Nutt. var. *hartwegii* (E. Greene) Jeps., *Man. Fl. Pl. Calif.* 1056. 1925. BASIONYM: *Erigeron hartwegii* E. Greene, *Erythea* 3:21. 1895. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Locality and date unspecified, *K.T. Hartweg 350* (NY!; Isolectotype: GH!). In the original description, Greene noted that this taxon had been "first collected by Hartweg, afterwards by Fremont, Bigelow, and by the present writer." Bentham (*Pl. Hartweg.* 316. 1849.) earlier had identified this same collection as *E. decumbens* Nutt. The notation "*Hartweg 1774*" denotes the number of sequential listing in *Plantae*

Hartwegianae rather than the collection number.

Erigeron blasdalei E. Greene, *Erythea* 3:124. 1895. LECTOTYPE (designated here): UNITED STATES. California: Calaveras Co., dry rocky soil, Stanislaus River near McCormic's Bridge, 10 Jun 1895, *W.C. Blasdale s.n.* (UC!; Probable isolectotype: ND-G!). The latter specimen is marked only as "*Erigeron blasdalei*," but the plants match those on the UC sheet.

Inner phyllaries (4-)5-6 mm long. Ray flowers 26-50, 8-13 mm long. Disc corollas 4.0-5.5 mm long.

California endemic, north and central Sierra Nevada Foothills (Map 7); rocky sites, commonly along rivers, hills in oak or pine-oak woodlands, 100-600 m; Apr-Jul.

Var. *hartwegii* has a geographically discrete distribution and the plants are very constant in morphology. Further comments are given following *Erigeron mariposanus* Congdon.

e. *Erigeron foliosus* Nutt. var. *mendocinus* (E. Greene) Nesom, *comb. et stat. nov.* BASIONYM: *Erigeron mendocinus* E. Greene, *Leafl. Bot. Obs. Crit.* 2:9. 1909. LECTOTYPE (designated here): UNITED STATES. California: Mendocino Co., Big River, Jul 1903, *J. McMurphy 353* (CAS!). Only a single collection was noted in the protologue, but its place of deposition was not specified.

Inner phyllaries 5.0-6.5 mm long. Ray flowers 25-48, 10-15 mm long. Disc corollas 3.8-5.0 mm long.

California endemic, North Coast Ranges (Map 6); bars, banks, and ledges along rivers, dry slopes, 30-750 m; May-Aug.

Representative collections examined: UNITED STATES. California: Del Norte Co.: Smith River near Myrtle Creek, 24 Jun 1938, *Parks & Tracy 11458* (UC); Smith River near Van Deventer Ranch, 29 Jun 1938, *Van Deventer 127* (JEPS). Humboldt Co.: Van Duzen River, mouth of Grizzly Creek, 11 Jul 1916, *Abrams 6055* (DS,LL,UC); Mad River, 10 Jul 1888, *Chesnut & Drew s.n.* (UC); South Fork Eel River, Upper Look Prairie, 29 May 1934, *Constance 720* (JEPS); near Alder Point, 22 Jun 1937, *Eastwood & Howell 4731* (CAS); Junction, E of Arcata, 16 Jul 1931, *Jones 29149* (MO,UC); near Ettersburg, 25 Jun 1927, *Kildale 3585* (DS); Bridgeville, 23 Jul 1928, *Kildale 5694* (DS); near Hydesville, bluffs along Van Duzen River, 2 Aug 1901, *Tracy 1241* (UC); Grasshopper Ridge, head of Canoe Creek, 4 Sep 1916, *Tracy 4756* (UC); Mad River gravel bar at Essex, 11 Jun 1924, *Tracy 6695* (UC); Bull Creek to Mattole Road, near ridge summit, 4 Jul 1930, *Tracy 8829* (DS,JEPS,LL,UC); Trinity River near Willow Creek, 17 May 1931, *Tracy 9433* (UC); Garberville, 18 Jul

1942, *Tracy 17284* (UC); Blue Slide on Van Duzen River, 24 Jul 1951, *Tracy 19625* (UC). Mendocino Co.: near Mendocino, May 1898, *Brown 786* (MO); Fort Bragg, 1914, *Mathews s.n.* (JEPS); Fort Bragg, 8 Jul 1933, *Stahelin s.n.* (UC).

These plants have been previously identified, for the most part, as *Erigeron foliosus* var. *hartwegii*, but the two are geographically and morphologically distinct.

8. *Erigeron inornatus* (A. Gray) A. Gray

Erigeron inornatus (A. Gray) A. Gray, Proc. Amer. Acad. Arts 16:88. 1881.

BASIONYM: *Erigeron foliosus* Nutt. var. *inornatus* A. Gray, *Bot. Calif.* 1:330. 1876. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Mendocino Co., Eel River, hot, sunny slopes, 1868-69, *A. Kellogg & Harford 347* (GH!; Isolectotypes: MO!, NY, US!).

Stems 2-7(-9) dm long, branched near the apex, basally decumbent but quickly erect, arising from a woody taproot, at least the upper portions glabrous. Leaves narrowly oblong-oblancheolate, (1-)2-6 cm long, 2-7 mm wide, the lamina glabrous or sparsely strigose, the lower usually with short, upcurved hairs, margins sparsely and widely ciliate with short, upturned hairs. Heads 7-12 mm wide, 5-many in a terminal, flat topped cluster; phyllaries glabrous, rarely minutely glandular, with broad, stramineous lateral areas and a thin, orange midvein, the inner 4.5-5.5 mm long. Ray flowers absent. Disc corollas 3.8-4.5 mm long. Achenes 2.0-3.0 mm long; pappus of 28-45(-60) bristles.

Key to the varieties of *E. inornatus*

1. Upper stems densely hirsutulous with slightly deflexed hairs, sometimes densely invested with strigose ascending hairs. var. *keilii*
1. Upper stems usually sparsely strigose to glabrous. (2)
 2. Stems 10-20 cm long, decumbent-ascending, with spreading-deflexed hairs below the middle, appressed above the middle; middle and lower leaves with hispid lamina and margins with stiff, spreading cilia; inner phyllaries 5.0-6.5 mm long. var. *calidipetris*
 2. Stems 30-70(-90) cm long, basally ascending, the upper portions erect, with appressed hairs below the middle; middle and lower leaves with short strigose lamina and eciliate margins; inner phyllaries 4.5-5.5 mm long. var. *inornatus*

a. *Erigeron inornatus* (A. Gray) A. Gray var. *inornatus*

Erigeron douglasii Torr. & Gray var. *eradiatus* A. Gray, *Pac. R.R. Rep.* 12(2):52. 1860. TYPE: UNITED STATES. Washington. [Yakima Co.,] sandy pine forest on the tableland east of Mount Adams, J.G. Cooper s.n. (not seen). *Erigeron eradiatus* (A. Gray) Piper, *Contr. U.S. Natl. Herb.* 11:568. 1906.

Erigeron inornatus (A. Gray) A. Gray forma *subradiatus* S.F. Blake, *J. Washington Acad. Sci.* 19:270. 1921. TYPE: UNITED STATES. California: Placer Co., Tahoe Tavern, 1900 m, 15 Aug 1927, S.F. Blake 10302 (HOLOTYPE: US!; Isotypes: GH-2 sheets!, LL-2 sheets!).

Erigeron inornatus (A. Gray) A. Gray forma *pseudoradiatus* S.F. Blake, *J. Washington Acad. Sci.* 28:487. 1938. TYPE: UNITED STATES. Nevada: Washoe Co., public campground, Mt. Rose, 7 mi W of Reno Hot Springs, 1700 m, 12 Jul 1937, W.A. Archer 5580 (HOLOTYPE: US!; Isotype: LL!).

Chromosome number, $n=9$ (Semple 1985; Strother 1983; Anderson *et al.* 1974; Raven *et al.* 1960).

Widespread in northern California (Map 2), to Oregon, southern Washington, and westcentral Nevada in Douglas, Ormsby, and Washoe cos.; chaparral to oak, pine, or pine-fir woods, (150-)750-2300 m but mostly 1050-1900 m; Jun-Sep(-Oct).

Erigeron inornatus has traditionally included varietal taxa recognized as *E. angustatus*, *E. biolettii*, *E. reductus*, and *E. petrophilus* in the present treatment. *Erigeron petrophilus* is broadly sympatric with *E. inornatus* (Maps 2 and 8), and *E. angustatus* is geographically and morphologically distinct. Some intermediates apparently are formed between *E. inornatus* and both *E. biolettii* and *E. reductus* (see the latter two for further comments).

Erigeron inornatus has the geographic widest range of all the taxa included here in sect. *Linearifolii*, and typical plants (with glabrous stems, leaves, and phyllaries) occur over its whole range. Plants with minutely glandular phyllaries, however, occur sporadically through the range and are within normal variability for the species. Some of the atypical variation in the species occurs in the sierra of eastcentral California and adjacent Nevada. As noted by Cronquist (1947), some plants there produce phyllaries and uppermost cauline surfaces that are slightly glandular as well as phyllaries and stems that are sparsely hirsutulous or minutely strigose (*e.g.*, Tuolumne Co., Congdon s.n.; Placer Co., Yates 5996; Washoe Co., Archer 5595). The origin of this variation is not clear, but such plants are best placed in *E. inornatus*. Further comments on these plants are given following *E. inornatus* var. *keilii*.

From the vicinity of Mt. Rose, near Reno in Washoe Co., Nevada, a collection of plants with very small ligules produced from hermaphroditic flowers

with abortive stamens has been named *Erigeron inornatus* forma *pseudoradiatus*. Cronquist (1947) regarded forma *pseudoradiatus* as a hybrid between typically radiate *E. breweri* and typically rayless *E. inornatus*, both of which also are known from the vicinity. Two other collections of more or less the same morphological form also were made at about the same time (*Archer 6401*-with longer, apparently normal rays, and *6402*) from the same area (Galena Creek), although each of these collections apparently represents a different biotype. It would be useful and interesting to reassemble (primarily from DS,RENO, and UC) a set of collections from this area (mostly near Galena Creek) and to evaluate them in more detail, in conjunction with field studies. Among these collections are numerous atypical plants that can be identified most closely as *E. breweri* var. *porphyreticus* and *E. inornatus* var. *inornatus*: *Archer 5580*, *5592*, *5595*, *6400*, *6401*, *6402*, and *Lehenbauer 890*. *Erigeron inornatus* forma *subradiatus*, a similar variant, was collected in adjacent California (Placer Co.).

Erigeron inornatus occurs in the area of Donner Lake, the type locality of *E. miser*, and a plant collected from there by E.L. Greene (Aug 1883-MO) has features that suggest it may be a hybrid between *E. inornatus* and *E. miser*.

- b. ***Erigeron inornatus*** (A. Gray) A. Gray var. ***calidipetris*** Nesom, var. nov. TYPE: UNITED STATES. California: Siskyou Co., Porcupine Lake (a small vernal depression in an indurate lava flow), T41N, R3E, Section 10, 4280 ft, moist margin of pond at high water mark, set in *Abies concolor*-*Pinus ponderosa* forest, 6 Aug 1987, *D.W. Taylor 9241* (HOLOTYPE: UC!).

Differt a *Erigeronte inornato* (A. Gray) A. Gray typico caulibus brevioribus decumbentibusque trichomatibus patentibus, foliis inferioribus laminis hispidis ac marginibus ciliatis, et phyllariis longioribus.

California endemic, Modoc Plateau and eastern margin of the Cascade Ranges, in Modoc, Siskyou, and Shasta cos., apparently disjunct to northern Butte Co. (Map 2); sandy habitats, commonly in pine or pine-oak woodlands, ca. 1100-1400 m; Jun-Aug.

Additional collections examined: UNITED STATES. California: Butte Co.: Jonesville, 6 Aug 1930, *Copeland 490* (CAS,DS,MO). Modoc Co., sandy flat in lava beds, no other data, 1893, *M.S. Baker s.n.* (JEPS). Siskyou Co.: McCloud, 21 Jun 1923, *Bethel s.n.* (CAS); Fowler Camp, McCloud River, 28 Jun 1938, *Dearing 2179* (CAS); toward Black Fox, 15 Aug 1899, *Dudley s.n.* (DS); Bigelow's, McCloud River, 25 Jul 1921, *Eastwood 10809* (CAS). Shasta Co.: 3-4 mi E of McCloud and Bartle on Hwy 89, knob cone and yellow pine association, loose sandy soil, 10 Aug 1941, *Ferris & Lorraine 10493a* (CAS,DS).

Var. *calidipetris* is different from typical *Erigeron inornatus* in vestiture and habit and has a more limited geographical range compared to the typical variety. At least in the area of McCloud, the two taxa appear to be sympatric, and the collection from Butte County is well within the range of var. *inornatus*. Ferris & Lorraine 10493 may have been collected in Siskiyou County rather than Shasta, but the label says Shasta Co. With more detailed study, var. *calidipetris* may prove to deserve rank as a species. Further comments are given following *E. petrophilus* var. *viscidulus* (A. Gray) Nesom, to which it may be closely related.

- c. *Erigeron inornatus* (A. Gray) A. Gray var. *keilii* Nesom, var. nov.
 TYPE: UNITED STATES. California: Tulare Co., ca. 3.5 mi from Balch Park, Sequoia National Forest, dry slope with incense cedar and *Arctostaphylos*, 31 Jul 1950, R.S. Ferris & L. Lorraine 12349 (HOLOTYPE: DS!; Isotypes: CAS!, UC!).

A *Erigeronte breweri* A. Gray var. *breweri* floribus radii carentibus praecipue differt; a *E. inornato* (A. Gray) A. Gray caulibus dense minute hispidulis et phyllariis dense brevistrigosis vel glandulosus differt.

California endemic, southern Sierra Nevada Foothills of Fresno and Tulare cos. (Map 2); dry, grassy slopes and meadows, areas of conifer woodlands, 1200-2200 m; Jun-Sep.

Additional collections examined: UNITED STATES. California: Fresno Co.: Sequoia Mills, 19 Jul 1892, *Brandegee s.n.* (UC); W edge of Lake Hume, 19 Jul 1961, *Breedlove 798* (DS); Bubb's Creek, S. Fork of King's River, 1-13 Jul 1899, *Eastwood s.n.* (CAS); grade to King's River Canyon from General Grant Natl. Park, 26 Jul 1942, *Ferris & Lorraine 10832* (DS); Tehipite Valley, 6-10 Jul 1900, *Hall & Chandler 486* (DS, MO); King's River Canyon, jct of Middle and S. Fork, 29 Jun 1940, *Rose 40676* (DS). Tulare Co.: NE of Springville along Bear Creek Road, Mountain Home State Forest, Methuselah Group Campground to vicinity of Dogwood Meadow, 2 Aug 1986, *Keil 19713-B* (TEX); NE of Springville along Bear Creek Road, Mountain Home State Forest, Methuselah Group Campground; montane mixed conifer forest around meadow, 25 Jul 1991, *Keil 19662* (OBI, TEX).

The collections of *Erigeron inornatus* var. *keilii* have been made from a relatively small area of Fresno and Tulare counties, near the southernmost extension of the geographic range of *E. inornatus*. Var. *keilii* is taxonomically positioned with the latter primarily because of its rayless heads, but in its dense, typically spreading stem vestiture, it is more like the plants of *E. breweri* with which it is sympatric. The rayless plants might justifiably be treated as a variety of *E. breweri* on the basis of their vestiture, but among

other taxa within sect. *Linearifolii*, the absence of ray flowers is indicative of differentiation between species.

The plants of var. *keilii* were first called to my attention by the recent collections of Dr. David Keil of California Polytechnic State University. According to Dr. Keil's collection data, the plants of 19713-B (rayless) were collected from a mixed population with both rayless and purple rayed forms (*Keil 19713-A*, radiate; identified here as the "tall form" of *E. breweri* var. *breweri*), although most populations in the area comprised only rayless forms. Variation in the presence or absence of ray flowers was not noted in the data of the other collections of var. *keilii*.

The stem vestiture of var. *keilii* is dense and composed of minute, spreading hairs that vary from slightly deflexed to ascending. Among the specimens of var. *keilii*, the stem hairs are ascending on *Hall & Chandler 486*, *Ferris & Lorraine 10832*, and *Rose 40676*; the others have spreading to slightly deflexed hairs. The phyllaries are densely short strigose and eglandular on *Ferris & Lorraine 10832*, *Rose 40676*, and the type, while the phyllaries are glandular without other hairs on *Hall & Chandler 486*, *Breedlove 798*, *Eastwood s.n.*, and *Brandegee s.n.*

Plants with strigose, eglandular phyllaries are designated here as typical var. *keilii*, with the hypothesis that those with merely glandular, *Erigeron breweri*-like ones have acquired these features through gene flow with *E. breweri*. The *E. breweri*-like stem vestiture also supports such an hypothesis, as does the mixed population of radiate/eradiate plants noted by Keil. Additionally, plants in a collection of radiate *E. breweri* sympatric with var. *keilii* in the vicinity of Hume Lake in Fresno Co. (17 Jul 1948, *Rose 48214-CAS*) produce densely strigose-hispidulous phyllaries similar to those of var. *keilii*, suggesting that the gene flow may be reciprocal. Further north, however, where var. *inornatus* is more common and sympatric with var. *breweri*, similar hybrids have not been collected (see notes, however, following *E. inornatus* on possible hybrids from westcentral Nevada referred to by Blake as *E. inornatus* var. *pseudoradiatus*). Occasional variants of typical *E. inornatus* var. *inornatus* from further north may produce a lightly strigose vestiture on stems and phyllaries but none with hairs so dense as var. *keilii*.

9. *Erigeron mariposanus*

Erigeron mariposanus Congdon, *Erythea* 7:185. 1900. LECTOTYPE (designated here): UNITED STATES. California: Mariposa Co., Mariposa, 16 Jul 1899, *I. W. Congdon s.n.* (UC!; Isolectotype: DS!). Congdon cited only one collection from the single date but did not specify its place of deposition.

Stems 15-28 cm long, decumbent-ascending, sometimes branched near the

apex, sometimes arising from short (1-4 cm). thin, rhizomelike or caudexlike branches; stems, leaves, and phyllaries sparsely to moderately strigose with loosely appressed hairs, eglandular. Leaves oblanceolate, entire, (25-)30-45 mm long, (2-)5-8 mm wide, reduced in size near the heads, axillary tufts of small leaves prominent at most nodes. Heads 8-12 mm wide, solitary or 2-3 on pedicels 15-20 mm long; inner phyllaries 4.0-5.0 mm long, 0.8-1.0 mm wide, with broad, scarious, nearly winglike margins, the outer phyllaries sparsely strigose with thin based hairs, with a prominent orange resinous midvein. Ray flowers 18-22, the corollas 7-9 mm long, bluish. Disc corollas 4.0-4.5 mm long. Achenes ca. 2.0-2.4 mm long; pappus bristles 28-32.

California endemic, central Sierra Nevada Foothills in Mariposa County (Map 9); habitat unknown, ca. 600-800 m; Jun-Aug.

Additional collections examined: UNITED STATES. California: Mariposa Co., Mariposa: *Congdon s.n.* 30 Jun 1892 (UC, on sheet with 16 Jul 1900); *Congdon s.n.* 9 Aug 1892 (DS); *Congdon s.n.* 19 Jun 1900 (UC on sheet with lectotype); *Congdon s.n.* 16 Jul 1900 (UC, on sheet with 30 Jun 1892).

These are very distinctive plants represented by several collections other than the type (over eight years, all made by Congdon). All are from "Mariposa," with no other collection data, but the present city of Mariposa is located at the southernmost margin of the range of *Erigeron foliosus* var. *hartwegii*. *Erigeron mariposanus* previously has been treated as a synonym of var. *hartwegii*, but the two are extremely different in morphology, the former immediately and most easily distinguished from var. *hartwegii* as well as all other varieties of *E. foliosus* by its short stems, short, broadly oblanceolate leaves, tufts of axillary leaves produced at most nodes, and inner phyllaries with broad, scarious margins. Details of contrast between var. *hartwegii* and *E. mariposanus* are provided in the following couplet.

1. Stems 30-85 cm long, without axillary tufts of small leaves; leaves narrowly oblanceolate to linear lanceolate, 35-80 mm long, 1-2(-4) mm wide, 17-40 times longer than wide; phyllaries without prominent scarious margins; ray flowers 26-50. *E. foliosus* var. *hartwegii*
1. Stems 15-20 cm long, axillary tufts of small leaves produced at most nodes; leaves oblanceolate, (25-)30-45 mm long, (2-)5-8 mm wide (at widest point), the lower and middle 5-9(-12) times longer than wide; inner phyllaries with prominent, broad, scarious margins; ray flowers 18-22. *E. mariposanus*

It may be suspected that *Erigeron mariposanus* occurs in some specialized habitat and that it may now even be extinct. In any case, the formal taxonomic recognition of these plants should stimulate an attempt to relocate the population and determine its present status.

9. *Erigeron miser* A. Gray

Erigeron miser A. Gray, Proc. Amer. Acad. Arts 13:372. 1878. LECTOTYPE (designated here): UNITED STATES. California: [Placer Co.], crevices of rocks at Donner Lake, 14 Oct 1874, *E.L. Greene 466* (GH!). Gray also cited a collection from the summit of Mt. Stanford made in Sep 1877 by *Lemmon, Gray, and Hooker*; this specimen is mounted on the same sheet as *Greene 466*.

Stems decumbent-ascending to ascending-erect, 5-25 cm long, slender, woody, and caudexlike basally, arising from a woody root, the stems and leaves villous with stiff, white hairs, also minutely glandular. Leaves narrowly obovate, 7-16 mm long, 1.0-3.5 mm wide. Heads 7-12 mm wide; phyllaries densely granular-glandular, without other vestiture, the inner (3.5-)4.0-5.0 mm long. Ray flowers absent. Disc corollas 3.2-4.5 mm long. Achenes 2.0-2.5 mm long; pappus bristles 18-25(-28).

California endemic, northern High Sierra Nevada (Map 8); talus, rock crevices, 1950-2290 m; Jul-Oct.

See comments following *Erigeron petrophilus* and *E. inornatus*.

10. *Erigeron oxyphyllus* E. Greene

Erigeron oxyphyllus E. Greene, Erythea 3:20. 1895. LECTOTYPE (designated here): UNITED STATES. Arizona, Mohave Co., Yucca, May 1884, *M.E. Jones s.n.* (US!; Isolectotype: PH).

Stems shiny glabrous, 5-25 dm tall, sharply ascending basally from short, caudexlike branches, numerous, arising from a thick woody taproot. Leaves sparsely and minutely strigose, eglandular, filiform to linear oblanceolate, 0.5-1.0(-2.0) mm wide, the lower 2-5(-10) cm long, quickly reduced in length upwards, widely separated and not at all overlapping. Heads 7-12 mm wide, mostly solitary on long, bracteate peduncles, less commonly the peduncles shorter and the heads in loose clusters of 2-3; phyllaries granular-glandular, without other vestiture or the outer sometimes sparsely and minutely strigose, the inner 4-5(-6) mm long, with (1-)3 orange veins. Ray flowers 12-27(-40), the corollas 6-9 mm long, drying bluish. Disc corollas 3.0-4.0 mm long. Achenes ca. 2.0 mm long, with 2-4(-5) orange-resinous nerves; pappus bristles 17-25. Chromosome number, $n=9$ (Pinkava & Keil 1977).

Southern Arizona in Maricopa, Mohave, Pinal, and Yuma cos., adjacent northwestern Sonora, México (not mapped); rocky hillsides around seeps or by streams, often with *Acacia-Yucca-Coleogyne*, 700-1100 m; (Feb-)May-Jun, Oct-Nov.

This species was included by Nesom (1989) in *Erigeron* sect. *Spinosi* (Alexander) Nesom & Sundberg on the basis of its putatively close relationship with

Map 8. *Erigeron petrophilus* and *E. miser*.

E. ortegae S.F. Blake (= *Aster spinosus* Benth.). The latter species has now been segregated as the monotypic genus *Chloracantha* Nesom *et al.*, apparently more closely related to the genus *Boltonia* L'Herit. and even *Heterotheca* Cass. than to either *Erigeron* L. or *Aster* L. (Nesom *et al.* 1991). The position of *E. byei* Sundberg & Nesom, which was also included in this section, remains equivocal (Sundberg & Nesom 1990) but apparently it is not close to *E. oxyphyllus*.

Cronquist (1947) did not recognize the close relationship of *Erigeron oxyphyllus* to the *E. foliosus* group but suggested instead a relationship with *E. arenarioides* (A. Gray) Rydb. The latter, however, produces persistent basal leaves and caudex branches with densely clustered, persistent petiole bases and its ray corollas do not coil at maturity; it has been placed with one other species in *Erigeron* sect. *Arenarioides* (Rydb.) Nesom (Nesom 1989).

Among the other taxa of sect. *Linearifolii*, *Erigeron oxyphyllus* is most similar in habit and vestiture to *E. serpentinus*, but each of these probably has been independently derived from the ancestral stock that produced the widespread and variable *E. foliosus*. *Erigeron oxyphyllus* differs from all other species of the section in its cauline leaves that are sharply reduced in length upwards, and it is geographically set apart as well from the rest of the *E. foliosus* group.

11. *Erigeron petrophilus* E. Greene

Erigeron petrophilus E. Greene, Pittonia 1:218. 1888. LECTOTYPE (designated here): UNITED STATES. California: Contra Costa Co., high rocks above Wild Cat Creek, near Berkeley, Aug 1887, *E.L. Greene s.n.* (ND-G!; Isolectotype: US!). Among several collections of this species at ND-G, all identified by Greene, this sheet is the earliest one collected. It is likely that the date of "1881" cited in the protologue resulted from a typographical error for "1887." Cronquist (1947) suggested that this collection might be the type but he cited only the US sheet.

Stems decumbent-ascending, sometimes described as "sprawling," mostly 1-2 dm long, (up to 3 dm and nearly erect in Monterey Co.), from rhizome-like bases, at least the upper stems and leaves glandular (eglandular or very sparsely glandular in var. *viscidulus*, see comments below), sparsely to densely villous with loose, thin, white hairs. Leaves narrowly oblong to oblanceolate, 10-25 mm long, 1-5 mm wide, usually with long, spreading cilia along the proximal margins. Heads 8-12 mm wide, (1-)2-5(-10) in a definite corymb produced at the branch apex; phyllaries glandular, uncommonly with a few, spreading nonglandular hairs, the inner 5.5-7.0(-8.0) mm long, the apices sometimes purple, sometimes loose. Ray flowers absent. Disc corollas 4-6 mm long. Achenes (2.0-)2.5-3.0 mm long; pappus of 22-30(-35) bristles.

Erigeron petrophilus is distinguished by its ascending stems arising from distinct, fibrous rooted, rhizomelike bases, its few headed but generally compact, corymboid capitulescences, absence of ray flowers, and by its distinctive vestiture. Vars. *petrophilus* and *sierrensis* Nesom produce a densely glandular vestiture, and at least the stems are invested with loose, white, spreading, nonglandular hairs variable in density.

The observations by Cronquist (1947) regarding the distinction between *Erigeron petrophilus* and *E. miser* remain generally justifiable. *Erigeron miser* is a narrow endemic at high elevations, in contrast to the relatively wide geographic distribution at lower elevations of *E. petrophilus*. The former is distinguished morphologically primarily by its smaller heads, but there are also overlapping differences in leaf size, disc corolla length, shape of the style appendages, and the number of pappus bristles. *Erigeron miser* might also be treated as taxonomically coordinate with the three varieties of *E. petrophilus*, particularly as it terminates the eastern "arm" of the distribution of *E. petrophilus*, where it is situated as a fourth, closely related, allopatric population system (Map 8).

Key to the varieties of *E. petrophilus*

1. Stems and leaves eglandular or very obscurely glandular, the eglandular hairs mostly stiff, straight or curved. var. *viscidulus*
1. Stems and leaves densely glandular, the eglandular hairs usually loose, often crinkly. (2)
 2. Phyllaries with a distinctly expanded, purplish area at the apex. var. *petrophilus*
 2. Phyllary apices not purplish and differently colored from the lower portion. var. *sierrensis*

a. *Erigeron petrophilus* E. Greene var. *petrophilus*

Chromosome number, $n=9$ (Strother 1983, reported as *E. miser*).

California endemic, South to North Coast Ranges, San Francisco Bay area (Map 8); rocky slopes, crevices, and talus, (530-)690-2100 m; May-Sep.

Some of the plants from the southernmost area of the range of var. *petrophilus*, particularly in Monterey and Santa Cruz counties, produce atypically tall and erect stems and are superficially similar to *E. biolettii*, but most others in the same area are shorter. A few collections are densely glandular but completely lack eglandular hairs (e.g., Marin Co., Elmer 4649-CAS; San

Benito Co., *Eastwood 6743*-CAS); these are superficially like *E. biolettii*, but they produce relatively short stems, and small heads and leaves, and clearly belong with *E. petrophilus*.

- b. ***Erigeron petrophilus*** E. Greene var. *sierrensis* Nesom, var. nov. TYPE: UNITED STATES. California: Yuba Co., Peterson Ridge Road, ca. 4 mi SE of Challenge, yellow pine forest, dry, red, rocky soil, 1000 m, 10 Aug 1983, *L. Ahart 4272* (HOLOTYPE: TEX!; Isotype: MO!).

Differt a *Erigeronte petrophilo* E. Greene var. *petrophilo* praecipue phyllariis absque apicibus purpuratis et habitationibus in sierris.

California endemic, northern Sierra Nevada Foothills (Map 8); ledges, other rocky sites in areas of pine and pine oak woods, most commonly on serpentine, 360-1910 m; Jul-Aug.

Additional collections examined: UNITED STATES. California: Butte Co.: Forbestown Res., ca. 5 mi NE of Forbestown, 24 Jul 1983, *Ahart 4206* (MO,TEX); near Pulga, 26 Jun 1951, *Howell 27525* (CAS); 2 mi W of Pulga, 19 Aug 1951, *Howell 28161* (CAS). El Dorado Co.: Junction Dam, W of Union Valley Reservoir, 20 Jul 1968, *Stebbins 6805* (CAS); foot of Jaybird Falls, above Jaybird Power House on canyon of Silver Creek, 20 Jul 1968, *Stebbins 6820* (CAS). Plumas Co.: Jamison Creek, 27 Jun 1951, *Howell 27625* (CAS); ca. 20 mi SW of Quincy, 1/4 mi E of Frenchman Hill, 27 Sep 1980, *Taylor et al. 3346A* (MO); Red Hill Lookout, ca. 3 air mi NE of Belden, 25 Aug 1981, *Taylor 4238* (MO); Rocky Point, head of No Ear Bar Trail, Middle Fork Feather River, among rocks in red clay, yellow pine forest with *Quercus kelloggii*, 21 Jul 1955, *Weatherby 1650* (UC).

- c. ***Erigeron petrophilus*** E. Greene var. *viscidulus* (A. Gray) Nesom, comb. nov. BASIONYM: *Erigeron inornatus* (A. Gray) A. Gray var. *viscidulus* A. Gray, *Syn. Fl.* 1(2):215. 1884. LECTOTYPE (designated here): UNITED STATES. California: [Siskyou Co.?], mountains about the headwaters of the Sacramento River, 1 Sep 1882, *C.G. Pringle 250* [or *14579*] (GH!; Isolectotypes: MO!,US). *Erigeron viscidulus* (A. Gray) E. Greene, *Pittonia* 1:174. 1888. Cronquist (1947) selected the Pringle collection over another syntype (*Kellogg & Harford s.n.*), but he did not choose between the GH and US specimens.

Erigeron decumbens Eastw., Bot. Gaz. (Crawfordsville) 41:290. 1906; not Nutt. 1840. TYPE: UNITED STATES. California: Siskyou Co., Mt. Eddy, 1400 m, 17 Aug 1903, *E.B. Copeland s.n.* (HOLOTYPE: CAS!).

Klamath Ranges of California and immediately adjacent Oregon (Map 8); open, rocky slopes, ledges, talus, sometimes on serpentine, 1490-2650 m; Jul-Sep.

Representative collections examined: UNITED STATES. California: Trinity Co.: Lower Canyon Lake, 5 Aug 1948, *Alexander 5400* (UC); summit of Scott Mtn., 2 Sep 1958, *Bacigalupi 6857* (JEPS); near top of Granite Peak, 8 Aug 1926, *Baker 267a* (UC); Trinity Alps, above Ward Lake, 19 Aug 1966, *Ferlatte 450* (JEPS); Siligo Peak-Summit Lake area, Dear Creek Pass, 16 Aug 1974, *Ferlatte 1660* (JEPS); summits near Dorleska, Jul 1909, *Hall 8588* (UC); Potato Mt., W slope, 2 Aug 1935, *Tracy 14497* (UC); Devil's Canyon Mts., head of White's Creek, 6 Aug 1935, *Tracy 14579* (JEPS,UC). Siskiyou Co.: near Toad, S Siskiyou County, 12 Aug 1911, *Alexander & Kellogg 307* (UC); Mt. Eddy, 30 Aug 1912, *Eastwood 2034* (UC); E side of Mt. Eddy, 28 Aug 1914, *Heller 11737* (UC); Scott Mts., Blue Point near Scott Mt. Public Campground, 8-9 Aug 1953, *Kellogg 123* (UC); side of Mt. Shasta, Jul [no year], *Lemmon s.n.* (UC); Caribou Lake, Salmon-Trinity Alps Primitive Area, 27 Jul 1955, *Wiggins 13560* (UC). Oregon: Jackson Co.: Mt. Ashland, S of Ashland, 29 Jun 1986, *Ertter 6457* (MO,UC); serpentine slopes of Red Mt., Siskiyou Mts., 29 Jul 1935, *Thompson 12374* (CAS,MO,UC).

A collection of typical var. *viscidulus* by J.G. Lemmon (s.n. - JEPS,UC) from "Sierra Valley" is almost certainly mislabeled if the locality is meant to be from Sierra County.

The cauline vestiture of var. *viscidulus* is variable, comprising stiff hairs that primarily are spreading to slightly deflexed hairs but that vary to antrorsely appressed. Plants of this taxon with spreading vestiture were included by Cronquist (1947) within *Erigeron petrophilus*, and some (especially in Trinity Co.) even approach typical *E. petrophilus* in the length, looseness, and density of the nonglandular hairs, although none produce the corresponding dense glandularity. Plants with ascending stem hairs, including the lectotypic Pringle collection, were maintained by Cronquist as *E. inornatus* var. *viscidulus*. Part of the origin of the appressed stem hairs is perhaps found in the area of Scott Mountain (Trinity Co.), where apparent intermediates between var. *viscidulus* and *E. reductus* var. *reductus* occur. These plants seem to grade into typical var. *viscidulus* (with spreading vestiture). However, among numerous collections examined from Mt. Eddy (Siskiyou Co.), well away from known populations of *E. reductus*, are plants with spreading stem hairs as well as others with appressed hairs. The morphology of such plants of var. *viscidulus* approaches that of *E. inornatus* and probably has provided the basis for considering the two taxa conspecific. The two, however, are sympatric and occur in generally the same kinds of habitats. While they are best regarded as separate species, it is possible that gene flow is occurring between them. Further, the variability accepted here within var. *viscidulus* leaves open the possibility that it may be polyphyletic in origin.

12. *Erigeron reductus* (Cronq.) Nesom

Erigeron reductus (Cronq.) Nesom, *comb. et stat. nov.* BASIONYM: *Erigeron inornatus* (A. Gray) A. Gray var. *reductus* Cronq., Brittonia 6:288. 1947. TYPE: UNITED STATES. California: Placer Co., on rocks, Yuba River near Cisco, 5600 ft, Transition Zone, 3 Jul 1910, H.M. Hall 8741 (HOLOTYPE: UC!; Isotype: US!).

Stems 8-20(-30) cm tall, basally erect or ascending, few, arising from long, slender, rhizomelike caudex branches, glabrous. Leaves linear, 8-25(-35) mm long, 0.5-1.0(-1.5) mm wide, glabrous or sparsely strigose on the lamina, the margins prominently ascending ciliate with thin based hairs. Heads 8-10 mm wide, solitary or 2-4 on short peduncles; phyllaries minutely but prominently granular-glandular, without other hairs, the inner 4.0-6.0 mm long. Ray flowers absent. Disc corollas 3.5-4.5 mm long. Achenes 2.2-2.8 mm long; pappus bristles 20-61.

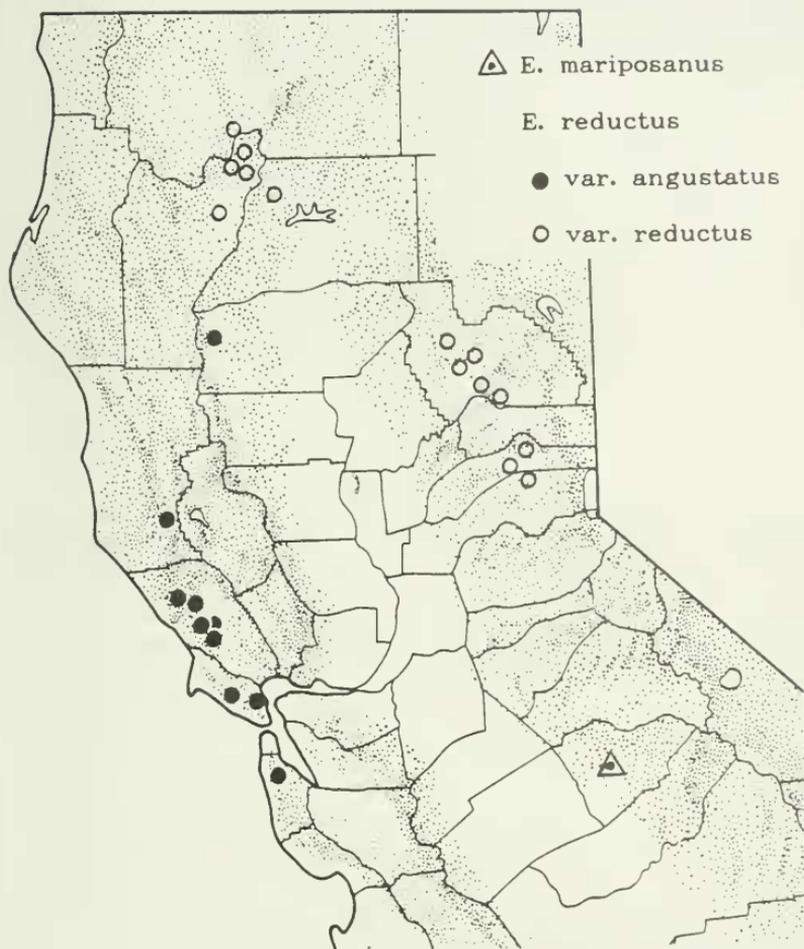
Erigeron reductus is composed of two allopatric but very similar entities united by their distinctive habit, highly reduced vestiture, and rayless heads. Both taxa have previously been treated as varieties of *E. inornatus*, but there is evidence that *E. inornatus* and var. *reductus* intergrade in Trinity Co. (see comments below). Cronquist (1947) also recognized var. *reductus* and var. *angustatus* as most closely related to each other, although his concept of the latter was broader than that here (see comment below). As treated here, *E. reductus* has a geographic distribution similar to that of *E. petrophilus*, forming a northern "hook" around the Sacramento Valley (Map 9).

Key to the varieties of *E. reductus*

1. Phyllary apices purplish (variably so in the Tamalpais region); pappus bristles (38-)46-61.var. *angustatus*
1. Phyllary apices greenish; pappus bristles 20-30.var. *reductus*

a. *Erigeron reductus* (Cronq.) Nesom var. *angustatus* (A. Gray) Nesom

Erigeron reductus (Cronq.) Nesom var. *angustatus* (A. Gray) Nesom, *comb. nov.* BASIONYM: *Erigeron inornatus* (A. Gray) A. Gray var. *angustatus* A. Gray, *Syn. Fl.* 1(2):215. 1884. LECTOTYPE (Cronquist 1947): UNITED STATES. California: Mendocino Co., Red Mountain, 2 Jul 1869, A. Kellogg & Harford 399 (GH!; Isolectotype: US!). Cronquist noted that the CAS sheet of Kellogg & Harford 399 bears a specimen of *E. biolettii*. In the original description, Gray also cited "Greene, Napa Co." (Greene's no. 339 at GH), but this is *E. angustatus*, the species.

Map 9. *Erigeron reductus* and *E. mariposanus*.

California endemic, San Francisco Bay area, Outer and High North Coast Ranges (Map 9); rocky sites, commonly on serpentine, often in pine or pine-oak woods, 600-1360 m; Jun-Aug.

Specimens examined: UNITED STATES. California: Marin Co.: Carson Ridge summit at head of Big Carson Canyon, 16 Jul 1943, *Bacigalupi 2772* (DS); Westpoint Road, Tamalpais, Jul 1907, *K. Brandegee s.n.* (UC); Mt. Tamalpais, 2 Aug 1896, *Eastwood s.n.* (JEPS,UC), Sep 1898, *Eastwood s.n.* (UC), 29 Jul 1912, *Eastwood 1518* (CAS,MO,UC); burned area S of Barth's Retreat, Mt. Tamalpais, 7 Jul 1946, *Howell 22197* (CAS,DS,UC); N end of Tiburon Peninsula, above Vista de la Bahia, 18 Jun 1972, *Howell 48875* (CAS); El Campo, Jul 1891, *Michener & Bioletti 1139a* (ND-G); S side of Mt. Tamalpais, 14 Jul 1913, *Suksdorf 538* (MO). Mendocino Co.: Little Red Mt., 6 Aug 1932, *Tracy 10306* (JEPS,UC), 7 Aug 1932, *Tracy 10316* (UC); Little Red Mt., 6 Aug 1932, *Jepson 16504* (JEPS) and *16502* (JEPS); Red Mt. near Ukiah, 24 Jul 1909, *McMurphy s.n.* (DS); Red Mt. N, 1 Jul 1982, *Smith & Wheeler 7563* (CAS) and *7576* (CAS). San Mateo Co.: Crystal Springs Lake, 9 Nov 1930, *Howell s.n.* (CAS). Sonoma Co.: 3 mi N of Occidental on Bohemian Hwy, 5 Jun 1981, *Best s.n.* (CAS); Monte Rio, Aug 1920, *Campbell s.n.* (CAS); Pepperwood Ranch, Franz Valley Road, 6 Jun 1981, *DeNevers 1451* (CAS); Pepperwood Ranch, Dentist's Lake, 20 Jun 1981, *DeNevers 1634* (CAS); 2 mi E of Occidental, 5 Jul 1946, *Mason & Grant 12898* (DS); unnamed ridge on W side of Dry Creek Valley. N of Crane Creek, S of Bradford Mt., 30 Jun 1985, *Raiche 50565* (CAS). Tehama Co.: serpentine slope on NW side of Tedoc Mt., 17 Jun 1972, *Heckard 2962* (JEPS).

In Cronquist's view (1947), this taxon included *Erigeron angustatus* and was subsumed as a variety of *E. inornatus*. *Erigeron angustatus* (the species) is different in habit from *E. reductus* and has a narrower geographic range.

b. *Erigeron reductus* (Cronq.) Nesom var. *reductus*

California endemic, southern Klamath Ranges, northern High Sierra Nevada (Map 9); crevices and open, rocky sites, commonly on serpentine, 760-1940 (-2360) m; Jun-Aug.

Specimens examined: UNITED STATES. California: Nevada Co.: 5.6 mi E of Emigrant Gap on US Hwy 40, 30 Jun 1940, *Beach 800* (CAS,JEPS,LL,UC); above Meadow Lake, 7 Aug 1892, *Sonne 5* (UC, on sheet with *E. miser*). Plumas Co.: slopes of Mt. Elwell above Long Lake, 10 Jul 1927, *Bacigalupi 1688* (DS); Feather River region, Summit Peak above Round Lake, 15 Jul 1920, *Head s.n.* (CAS); Feather River region, Lake Center Camp, 15 Jul 1921, *Head s.n.* (CAS); Jamison Lake, 5 Sep 1932, *Rose 32621* (CAS). Shasta Co.: Lamoine, 16 Jul 1910, *Blankinship s.n.* (JEPS). Siskiyou Co.: Trinity Mts., road to Mumbo Basin, just below summit, 29 Jul 1967, *McClintock s.n.* (CAS).

Trinity Co.: 2 mi S of Scott Mtn Forest Camp, on Scott Mtn. Road, 3 Aug 1955, *Barbe 336* (UC); N of Coffee Creek, 16 Aug 1988, *Dean 175* (UC); SW of Peanut, 17 Jul 1955, *Howell 30701* (CAS); 1 mi S of Scott Mt. Summit, 20 Jul 1949, *Keck 6377* (DS-2 sheets); head of Rush Creek, 20 Jul 1914, *Yates 541* (JEPS).

In Trinity County, plants of some collections of *Erigeron reductus* appear to vary toward *E. inornatus* (and vice versa), but identifications can generally be made on the basis of the habit. The stems of *E. reductus* usually arise singly from slender, rhizomelike caudex branches, while the stems of *E. inornatus* are more numerous and arise from a woodier base, which is rarely collected. The plants in the northern segment of var. *reductus* range somewhat taller than typical, perhaps reflecting genetic input from *E. inornatus*.

13. *Erigeron serpentinus* Nesom

Erigeron serpentinus Nesom, *sp. nov.* TYPE: UNITED STATES. California: Sonoma Co., Layton Mine, Austin Creek, serpentine soil, 30 May 1947, *F.W. Hoffman 558* (HOLOTYPE: UC!).

Differt a *Erigeronte angustato* E. Greene floribus radii carentibus et capitulis minoribus. Differt a *Erigeronte folioso* Nutt. var. *franciscensi* Nesom ac var. *mendocino* (E. Greene) Nesom caulibus numerosis ad apicem radice statim orientibus, caulibus ac foliis glabris, et floribus radii paucioribus.

Stems 4-5 dm tall, erect, numerous, arising directly from the crown atop a woody taproot. Stems and leaves mostly glabrous, leaves sparsely ascending ciliate with thin based hairs. Leaves linear, 2-4 cm long, 0.6-0.8 mm wide. Heads 9-12 mm wide; phyllaries minutely granular-glandular, with very few, minute, appressed non-glandular hairs, the inner 4.5-5.0 mm long. Ray flowers 9-13, the corollas 7-8 mm long, 1.5-2.5 mm wide, drying blue. Disc corollas 3.2-4.0 mm long. Mature achenes not seen; pappus bristles 26-32.

California endemic, North Coast Ranges in Sonoma Co., vicinity of Layton Mine along Austin Creek (Map 1); shrubby vegetation over serpentine, ca. 400-600 m; May-Aug.

Additional collection examined: UNITED STATES. California: Sonoma Co., near seep above Austin Creek, (below Layton Mine buildings), the Cedars, occasional in chaparral on serpentine, usually close to moisture, 6 Aug 1983, *Raiche 30587* (JEPS).

Erigeron serpentinus apparently is a narrow endemic restricted to serpentine outcrops in central Sonoma County. It is similar in habit and vestiture to *E. angustatus*, and probably most closely related to it, but plants of the latter

are rayless and they have larger heads and longer disc corollas. *Erigeron angustatus* also is endemic to serpentine exposures of the same region, although it is somewhat more widespread (Map 1). The collection information for *E. serpentinus* (30587) notes that the plants "apparently spread by rhizomes," but the specimens do not show this. Instead, the numerous stems on the specimens collected arise densely and immediately erect from the crown.

Among the radiate taxa with glabrous to sparse and appressed stem vestiture, the geographical range of *Erigeron serpentinus* occupies a region between that of *E. foliosus* var. *franciscensis* and var. *mendocinus*. It is strikingly different from both of the latter in vestiture as well as head morphology; scattered individuals of var. *foliosus* approach *E. serpentinus* in habit, or in vestiture, or in the reduced number of ray flowers, but I have seen no specimen of var. *foliosus* that combines the distinctive features of *E. serpentinus*.

SPECIES PERIPHERAL TO SECT. *LINEARIFOLII*

In contrast to the group of taxa closely centered around *Erigeron foliosus*, the other species that most closely resemble them differ in significant features. These latter were included with the *E. foliosus* group in *Erigeron* sect. *Linearifolii* (Nesom 1989), but after detailed study of the typical part of the section, it is more difficult to retain the peripheral elements together with the typical. The former are included and briefly treated here, as they may prove to be closely related, but it would not be surprising if they were found to represent, even among themselves, a diverse group of taxa most closely related to disparate phyletic lines within the genus.

1. *Erigeron hyssopifolius* Michx.

Erigeron hyssopifolius Michx., *Fl. Bor. Amer.* 2:123. 1803. TYPE: CANADA. Quebec: Lake Mistassini, A. Michaux s.n. (GH photo!, UC photo, US photo!).

Aster graminifolius Banks ex Pursh, *Fl. Amer. Septent.* 2:545. 1814. TYPE: [Canada]. at Hudson's Bay, Aug, Sep, [year not specified], Dr. Richardson s.n. ("herb. Banks," not seen). *Galatella graminifolia* (Banks ex Pursh) W.J. Hook., *Fl. Bor. Amer.* 2:15. 1834.

Southeastern Canada and adjacent northeastern United States. Chromosome number, $n=9$ (Montgomery & Yang 1960; Gervais 1979; Löve & Löve 1980; Morton 1981; Semple 1980; Löve & Löve 1982; Chinnappa & Chmielewski 1987).

Two varieties have been recognized within *Erigeron hyssopifolius*, but I have not attempted to evaluate their status. Cronquist (1947) included the

species within sect. *Pycnophyllum* (the *E. foliosus* group) on account of its narrow leaves densely arranged on the stems, occasionally resembling *E. foliosus* var. *confinis*, but as he noted (p. 277), "it certainly is not approached by anything else in the section." It differs strongly from the species centered around *E. foliosus* in several features: cauline leaves abruptly and sharply reduced in size, the heads solitary on bracteate peduncles 5-10 cm above the level of the leaves; 3 nerved phyllaries all nearly equal in length; and ligules of the ray corollas not coiling. Should *E. hyssopifolius* prove to be only distantly related to the *E. foliosus* group, *Erigeron* sect. *Linearifolii* probably would comprise only *E. hyssopifolius*, and sect. *Pycnophyllum* would be the correct name for the numerous taxa of the *E. foliosus* group.

2. *Erigeron lepidopodus* (B. Rob. & Fern.) Nesom

Erigeron lepidopodus (B. Rob. & Fern.) Nesom, Sida 9:31. 1981. BASIONYM: *Aster lepidopodus* B. Rob. & Fern., Proc. Amer. Acad. Arts 30:117. 1894. TYPE: MEXICO. Chihuahua: Pine forests about Chuchuichupa, 14 Jun 1891, C.V. Hartman 697 (HOLOTYPE: GH!; Isotypes: US-2 sheets!).

Central Chihuahua, México. Chromosome number, $n=9$ (R.W. Spellenberg unpubl.).

Erigeron lepidopodus and *E. rhizomatus* Cronq. are closely similar in geographic range and morphology, and they are almost certainly related as sister species. Plants of both produce stems from rhizomelike caudex branches, without clustered basal leaves, but both produce long, noncoiling ray corollas and phyllaries that are nearly equal in length, unlike any taxa of the *E. foliosus* group. Cronquist (1947) placed *E. rhizomatus* as a member of *Erigeron* sect. *Wyomingia* (A. Nelson) Cronq.

3. *Erigeron rhizomatus* Cronq.

Erigeron rhizomatus Cronq., Brittonia 6:274. 1947. TYPE: UNITED STATES. New Mexico: McKinley Co., canyon S of Fort Wingate, 16 May 1943, Ripley & Barneby 5272 (HOLOTYPE: NY!).

Southwestern New Mexico, United States. Chromosome number, $n=9$ (Ward & Spellenberg 1986).

4. *Erigeron chiangii* Nesom

Erigeron chiangii Nesom, Sida 8:65. 1979. TYPE: MEXICO. Coahuila: Cañon de la Madera, Sierra de la Madera, 29 Mar 1975, T. Wendt & E. Lott 842 (HOLOTYPE: LL!).

Central to northern Coahuila, México. Chromosome number, $n=18$ (Nesom 1979).

The relationships of *Erigeron chiangii* and *E. scoparioides* Nesom were not clearly understood at the times of their separate publications, but it now appears that they may be sister species. Both have a habit generally characteristic of the *E. foliosus* group, although the basal leaves of *E. chiangii* are sometimes persistent. The latter was originally compared to the *E. foliosus* group, but both it and *E. scoparioides* produce features anomalous among those western species. Their potential relationship, however, to any more geographically proximal species is equally as obscure.

5. *Erigeron scoparioides* Nesom

Erigeron scoparioides Nesom, *Phytologia* 66:488. 1989. TYPE: MEXICO. Tamaulipas: Mpio. Bustamante, ca. 1 mi NW of Hwy 101 on road to Bustamante, pine-juniper woodlands, 1680 m, 2 Aug 1983, G. Nesom 4785 (HOLOTYPE: TEX!; Isotypes: ANSM!, CAS!, GH!, MEXU!, MICH!, NY!, US!).

Westcentral Tamaulipas, México.

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