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CANOTIA

Volume 1

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THE NEW YORK BOTANICAL GARDEN

CANOTIA

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A NEW JOURNAL, **CANOTIA**

In recent years the Internet has revolutionized communication in the same way that the printing press did a few hundred years ago. Information can be disseminated rapidly and inexpensively via the Internet and can potentially reach a vast audience. Several societies now offer electronic and printed copies of their publications. As long as printed copies are deposited in several libraries, then there is a great advantage in this means of publication. First it is inexpensive. Second it requires less work to disseminate because copies can be sent as attachments to e-mail or can be posted on the web. And third, it allows for color illustrations at no significant extra cost. Those of us working on the Vascular Plants of Arizona project see the advantage of this approach to publication. We want our work to be as widely available as possible. Since 1992 we have had a collaborative working relationship with the Arizona-Nevada Academy of Science and seven issues of the Journal of that organization have been published devoted to the Vascular Plants of Arizona. We are extremely grateful to the Academy for its support. We think we now can produce our own journal entirely devoted to botanical matters, and especially the Vascular Plants of Arizona project. Other contributions, will be welcome, for instance, notes on species new to Arizona, checklists, and local floras. We expect to print a minimum of 30 copies to be deposited at local, national and international libraries. For the time being electronic copies will be available free of charge and can be used to print one's own hard copy.

Printed copies of volume one of **Canotia** are being made possible through a grant from the Arizona Native Plant Society. Andra Williams is gratefully acknowledged for her last minute help with formatting.

A NEW FLORA FOR ARIZONA IN PREPARATION

Arizona is a floristically rich state with perhaps as many as 3,900 species of vascular plants. Over the last 60 years an average of 12 new species records have been reported annually. The first manuals for identifying the plants of the state were *Flora of Arizona and New Mexico* by

Tidestrom & Kittle (1941) and *Flowering Plants and Ferns of Arizona* by Kearney and Peebles (1942). When the latter, a government publication, was no longer available, the authors revised their book, and it was republished in 1951 by the University of California Press under the title of *Arizona Flora*. A second edition appeared in 1960 with a supplement provided by J. T. Howell, Elizabeth McClintock, and collaborators. The second edition, now over 40 years old, is taxonomically out-of-date.

In 1987, the botanists at the herbaria of Arizona State University and The University of Arizona formed an editorial committee with the intent of producing a new book – *Vascular Plants of Arizona*. Tina Ayers of Northern Arizona University joined the committee in 2005. Help was solicited from authorities in various taxonomic groups, and approximately 100 specialists are contributing to the project. Many completed manuscripts have been published in the *Journal of the Arizona-Nevada Academy of Science* and now they will be published in *CANOTIA*. This treatment of the Polemoniaceae is the eighth in the series.

Some authors will take advantage of these journal contributions by augmenting their treatments with maps and illustrations, which are not envisioned for the final book. Please note that an asterisk (*) before a taxon indicates that it grows near the borders of Arizona, but is not definitely known to occur in the state.

Various persons have contributed to the production of this first issue of *CANOTIA*, most notably Raul Gutierrez who helped with maps and Shannon Doan with the word processing. Although each manuscript has gone through two editorial steps, errors or omissions may persist. It is the hope and the intent of the Vascular Plants of Arizona Editorial Committee that readers will report any problems they may encounter in the use of these treatments. If errors are found, please send a note addressed to one of the following: Herbarium, University of Arizona, Tucson, AZ 85721; Herbarium, School of Life Sciences, Arizona State University, Box 874501, Tempe, AZ 85287-4501; or Herbarium, Department of Biological Sciences, Northern Arizona University, P. O. Box 5640, Flagstaff, AZ 86011. If extended distributions are determined, a labeled voucher specimen should be sent to one or more of these herbaria. Your help will be greatly appreciated in our attempt to make the new manual as accurate and complete as possible. An index to the published treatments appears on pages iii to v of this issue.

These treatments are based largely on specimens housed at the following Arizona herbaria: University of Arizona (ARIZ), Northern Arizona University (ASC), Arizona State University (ASU), the Desert Botanical Garden (DES), and the Museum of Northern Arizona (MNA).

Vascular Plants of Arizona Editorial Committee

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Charles T. Mason
John R. Reeder

Arizona State University
Leslie R. Landrum
Donald J. Pinkava

Northern Arizona University
Tina Ayers

INDEX TO FAMILIES OF THE VASCULAR PLANTS OF ARIZONA

Bolded treatments are published in volumes 26, 27, 29, 30, 32, 33, and 35 of the *Journal of the Arizona-Nevada Academy of Science* (JANAS) or volume 1 of *CANOTIA*. Unbolded entries indicate families with no treatments published to date. Figure numbers refer to illustrations in the "Key to Families of Vascular Plants in Arizona" in JANAS 35(2).

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POLEMONIACEAE PHLOX FAMILY

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Annuals, perennial herbs, or shrubs, pubescent, rarely glabrous. LEAVES alternate to opposite, simple to compound; stipules absent. INFLORESCENCE cymose, open to congested, the cymes usually arranged in panicles; flowers rarely solitary. FLOWERS perfect, actinomorphic to zygomorphic, hypogynous; sepals usually 5, united, with equal to unequal lobes, the tube usually with herbaceous ribs separated by hyaline membranes that are distended or ruptured in fruit; corolla tubular, with 5 lobes; stamens usually 5, epipetalous, alternate with the corolla lobes, equally to unequally inserted; filaments equal to unequal in length; ovary usually with 3 locules; style simple, included to exerted, with (2-)3 stigmatic lobes. FRUIT a capsule, rarely indehiscent or circumscissile, with 1-many ovules and seeds in each locule, the mature seeds in most taxa becoming gelatinous when wet. —ca 26 genera, ca 380 spp., chiefly of western N. Amer. but also in western S. Amer. and temperate Eurasia. Porter, J. M. and L. A. Johnson. *Aliso* 19: 55-91. 2000.

1. Calyx tube herbaceous throughout, membranous and not ruptured in fruit
 2. Annual; leaves entire to toothed *Collomia*
 - 2' Perennial; leaves pinnately compound *Polemonium*
- 1' Calyx tube with herbaceous ribs separated by thin, translucent membranes, these usually distended or ruptured in fruit, or if herbaceous or membranous, then the leaves opposite and palmately lobed
 3. Cauline leaves mostly opposite, upper ones sometimes alternate, either simple or palmately lobed to compound
 4. Stamens inserted at different levels on the tube; corolla salverform; leaves simple, linear to linear-oblong or narrowly lanceolate
 5. Annual; corolla tubes 4-8 mm long *Microsteris*
 - 5' Perennial; corolla tubes 8-30 mm long *Phlox*
 - 4' Stamens inserted at the same level on the tube; corolla rotate, campanulate, or funnellform, if salverform then the leaves somewhat rigid and spinulose; leaves simple and filiform to palmately compound, the blades or lobes filiform to linear
 6. Perennial, suffrutescent to woody; corolla salverform

- 7. Hyaline membranes separating the calyx lobes narrow and somewhat obscure; uppermost leaves opposite; corolla diurnal, and often open at night, corolla tube glandular pilose externally *Leptosiphon*
- 7' Hyaline membranes separating the calyx lobes prominent; uppermost leaves often alternate; corolla nocturnal, closed during the day, corolla tube glabrous externally *Linanthus*
- 6' Annual; corolla rotate to campanulate or funnelform
 - 8. Corolla rotate, the throat orange or maroon..... *Leptosiphon*
 - 8' Corolla campanulate to funnelform, the throat white to lavender or bluish..... *Linanthus*
- 3' Cauline leaves mostly alternate, simple to pinnately lobed or compound
 - 9. Each flower closely subtended by 5-6 bracts, the inner ones translucent, with conspicuous veins..... *Loeselia*
 - 9' Bracts 1 per flower, herbaceous throughout, or some flowers lacking bracts
 - 10. Leaves deeply palmately to subpalmately lobed, the lobes rigid
 - 11. Corolla white to cream-colored or yellowish, opening nocturnally, usually closed during the day..... *Linanthus*
 - 11' Corolla bright blue, opening from noon to sundown, closed during the night *Giliastrum*
 - 10' Leaves entire or pinnately lobed to toothed, the lobes usually soft and herbaceous (rigid in *Navarretia*)
 - 12. Calyx and corolla lobes 3 to 5 times longer than the inconspicuous tube; corolla lobes yellow, minutely red-spotted at base..... *Linanthus*
 - 12' Calyx and corolla lobes shorter, equal to, or 1 to 2 times longer than the tube, the tube usually conspicuous; corolla lobes white to red or bluish, not red-spotted at base
 - 13. Leaf tips and lobes with 1-3 long, white bristles
 - 14. Corolla actinomorphic; leaves mostly oblanceolate, the proximal lobes tipped with 2-3 bristles; pollen white or blue ...
..... *Langloisia*
 - 14' Corolla zygomorphic; leaves mostly oblong, the proximal lobes tipped with 1 bristle; pollen yellow..... *Loeseliastrum*
 - 13' Leaf tips or lobes acute, mucronate, or short aristate, but not tipped with long, white bristles
 - 15. Inflorescence capitate to densely corymbose, terminal at tips of ascending to erect branches; flowers subsessile to sessile
 - 16. Calyx lobes unequal; floral bracts pinnately lobed, the apices firm or rigid
 - 17. Upper leaves and floral bracts woolly or with entangled hairs; anthers sagittate *Eriastrum*
 - 17' Upper leaves and floral bracts glabrous or short glandular pubescent; anthers elliptic *Navarretia*
 - 16' Calyx lobes equal; floral bracts usually entire to toothed, the apices acute to short aristate but not sharply rigid

18. Corolla campanulate to funnelform, blue or with white to bluish lobes and a yellow tube or throat..... *Gilia*
- 18' Corolla salverform, uniformly white to lavender.....
.....*Ipomopsis*
- 15' Inflorescence open and diffuse, with 2-5 flowers at the branch tips, or composed of several compact to dense, lateral clusters; flowers short to long pedicellate
19. Upper cauline leaves deeply subpinnately to pinnately lobed, the terminal lobe often longer and slightly wider than the lateral ones, the apices obtuse; seeds dark brown *Allophyllum*
- 19' Upper cauline leaves entire to pinnately lobed, the terminal lobe similar to the lateral ones, the apices acute to mucronate; seeds light gray to tan
20. Corolla salverform, uniformly white to bluish or red; flowers usually more than 7, congested at tips of lateral branches.....*Ipomopsis*
- 20' Corolla funnelform to salverform, if salverform then usually with white to bluish lobes and a yellow tube or throat (crimson in *Aliciella subnuda*); flowers 2-5(7) in loose, terminal clusters
21. Corolla broadly funnelform, rotate, uniformly deep blue; leaves gradually reduced upwards, the lobes needle-like.....*Giliastrum*
- 21' Corolla narrowly funnelform to salverform, the lobes white to red or bluish, the throat or tube often yellow; leaves abruptly reduced above a basal rosette (except *A. latifolia*), the lobes usually acute or mucronate
22. Glandular hairs on calyx, pedicels, and upper leaves colorless; basal and lower leaves glabrous or mostly glandular; seeds not conspicuously gelatinous when wet.....*Aliciella*
- 22' Glandular hairs on calyx, pedicels, and leaves, if present, dark or reddish; basal and lower leaves with short, curled hairs or cobwebby hairs; seeds gelatinous when wet..... *Gilia*

Aliciella A. Brand

Annual or perennial herbs, simple to branched, leafy to scapose, mostly glandular, the hairs uniseriate with terminal, multicellular glands, the glands colorless. LEAVES basal to alternate, entire to deeply pinnately lobed, the lobes completely confluent with the rachis, flat to terete. INFLORESCENCE terminal, paniculate, open to congested, the basic unit composed of 2-7 pedicelled flowers subtended by a single bract. FLOWERS actinomorphic; calyx tube membranes usually ruptured in fruit, rarely remaining intact; corolla funnelform to salverform, the tube, throat, and lobes similar in color or with different hues; stamens equally inserted on the corolla tube or throat; filaments equal or unequal in length; anthers included

to exerted; style included to exerted. CAPSULE ovoid to spheroid; seeds 2-many per locule, weakly gelatinous when wet. —21 spp.; w N.Amer. (Alice Eastwood, western North American botanist) Porter, J. M. *Aliso* 17: 23-46. 1998.

1. Stamens more or less unequally inserted on the upper tube; flowers subsessile to short pedicelled, in terminal, corymbose or capitate terminal clusters; corolla deep scarlet to crimson*A. subnuda*
- 1' Stamens equally inserted at the sinuses of the lobes or on the mid-tube; most flowers pedicelled, the clusters spreading to ascending in open inflorescences; corolla white, bluish, lavender or magenta
 2. Leaves oblanceolate to broadly ovate, dentate, the teeth broad, acuminate-aristate; stamens inserted on the mid-tube; filaments papillose below the anthers....*A. latifolia*
 - 2' Leaves linear to oblanceolate, pinnately lobed, the teeth acute to at most mucronate; stamens inserted at the sinuses of the lobes; filaments smooth below the anthers
 3. Corolla lobes 3-toothed, the central one longest; corolla somewhat salverform*A. triodon*
 - 3' Corolla lobes obtuse to acuminate; corolla somewhat funnellform
 4. Basal and lower leaves usually twice pinnately lobed; corolla tube conspicuously glandular externally.....*A. hutchinsifolia*
 - 4' Basal and lower leaves dentate to once pinnately lobed; corolla tube glabrous externally, sometimes with a few glandular hairs in *A. haydenii*
 5. Corolla tube 8-15 mm long, lobes 3.5-6 mm long; short-lived perennials, with 1-3 rosettes*A. haydenii*
 - 5' Corolla tube 3-6 mm long, the lobes 1-3 mm long; annual
 6. Upper surface of basal leaves glandular *A. leptomeria*
 - 6' Upper surface of basal leaves glabrous*A. lottiae*

Aliciella haydenii (A. Gray) J. M. Porter (Ferdinand Hayden, geologist and explorer). —Short-lived perennial, 12-50 cm tall, usually branched throughout; stems glabrous to glandular pubescent. LEAVES gradually to abruptly reduced above the basal rosette; basal and lower sparsely short pubescent above, glabrous beneath, lobed to toothed, the rachis broader than the lobes; cauline usually glabrous, toothed to entire. INFLORESCENCE open, with 1-5 pedicelled flowers on tips of spreading to ascending branches. FLOWERS: calyx 4-5 mm long, glandular pubescent to nearly glabrous in AZ, the lobes acute; corolla funnellform, 6-10 mm long, bluish to magenta; stamens inserted at the sinuses of the corolla lobes; anthers located at the orifice or slightly exerted; stigma located above to below the anthers. CAPSULE 3-5 mm long, ovoid. $2n=16$. [*Gilia haydenii* A. Gray] 2 subspp., UT to CO, s to AZ and NM.

Subsp. ***haydenii*** Corolla 10-20 mm long, magenta or bluish, tube with a few glands externally. —Rocky soils, clay badlands, pinyon-juniper woodland; Apache Co.; 1525-1980 m (5000-6500 ft); May-Jun. Range of the species.

Aliciella hutchinsifolia (Rydberg) J. M. Porter (leaves like *Hutchinsia*). —Annual, 5-30 cm tall, usually branched throughout; stems glandular. LEAVES glandular and short pilose, reduced above the basal rosette; basal and lower lobed once or twice, the lobes entire to toothed; cauline basally lobed to entire. INFLORESCENCE open, with 1-2 pedicelled flowers at branch tips. FLOWER: calyx 2-3 mm long, glandular pubescent, the lobes

acuminate to attenuate; corolla narrowly funnellform to salverform, 7-15 mm long, the tube and lobes white to lavender, the throat yellow; stamens inserted on upper throat; anthers located slightly above the throat; stigma located slightly below or among the anthers. CAPSULE 3-6 mm long, ovoid. $2n=18$. [*Gilia hutchinsifolia* Rydberg] —Washes, bajadas, desert shrublands and woodlands: Coconino Co.; 1150-1700 m (3800-5600 ft); Apr-Jun; s CA to s UT, s to AZ.

Aliciella latifolia (S. Watson) J. M. Porter (broad leaf). —Annual, (4-)8-30 cm tall, simple to branched throughout; stems glandular. LEAVES glandular and pilose, gradually reduced upwards, simple, oblanceolate to rotund, dentate to shallowly lobed, the teeth or lobes acuminate. INFLORESCENCE open, with 1-2 pedicelled to subsessile flowers at branch tips or in axils. FLOWER: calyx 4.5-7 mm long, sparsely to moderately glandular pubescent, the lobes equal to or longer than the tube, spinulose; corolla funnellform, bright pink to pink-purple, the tube and throat 6-11 mm long, the lobes 3-8 mm long; stamens inserted on the lower throat; anthers located in the upper throat; stigmas slightly exceeding the stamens. CAPSULE 4.5-7 mm long, ovoid to oblong. $2n=36$. [*Gilia latifolia* S. Watson] 2 subsp., s CA to s UT, s to nw Mex.

Subsp. ***latifolia***. Calyx 3-5 mm long; fruits 5-7 mm long. —Sandy washes, open flats, desert shrubland: Mohave, Yuma cos.; 150-600 m (500-2000 ft); Mar-May. Range of the species.

Aliciella latifolia subsp. ***imperialis*** (S. L. Welsh) J. M. Porter is restricted to the Colorado River drainage of se UT, and may be expected along the Colorado River in nc AZ. Subspecies *imperialis* differs in its smaller calyx (2-5 mm vs. 4.5-7 mm) and fruit (3.0-4.5 mm vs. 4.5-7.0 mm) and its larger stature (frequently over 25 cm tall vs usually less than 25 cm tall).

Aliciella leptomeria (A. Gray) J. M. Porter (thin parts). —Annual, 6-30 cm tall, simple to branched; stems usually glandular. LEAVES glandular, rarely glabrous, abruptly reduced above the basal rosette; basal and lower dentate to shallowly lobed, the teeth or lobe length equal to the rachis width; cauline dentate to entire. INFLORESCENCE open, with 1-3 pedicelled flowers at branch tips, the terminal pedicel subsessile or often shorter than those below. FLOWER: calyx 1-3 mm long, usually glabrous, the lobes obtuse to cuspidate; corolla salverform to narrowly campanulate, 3-7 mm long, the tube equal to or slightly longer than the calyx, the lobes acuminate; the tube and lobes white, pink, or lavender, the throat yellow; stamens inserted on the upper throat; anthers slightly exerted; stigmas slightly exceeding the anthers. CAPSULE 3-5 mm long, narrowly ovoid. $2n=16,34,36$. [*Gilia leptomeria* A. Gray] —Washes, rocky slopes, desert shrublands and woodlands; Apache, Coconino, Mohave, Yavapai cos.; 850-1700 m (2800-5600 ft); Apr-Jun; WA to ID, s to CA and NM.

Aliciella lottiae (A. Day) J. M. Porter (Patricia Lott, botanist). —Annual, 5-45 cm tall, branched from the base; stems usually glandular. LEAVES glabrous above, glandular below, abruptly reduced above the basal rosette; basal and lower dentate to shallowly lobed, the teeth or lobe length equal to the rachis width; cauline dentate to entire. INFLORESCENCE open, with 1-3 pedicelled flowers at branch tips, the terminal pedicel subsessile or shorter than those below. FLOWER: calyx 1-3 mm long, glandular, the lobes obtuse to cuspidate; corolla narrowly funnellform, 6-8 mm long, the tube longer than the calyx, the lobes acute; the tube and lobes white, pink, or lavender, the throat yellow; stamens inserted on the upper throat; anthers slightly exerted; stigmas slightly exceeding the anthers. CAPSULE 3-5 mm

long, narrowly ovoid. $2n=32,34,50$. [*Gilia lottiae* A. Day] —Washes, rocky slopes, desert shrublands and woodlands; Mohave Co.; 850-1700 m (2800-5600 ft); Apr-Jun; WA to ID, s to CA and UT.

Aliciella subnuda (Torrey ex A. Gray) J. M. Porter (almost naked). —Biennial or short-lived perennial, 10-70 cm tall; stem branching only within the inflorescence, glandular. LEAVES glandular, abruptly reduced above the basal rosette; basal oblanceolate, dentate to shallowly lobed distally; cauline narrowly oblong to linear, entire. INFLORESCENCE congested, usually corymbose, with short-pedicelled flowers at top of stem. FLOWER: calyx 4-6 mm long, glandular short pubescent; corolla salverform, 10-20(25) mm long, deep scarlet to crimson, the tube 2-3 times the calyx; stamens inserted on the upper tube; anthers included in the tube or slightly exerted; stigma located below to above the anthers. CAPSULE 3-5 mm long, narrowly ovoid. $2n=16$. [*Gilia subnuda* Torrey ex A. Gray] —Sandy soils, sandstone outcrops; Apache, Coconino, Navajo cos; 1500-2400 m (5000-7800 ft); Apr-Jun(-Aug); s UT.

Aliciella triodon (Eastwood) A. Brand (three teeth, referring to corolla lobes). —Annual, 5-15(-20) mm tall, simple to branched; stems glandular. LEAVES glandular, abruptly reduced above the basal rosette; basal dentate to shallowly lobed, the rachis broader than the teeth or lobes; cauline usually entire, linear. INFLORESCENCE open, with 1-3 short pedicelled flowers on distal branches. FLOWER: calyx 1-3 mm long, usually glabrous, the lobes acuminate; corolla narrowly funnelform, 3-6 mm long, the tube exerted, white to pink, the throat light yellow, the lobes 3-toothed, white to pink; stamens inserted on the upper throat; anthers slightly exerted; stigma slightly exceeding the anthers. CAPSULE 3-4 mm long, narrowly ovoid. $2n=18$. [*Gilia triodon* Eastwood] —Sandy to gravelly soils, sagebrush shrubland, pinyon-juniper woodland; Apache, Coconino, Mohave cos.; 250-1600 m (2500-5300 ft); May-Jun; se CA to w WY, s to nw NM.

Allophyllum (Nuttall) A. D. Grant and V. E. Grant

Annuals. LEAVES alternate, the basal and lower leaves entire to deeply pinnately lobed, the upper pinnately to subpalmately lobed, the distal lobe often larger than the lateral lobes. INFLORESCENCE with cymes congested, bracteate. FLOWER (in AZ) short-pedicelled to sessile, actinomorphic; calyx tube ruptured in fruit, the lobes acute; corolla actinomorphic, funnelform; stamens subequally inserted on the upper tube; filaments unequal in length; anthers included or exerted; style (in AZ) included. CAPSULE subglobose; seeds (in AZ) 1 per locule, dark brown, gelatinous when wet. $2N = 16, 18$. —6 spp.; w N. Amer. (Latin *allo* = different + *phyllum* = leaf). Grant, A. and V. E. Grant, *El Aliso* 3: 93-110. 1955.

Allophyllum gilioides (Bentham) A. D. Grant and V. E. Grant (resembling *Gilia*). —Annuals, 8-35 cm tall, simple or few-branched from base; stems short pubescent, glandular. LEAVES pubescent; basal and lower pinnately lobed, the lobes (3-)5-11, linear to narrowly lanceolate; upper mostly subpalmately lobed, the lobes 3-5, the distal wider and longer than the lateral lobes. INFLORESCENCE with 2-6 flowers per branch. FLOWERS: calyx 3-4 mm long; corolla 6-8 mm long, dark bluish violet; stamens with anthers included to exerted, the upper anthers located just above the throat; stigma included, located among the lower anthers. CAPSULE 2.5-3 mm long. $2n=18$. [*Gilia gilioides* (Bentham) Greene]. —Steambeds, canyons, oak woodland, pine forest; Coconino, Gila, Maricopa, Pima, Pinal, Yavapai cos; 600-1600 m (2000-5300 ft); Apr-Jun; s OR to CA and AZ.

Collomia Nuttall

Annuals or perennials. LEAVES mostly alternate, simple to lobed. INFLORESCENCE terminal and axillary, compact, subcapitate or rarely solitary, bracteate. FLOWERS perfect, actinomorphic, subsessile; calyx herbaceous, becoming membranous, not ruptured in fruit, the membranes distended or carinate in fruit, the ribs and lobes with prominent veins in fruit, acute to acuminate; corolla funnelform to salverform, blue, red, yellow or white; stamens equally or unequally inserted in the corolla tube; filaments mostly unequal in length; anthers included to exserted; style included to exserted. CAPSULE ovoid to ellipsoid, explosively dehiscent; seeds (in AZ) 1 per locule, gelatinous when wet. $2n = 16$. —15 spp., w N. Amer., 1-2 sp. in S. Amer. (from the Greek *kolla*, meaning glue, referring to the seeds when wetted). Wherry, E. 1944. Amer. Midl. Nat. 31: 216-231.

1. Corolla 15-30 mm long, yellow to orange; pollen blue; calyx lobes acute .. *C. grandiflora*
 1' Corolla 8-15 mm long, white to bluish-violet; pollen cream to blue; calyx lobes
 acuminate..... *C. linearis*

Collomia grandiflora Douglas ex Lindley (large flowers). —Annual; stems 1-5 dm. LEAVES subsessile, entire to toothed, 1-6 cm long, the lower cauline leaves linear to narrowly elliptic, the upper leaves lanceolate to ovate. INFLORESCENCE terminal or axillary, compact, the bracts ovate to lanceolate, 10-22 mm long, 4-10 mm wide, the lower margins short pubescent. FLOWERS: calyx lobes acute; corollas of normal flowers open, 15-25(30) mm long, orange to salmon or (in cleistogamous flowers) unopened, often restricted to the lower axillary cymes, less than 5 mm long, white to light yellow; pollen blue; style equal to the corolla tube. CAPSULE 5-6 mm long. —Dry streambeds, shaded slopes, pine forest, oak woodland: Coconino, Gila, Maricopa, Yavapai cos.; 4500-8200 ft; Apr-Jun-(Aug). British Columbia, WA to ID, s to CA and AZ.

Collomia linearis Nuttall (narrow leaves). —Annual; stems 1-5 dm. LEAVES subsessile, entire, 1-6 cm long, the lower cauline leaves linear to lanceolate, the upper leaves narrowly lanceolate. INFLORESCENCE terminal, rarely axillary, compact, the bracts ovate to lanceolate, 8-20 mm long, 3-6 mm wide, the lower margins glandular. FLOWERS: calyx lobes acuminate; corollas salverform, 8-15 mm long, bluish violet to nearly white; pollen cream to blue; style equal to the corolla tube. CAPSULE 3-5 mm long. —Open sites, meadows, pine forest: Apache, Coconino cos.; 6500-8000 ft; Jun-Jul-(Sep). W Can to CA and NM.

Eriastrum Wooton and Standley

Annual (in AZ); stems solitary to much branched, erect to prostrate, leafy. LEAVES basal to alternate, simple to deeply pinnately lobed, the lobes confluent with the rachis, flat to terete, spinulose. INFLORESCENCE terminal, compact, bracteate, short woolly, the outer bracts deeply lobed. FLOWERS sessile, actinomorphic to slightly irregular; calyx tube membranes usually ruptured in fruit, the lobes subequal to strongly unequal, acute to attenuate, often spinulose; corolla actinomorphic, funnelform to salverform, or zygomorphic with at least 2 lobes unequal, white to deep bluish lavender; stamens equally to unequally inserted on the throat; anthers usually exserted; filaments equal to subequal in length; style included to exserted. CAPSULE ellipsoid to ovoid; seeds 1-several per locule. —Ca. 14

spp.; sw U.S., nw MEX. (from the Greek erion, meaning wool, and aster, meaning star).
Harrison, H. K., Brigham Young Sci. Bull. 16: 1-26. 1972.

1. Corolla 12-20 mm long, the lobes subequal, 4-8 mm long; anthers 1-2 mm long *E. eremicum*
.....
1' Corolla 6-11 mm long, the lobes equal, 2-4 mm long; anthers less than 1 mm long
..... *E. diffusum*

Eriastrum diffusum (A. Gray) H. Mason (diffuse). —Annual 3-35 cm tall, erect and simple to diffusely branching. LEAVES subglabrous to sparsely woolly, entire or with 1-2 pairs of lobes near the base of the rachis, 1-3 cm long. CALYX 6-7 mm long; corolla actinomorphic, narrowly funnellform to slightly zygomorphic, the throat white to yellow, the lobes white to pale blue or bluish lavender, the tube and throat 4-7 mm long, slightly longer than the calyx tube, the lobes 3-5 mm long; stamens inserted on the throat near the sinuses, less than the length of the corolla lobes; filaments slightly unequal in length; pistil 5-7 mm long; style included in the tube or throat. CAPSULE 2-4 mm long. —Open sites, desert shrublands, sagebrush, pinyon-juniper woodland: Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos; 700-5600 ft; Feb-Jun. s CA to w CO, s to n Mex. This species includes plants assigned to *E. diffusum* subsp. *jonesii* H. L. Mason, with corollas 10-12 mm long and anthers 0.7-1 mm long. The typical, more common subsp. *diffusum* usually has shorter corollas and anthers less than 0.8 mm long. These differences do not appear correlated with geographical or ecological distribution.

Eriastrum eremicum (Jepson) H. Mason (of deserts) —Annual 5-30 cm tall, erect, with several branches. LEAVES subglabrous to sparsely villous and viscid, entire to pinnately lobed, with 1-3 pairs of lateral lobes, 1-5 cm long. CALYX 5-7 mm long; corolla slightly zygomorphic, with 3 dorsal lobes and 2 ventral lobes, the tube and throat 6-14 mm long, often twice the length of the calyx, the lobes 4-8 mm long, the throat yellow, the lobes bright blue to bluish lavender; stamens inserted near the base of the throat, about equal to the length of the lobes, exerted and often bent upward; pistil 12-15 mm long; style included in the throat to slightly exerted. CAPSULE 3-5 mm long. —Washes, bajadas, desert shrublands and woodlands: Cochise, Gila, Graham, La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma cos; 1000-4500 ft; Mar-Jun. s CA to sw UT, s to n MEX. This species includes subsp. *yageri* (M. E. Jones) H. L. Mason, with slightly zygomorphic, bright blue corollas. This is the common subspecies throughout much of AZ, but the differences from typical subsp. *eremicum*, which has more lightly colored, zygomorphic corollas, are apparently gradual over a broad geographical gradient extending into CA and s NV.

Gilia Ruiz and Pavon

Annual; simple to branched, leafy to scapose, glabrous, pubescent to glandular, the hairs sometimes loosely tangled like cobwebs. LEAVES basal to alternate, entire to deeply pinnately lobed, the lobes completely confluent with the rachis, flat to terete. INFLORESCENCE terminal, paniculate, open to congested, the basic unit composed of 2-7 pedicelled flowers subtended by a single bract, rarely solitary. FLOWERS actinomorphic; calyx tube membranes usually ruptured in fruit, rarely remaining intact; corolla funnellform to salverform, the tube, throat, and lobes often with different hues; stamens equally to subequally inserted on the corolla tube or throat; filaments equal or unequal in length; anthers

included to exserted; style included to exserted. CAPSULE ovoid to spheroid; seeds 2-many per locule. —ca 40 spp.; w N.Amer, s S. Amer. (Felipe Luis Gil, Spanish botanist).

1. Flowers subsessile to short pedicelled, in terminal, corymbose or capitate terminal clusters
 2. Calyx streaked with purple; corolla usually funnelform *G. flavocincta*
 - 2' Calyx not streaked with purple; corolla campanulate (rarely collected plants presumably escaped from cultivation or waifs brought in with animal fodder)
 3. Flowers many per cluster; corolla blue to bluish violet; stamens and style exserted..... *G. capitata*
 - 3' Flowers 3-7 per cluster; corolla with yellow tube and throat, throat purple-spotted, limb white to bluish; stamens and style included *G. clivorum*
- 1' Most flowers pedicelled, spreading to ascending in open inflorescences
 4. Leaf axils and stems without cobwebby hairs, the hairs glandular or straight or curled and sometimes branched
 5. Basal and lower cauline leaves with mostly curled (sometimes branched), nonglandular hairs *G. stellata*
 - 5' Basal and lower cauline leaves with glandular and short nonglandular hairs.....
..... *G. scopulorum*
 - 4' Lower cauline leaf axils with cobwebby pubescence; lower stems and basal leaves often cobwebby pubescent (glandular in *G. sinuata*)
 6. Stems near base glabrous and glaucous; basal leaves usually glabrous; cauline leaves clasping; rachis of basal leaves strap-shaped *G. sinuata*
 - 6' Stems near base and basal leaf axils cobwebby-pubescent; cauline leaves not clasping; basal leaf rachis \pm linear
 7. Calyx with short to long, glandular hairs
 8. Corollas 12-24 mm long; anthers exserted; basal leaf lobes ovate to oblong *G. cana*
 - 8' Corollas 4-9 mm long; anthers included in throat to barely exserted; basal leaf lobes \pm linear
 9. Basal leaf lobes usually less than 1 mm wide, pointed toward leaf apex; capsule narrowly ovoid *G. minor*
 - 9' Basal leaf lobes 1-2 mm wide, spreading at right angles to rachis; capsule broadly ovoid *G. transmontana*
 - 7' Calyx glabrous to sparsely cobwebby-pubescent, hairs not glandular
 10. Calyx streaked with purple *G. flavocincta*
 - 10' Calyx without purple streaks
 11. Basal and lower cauline leaf lobes usually less than 1 mm wide, usually pointed toward the leaf apex *G. mexicana*
 - 11' Basal and lower leaf lobes more than 1 mm wide, spreading at right angles to the rachis
 12. Corolla 4-8 mm long, throat white to pale blue, lobes equal to or longer than the throat; calyx lobes acute *G. clokeyi*
 - 12' Corolla 7-12 mm long, throat yellow, lobes shorter than the throat; calyx lobes acuminate *G. ophthalmoides*

Gilia cana (M. E. Jones) A. A. Heller (grayish) —Annual, 5-30(-40) cm tall, simple to branching in upper half; stems cobwebby pubescent below, glandular above. LEAVES densely cobwebby to glandular, abruptly reduced above the basal rosette; basal deeply lobed, the lobes ovate to oblong, entire to toothed; cauline entire or 3-lobed at base. INFLORESCENCE congested, with 2-8 pedicelled flowers on spreading to erect branches. FLOWERS: calyx 3-4 mm long, glandular, the lobes acuminate; corolla funnelform, 12-30 mm long, the tube 1-4 times the calyx length, purple, the throat yellow in lower half, bluish in upper half, the lobes pink; stamens inserted on the upper throat; anthers exerted; stigma located above the anthers. CAPSULE 4-8 mm long, broadly ovoid to globose. —5 subspp.; CA to AZ.

Subsp. ***speciformis*** A. D. Grant & V. E. Grant (speci = species + formis = form of) — FLOWERS: corolla tube 2-4 times the calyx length. $2n=18$. —Sandy soils, washes, desert shrubland; Mohave co; 200- 600 m (700-2000 ft); Mar-May; CA to s NV, s to AZ. Incorrectly referred to *G. tenuiflora* Jones by Kearney and Peebles. Plants with corolla tubes 1-2 times the calyx length belong to subsp. *triceps* (A. Brand) A. D. Grant & V. E. Grant, which may be expected from nw AZ.

Gilia capitata Sims (head-like). —Annual, 10-50 cm tall, branched throughout; stems glabrous to glandular. LEAVES pubescent, gradually reduced upwards, deeply lobed once or twice, the lobes linear. INFLORESCENCE usually globose, with many subsessile flowers at the branch tips. FLOWER: calyx 4-5 mm long, pubescent, the lobes acuminate; corolla campanulate, 7-12 mm long, blue to bluish violet, the tube equal to the calyx, the throat exerted; stamens inserted on the throat; anthers exerted; stigmas located among or above the anthers. CAPSULE 5-6 mm long, ovoid to globose. $2n=18$. [*Gilia achilleifolia* Bentham subsp. *staminea* (Greene) Mason & Grant] —Canyons, washes, desert shrubland; Pima, Pinal cos.; 600-1400 m (2000-4600 ft); Mar-May; CA. Collected between 1903 and 1915. Our plants are referable to subsp. *staminea* (E. Greene) V. E. Grant, native to the San Joaquin Valley and adjacent mountains of CA. Reports of *Gilia achilleifolia* Bentham subsp. *multicaulis* (Bentham) A. & V. E. Grant from AZ are incorrect.

Gilia clivorum (Jepson) V. Grant (of hills). —Annual, 8-30 cm tall, simple to few branched; stem glabrous to slightly short pubescent below, glabrous above. LEAVES glabrous to sparsely short pubescent, gradually reduced upwards, deeply lobed once or twice, the primary lobes linear, spreading. INFLORESCENCE loosely clustered, with 2-7 subsessile flowers at distal branch tips. FLOWERS: calyx 3-5 mm long, glabrous, the lobes acute; corolla funnelform, 5-9 mm long, white to lavender, the tube 1-2 times the calyx, yellow, the throat yellow, with purple spots; stamens inserted on the upper tube; anthers included; stigma slightly above the anthers. CAPSULE 4-6 mm long, ovoid. $2n=18$. — Collected at Clifton (Greelee Co.) and in hayfields near Baker's Butte (Coconino Co.) in Sep, 1942; native to coastal CA and adventive in AZ.

Gilia clokeyi H. L. Mason (Ira Clokey, botanist). —Annual, 8-20(-35) cm tall, branched throughout; stems cobwebby pubescent below, glandular above. LEAVES cobwebby pubescent, reduced above the basal rosette; basal and lower deeply lobed, the lobes linear to oblong; cauline basally lobed or entire. INFLORESCENCE open, with 1-2 pedicelled flowers at branch tips. FLOWERS: calyx 2-5 mm long, the lobes acute; corolla funnelform, 4-7 mm long, the tube equal to the calyx, the throat pale blue to white, the lobes light to deep violet, yellow spotted at base; stamens inserted on the throat; anthers located above the throat; stigma situated among the anthers. CAPSULE 3-6.5 mm long, globose to

ovoid. $2n=18$. —Open sites, shrubland, woodland; Coconino, Mohave, San Juan, Yavapai, Yuma cos.; 450-1300 m (1600-4200 ft); Mar-Apr; CA to WY, s to AZ and NM.

Gilia flavocincta A. Nelson (encircled by yellow, referring to the corolla throat). —Annual, 6-30(-45) cm tall, branched throughout; stems cobwebby below, glabrous to sparsely glandular above. LEAVES sparsely cobwebby, reduced above the basal rosette; basal and lower lobed once or twice, the lobes entire or toothed; cauline entire or basally lobed. INFLORESCENCE congested, with short pedicelled to subsessile flowers in terminal clusters. FLOWERS: calyx 3-5(-8) mm long, glabrous to sparsely cobwebby, the lobes acuminate to attenuate; corolla funnellform, 7-27 mm long, the tube equal to or longer than the calyx, violet or yellow, the throat yellow, the lobes pink to yellow with violet flecks; stamens inserted on the throat; anthers slightly exerted; stigma exerted or located among the anthers. CAPSULE 5-8.5 mm long, broadly ovoid. —2 subsp.; NV to TX and n Son. Incorrectly referred to *Gilia tenuiflora* Jones by Kearney and Peebles.

1. Corolla 7-18 mm long, tube equal to or slightly exceeding the calyx; style usually not exceeding the stamens subsp. *australis*
- 1' Corolla 12-27 mm long, tube longer than the calyx; style usually exceeding the stamens ..
..... subsp. *flavocincta*

Subsp. ***flavocincta*** (A. Nelson) A. D. Grant & V. E. Grant —Corollas 12-27 mm long, the tube exerted, longer than the calyx. $2n=36$. —Sandy soils, washes, bajadas, desert shrublands; Apache, Gila, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 450-1300 m (1500-4300 ft); Feb-May. Range of the species.

Subsp. ***australis*** (A. D. Grant and V. E. Grant) A. G. Day and V. E. Grant (southern). —Corollas 7-18 mm long, the tube included and equal to the calyx, the throat exerted. $2n=36$. —Sandy to gravelly soils, washes, canyons, bajadas, desert shrublands, pinyon-juniper woodland; Apache, Cochise, Graham, Mohave, Pima, Santa Cruz, Yavapai cos.; 850-1550 m (2800-5000 ft); Mar-May; AZ to TX, n Mex.

Gilia mexicana A. D. Grant and V. E. Grant (of Mexico) —Annual, 10-35 cm tall, usually branched; stems cobwebby pubescent below, sparsely glandular above. LEAVES cobwebby pubescent, reduced above the basal rosette; basal and lower deeply lobed, the lobes linear, entire or toothed; cauline leaves basally lobed to entire. INFLORESCENCE open, with 1-2 pedicelled flowers at branch tips. FLOWERS: calyx 2.5-5 mm long, glabrous, the lobes acute to acuminate; corolla funnellform, 4-8 mm long, the tube and throat equal to or slightly exceeding the calyx, white, the throat white with yellow flecks, lobes white to pale blue, sometimes streaked with violet flecks; stamens inserted on the throat; anthers slightly exerted; stigma located among the anthers. CAPSULE 3.5-6 mm long, oblong-ovoid. $2n=36$. —Sandy soils, bajadas, canyons, desert shrublands, coniferous or oak woodlands; Cochise, Graham, Pima, Pinal, Santa Cruz, Yavapai cos.; 1150-1650 m (3700-5450 ft); Apr-Jun; AZ to sw NM, s to n Mex.

Gilia minor A. D. Grant & V. E. Grant (small). —Annual, 6-25(20) cm tall, branched throughout; stems usually cobwebby pubescent below, glandular above. LEAVES cobwebby pubescent, sometimes glabrous, reduced above the basal rosette; basal deeply lobed, the lobes linear to oblong; cauline basally lobed to entire. INFLORESCENCE open, with 1-2 pedicelled flowers at the branch tips. FLOWER: calyx 3-4 mm long, glandular, the lobes acute; corolla funnellform, 5-9 mm long, the tube exceeding the calyx, purple, the throat

purple or yellow with purple veins, the lobes lavender; stamens inserted on the upper throat; anthers slightly exerted; stigma located above the anthers. CAPSULE 4-6 mm long, narrowly ovoid. $2n=18$. —Washes, bajadas, desert shrublands; Maricopa, Mohave cos.; 550-1100 m (1800-3500 ft); Mar-Apr; s CA to AZ.

Gilia ophthalmoides A. Brand (eye-like, referring to yellow throat). —Annual, 8-30 cm tall, branched throughout; stems cobwebby pubescent below, glandular above. LEAVES cobwebby pubescent, reduced above the basal rosette; basal and lower leaves deeply lobed once or twice; cauline basally lobed or entire. INFLORESCENCE open, with 1-2 pedicelled flowers at the branch tips. FLOWERS: calyx 3-5 mm long, glabrous, the lobes acuminate; corolla funnelform, 7-12 mm long, the tube usually exerted, purple, the throat yellow, the lobes pink; stamens inserted on the throat; anthers exerted; stigma located among the anthers. CAPSULE 4-6 mm long, ovoid to subglobose. $2n=36$. —Open sites, shrublands, woodlands; Apache, Coconino, Gila, Greenlee, Mohave, Navajo, Yavapai cos; 1000-2150 m (3200-7000 ft); Apr-Jun; se CA to UT, s to AZ and NM.

Gilia scopulorum M. E. Jones (rock loving). —Annual, 5-40 cm tall, simple to branched; stems glandular. LEAVES glandular and short pilose, reduced above the basal rosette; basal and lower lobed once or twice, the lobes entire or toothed; cauline lobed to entire, the lobes ovate. INFLORESCENCE open, with 1-2 pedicelled flowers at branch tips. FLOWER: calyx 3-5 mm long, slightly glandular, the lobes acuminate; corolla funnelform to salverform, 10-16 mm long, the tube 2-3 times the calyx length, pink to lavender, the throat yellow, the lobes pink to lavender; stamens inserted on the upper throat; anthers located just above the throat; stigma located among the anthers. CAPSULE 4-6 mm long, broadly ovoid. $2n=18,36$. —Washes, rocky slopes, desert shrublands; Coconino, La Paz, Mohave, Yuma cos.; 450-1100 m (1500-3600 ft); Feb-May; s CA to sw UT, s to AZ.

Gilia sinuata Dougl. ex Benth. (sinuate). —Annual, 9-30(-35) cm tall, simple or branched above rosette, glabrous and glaucous below, glandular above. LEAVES cobwebby pubescent on upper surface, abruptly reduced above the basal rosette; basal deeply lobed once, the lobes oblong; cauline clasping, dentate to entire. INFLORESCENCE open, with 1-3 short pedicelled flowers at branch tips. FLOWERS: calyx 3-5 mm long, glandular, the lobes short acuminate; corolla funnelform, 7-12 mm long, the tube exerted, purple and white striate, the throat yellow or purple tinged below, the lobes white to lavender; stamens inserted on the throat; anthers exerted; stigmas located among or slightly above the anthers. CAPSULE 4-7 mm long, ovoid. $2n=36$. —Sandy soils, shrubland, woodland; Apache, Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Yavapai cos.; 300-1900 m (1000-6200 ft); Mar-May; WA to ID, s to CA and AZ.

Gilia stellata A. A. Heller (starlike, referring to hairs). —Annual 7-70 cm tall, simple to branched; stems densely pubescent below, the hairs bent to curled and sometimes branched, glandular above. LEAVES pubescent with curled hairs, reduced above the basal rosette; basal and lower deeply lobed once or twice; cauline deeply lobed to entire. INFLORESCENCE open, with 2-8 pedicelled flowers on the distal branches. FLOWER: calyx 3-5 mm long, pubescent or glandular, the lobes acuminate; corolla funnelform, 6-10 mm long, white, the tube usually 2 times the calyx, the throat yellow with purple spots; stamens inserted on the upper throat; anthers slightly exerted; stigmas located slightly above the anthers. CAPSULE 5-7 mm long, broadly ovoid. $2n=18$. —Sandy washes, slopes, desert shrublands and woodlands, Oak shrublands at higher elevations; Graham, La Paz,

Maricopa, Mohave, Pima, Pinal, Yavapai, Yuma cos; 300-1300 m (1000-4200 ft); Mar-May; s CA to sw UT, s to n Mex.

Gilia transmontana (H. Mason & A. D. Grant) A.D. Grant & V. E. Grant. (across the mountains). —Annual, 10-35 cm tall, usually branched throughout; stems cobwebby pubescent below, glandular above. LEAVES cobwebby pubescent, reduced above the basal rosette; basal and lower deeply lobed, the lobes linear; cauline basally lobed or entire. INFLORESCENCE open, with 2-3 pedicelled flowers on distal branches. FLOWER: calyx 3-4 mm long, glabrous to slightly glandular, the lobes acute; corolla funnelform, 4-8 mm long, the tube purple to violet, the lower throat yellow, the upper white with purple spots below lobes, the lobes lavender; stamens inserted on the throat; anthers located slightly above the throat; stigmas located among the anthers. CAPSULE 3.5-6 mm long, ovoid. $2n=36$. [*Gilia ochroleuca* Jones subsp. *transmontana* Mason & A. Grant]. —Sandy soils, bajadas, canyons, desert shrublands and woodlands; Maricopa, Mohave, Yavapai cos.; 350-700 m (1200-2300 ft); March-May; s CA, s NV.

Giliastrum (A. Brand) Rydberg

Perennial herbs, sometimes flowering the first year, simple to branched, leafy to subscapose, glabrous or sparsely pubescent. LEAVES basal to alternate, gradually reduced upwards, entire to pinnately lobed, the lobes completely confluent with the rachis, usually flat. INFLORESCENCE terminal, paniculate, open to congested, the basic unit composed of 2-5 pedicelled flowers subtended by a single bract, rarely solitary. FLOWERS actinomorphic; calyx tube membranes ruptured in fruit; corolla rotate to broadly funnelform, the tube, throat, and lobes often with the same hues; stamens equally inserted on the lower corolla tube; filaments equal or unequal in length; anthers included to exserted; style included to exserted. CAPSULE ovoid to spheroid; seeds 2-many per locule. —9 spp.; w N.Amer, s S. Amer. (from the Greek, resembling *Gilia*).

Giliastrum acerosum (A. Gray) Rydberg (needle-like, referring to the leaves). —Perennial, 6-15 cm tall, branched at the base; stems 5-12, spreading to erect, woody below, glandular throughout. LEAVES slightly reduced upwards; lower deeply pinnately lobed, the lobes needle-like; upper subpalmately lobed, the lobes 3-5. INFLORESCENCE open, with 1-3 pedicelled flowers at branch tips. FLOWER: calyx 7-8 mm long, the lobes attenuate, needle-like; corolla broadly funnelform, 7-10 mm long, deep blue, the tube usually shorter than the calyx; stamens inserted on the lower tube; anthers located above the throat, bright yellow; stigma located among the anthers or slightly above. CAPSULE 4-5 mm long, broadly ovoid. $2n=18,20$. [*Gilia rigidula* Benth in DC. subsp. *acerosa* (A. Gray) Wherry] —Gravelly soils, rocky slopes, canyons, shrublands, woodlands; Apache, Cochise, Navajo, Santa Cruz cos.; 1300-1950 m (4200-6400 ft); May-Sep; AZ to TX and n Mex. Porter, J. M. Aliso 17: 83-85.

Ipomopsis Michx.

Annuals, perennial herbs, or subshrubs, simple to branched. LEAVES basal to alternate, entire to deeply pinnately lobed, gradually reduced upward, the lobes completely confluent with the rachis, flat to terete, usually linear to oblong. INFLORESCENCE terminal, paniculate, open to congested, the basic unit composed of 2-7 pedicelled flowers subtended by a single bract, these sometimes arranged along one side of the rachis.

FLOWERS actinomorphic to slightly zygomorphic; calyx tube membranes usually ruptured in fruit; corolla rotate to salverform, white to purplish or red; stamens unequally inserted on the corolla tube or throat; filaments equal or unequal in length; anthers included to exserted; style included to exserted. CAPSULE ovoid; seeds 1-many per locule. —ca. 30 spp. in w N.Amer, 1 sp. in se U.S., and 1 sp. in S.Amer. (based on the resemblance of *Ipomopsis rubra* to *Ipomoea quamoclit.*)

1. Flowers in terminal, capitate clusters; corolla tubes 3-8 mm long; stamens inserted on the upper throat between the lobes
 2. Perennials, often branched and woody at base; stems 5-60 cm tall; seeds 1 per locule, sometimes locules empty
 3. Stamens equally inserted slightly below the sinuses of the corolla lobes; cauline leaves linear and entire to pinnatifid with linear segments; calyx villous, but not glandular *I. spicata*
 - 3' Stamens unequally inserted on the corolla tube; cauline leaves trifid; calyx glandular *I. congesta*
 - 2' Annuals, usually branching from the primary axis, 5-30 cm tall; seeds several per locule (except sometimes in *I. gunnisonii*)
 4. Lower cauline leaves linear and entire; seeds 1-2 per locule *I. gunnisonii*
 - 4' Lower cauline leaves with 3-5 teeth or ovate to oblong lobes; seeds 2-3(-4) per locule
 5. Outer inflorescence bracts toothed; stems with short curly hairs; corolla tube 3-5 mm long, lobes 1-1.5(-1.8) mm long *I. polycladon*
 - 5' Outer inflorescence bracts reduced, entire; stems with woolly hairs; corolla tube 4-8 mm long, lobes 2-3.5(-4) mm long *I. pumila*
- 1' Flowers usually in clusters at tips of lateral branches, the inflorescence a diffuse to congested panicle (open in *I. longiflora*); corolla tubes 5-50 mm long (5-15 mm long in *I. multiflora*); stamens inserted on the tube or base of throat
 6. Inflorescence diffusely branched, the flowers pedicelled, solitary or in pairs *I. longiflora*
 - 6' Inflorescence open to narrow, often one-sided, the flowers short-pedicelled to sessile, in lateral, pedunculate clusters
 7. Corollas scarlet to magenta
 8. Corolla tubes 18-25 mm long; anthers and style located in the throat or strongly exserted *I. aggregata*
 - 8' Corolla tubes 10-15 mm long; anthers and style included in the tube *I. arizonica*
 - 7' Corollas white, lavender or pale violet to purplish
 9. Corolla tube 5-15 mm long; stamens inserted at the same level on the upper tube or throat *I. multiflora*
 - 9' Corolla tube 15-50 mm long, stamens inserted unequally on the tube
 10. Corolla tube 15-25 mm long, bent slightly downward; calyx lobes short-aristate *I. macombii*
 - 10' Corolla tube 25-50 mm long, straight; calyx lobes mucronate
 11. Corolla lavender to bluish purple, the throat 4-6 mm wide, the lobes obovate, the apices rounded to apiculate *I. thurberi*

- 11' Corolla light to dark lavender, the throat 2-4 mm wide, the lobes lanceolate, the apices acute to attenuate
12. Corolla tube 30-40 mm long, the lobes lavender, with dark purple flecks *I. macrosiphon*
- 12' Corolla tube 25-35 mm long, the lobes white to bright lavender, not conspicuously flecked..... *I. tenuituba*

Ipomopsis aggregata (Pursh) V. E. Grant (aggregated, referring to flowers). —Short-lived perennial, 20-100 cm tall, simple to branched at base; stems with short glandular hairs, often with short, curly nonglandular hairs below. LEAVES subglabrous to short-pilose, deeply lobed. INFLORESCENCE diffuse to one-sided, with subsessile to short-pedicelled flowers on lateral branches. FLOWER: calyx 3-8 mm long, short-glandular pubescent, the lobes shorter than or equal to the tube and acuminate in AZ; corolla usually scarlet, the tube 15-30 mm long, the throat 3-6 mm wide, the lobes lanceolate, acuminate, often with dark red flecks; stamens inserted unequally above the mid-tube; filaments unequal; anthers located in the throat or exerted; stigma slightly exceeding the anthers. CAPSULE 8-12 mm long; seeds 5-10 per locule. [*Gilia aggregata* (Pursh) Sprengel]. Ca. 7 subspp.; w N. Amer.

Subsp. ***formosissima*** (Greene) Wherry. —Calyx lobes acuminate; corolla tube 18-25 mm long, the throat 4-8 mm wide; anthers and stigma usually exerted. $2n=14$. [*G. aggregata* var. *maculata* Jones] —Open sites, shrublands, pinyon-juniper woodland, coniferous forest; Apache, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Yavapai cos.; 1680-2840 m (5500-9300 ft); May-Sep; CA to CO, s to AZ and TX. Subsp. *aggregata*, with attenuate calyx lobes longer than the tube and anthers located in the throat, occurs from MT to s CO. Hybrids with *I. tenuituba*, intermediate in corolla size and color, are known from the Kaibab Plateau, San Francisco Peaks, and the White Mountains.

Ipomopsis arizonica (Greene) Wherry (of Arizona). —Short-lived perennial, 20-45 cm tall, simple to branched at base; stems with short glandular hairs. LEAVES sparsely short-pilose, deeply lobed. INFLORESCENCE diffuse to one-sided, with subsessile to short-pedicelled flowers crowded near tips of lateral branches. FLOWER: calyx 3-5 mm long, short-glandular pubescent, the lobes lanceolate, acuminate; corolla magenta, the tube 10-15 mm long, the throat 3-5 mm wide, the lobes ovate, acuminate to apiculate, not conspicuously flecked; stamens inserted near the mid-tube; filaments subequal; anthers included in the tube; stigma slightly exceeding the anthers. CAPSULE 5-8 mm long; seeds 4-7 per locule. $2n=14$. [*Gilia aggregata* (Pursh) Sprengel var. *arizonica* (Greene) Fosberg] —Open sites, pinyon-juniper woodland, coniferous forest; Coconino, Mohave cos.; 1525-2440 m (5000-8000 ft); May-Oct; se CA to s UT and AZ.

Ipomopsis congesta (Hook.) V. E. Grant (congested, referring to flowers). —Perennial, herbaceous to woody at base, 20-60 cm tall, simple to branched at base; stems with short, white, curly or woolly hairs. LEAVES subglabrous to short woolly, entire to pinnately or palmately lobed. INFLORESCENCE a dense terminal head, bracteate; flowers subsessile to sessile. FLOWER: calyx 3-4 mm long, the lobes lanceolate, acuminate; corolla white, the tube 3-5 mm long, the throat 0.5-1 mm wide, the lobes rounded, sometimes with pinkish flecks; stamens inserted on the throat between the lobes; filaments subequal; anthers and stigma slightly exerted. CAPSULE 1.5-2 mm long; seeds 1-2 per locule. $2n=14$. —7 subspp.; w N. Amer.

Subsp. **frutescens** (Rydberg) A. G. Day —Stems several, woody at base, with short, curly hairs. LEAVES entire. —Rocky outcrops, gravelly soils, pinyon-juniper woodland; Coconino, Mohave cos.; 1525-1620 m (5000-5300 ft); Jul-Aug; w CO to UT, s to n AZ .

Ipomopsis gunnisonii (Torrey & A.Gray) V. E. Grant (John W. Gunnison, surveyor). —Annual, 3-30 cm tall, simple to branched; stems glabrous or with short glandular hairs. LEAVES glabrous to sparsely short pilose, entire to remotely few toothed.

INFLORESCENCE with flowers congested in terminal heads, bracteate; flowers subsessile. FLOWER: calyx 3-4.5 mm long, glabrous to sparsely glandular, the lobes acuminate; corolla white to pale lavender, the tube 4-7 mm long, throat 0.5-1 mm wide, the lobes rounded; stamens inserted on the upper tube or throat; filaments subequal; anthers and stigma slightly exerted. CAPSULE 3-4 mm long; seeds 1-2 per locule. $2n=14$. [*Gilia gunnisonii* Torrey & A. Gray] —Sandy soils, shrublands, pinyon-juniper woodland; Apache, Coconino, Navajo cos; 1280-2200 m (4200-7200 ft); May-Jul(Sep); s UT to sw CO, s to AZ and NM.

Ipomopsis longiflora (Torrey) V. E. Grant (long flower). —Annual in AZ or biennial, 25-100 cm tall, simple to branched; stems glabrous to sparsely short pubescent. LEAVES glabrous to sparsely short pilose, deeply lobed. INFLORESCENCE diffuse, with 1-3, subsessile to long pedicelled flowers at tips of branches. FLOWER: calyx 5-11 mm long, short glandular pubescent, the lobes lanceolate to ovate, acuminate; corolla white to bluish, tube 30-50 mm long, the throat 2-3 mm wide, the lobes ovate, rounded to acuminate; stamens inserted on the tube; filaments unequal; anthers included to exerted; stigma slightly exceeding the anthers. CAPSULE 7-15 mm long; seeds 8-15 per locule. $2n=14$. [*Gilia longiflora* Torrey]. —3 subspp.; UT to SD, s to TX and n Mex.

1. Capsule 7-10 mm long, equal to or slightly shorter than the calyx in fruit subsp. **australis**
- 1' Capsule 10-15 mm long, 1.5-2 times longer than the calyx subsp. **neomexicana**

Subsp. **australis** Wagner and Fletcher (southern) —Apices of calyx lobes short-pubescent; capsules 7-10 mm long. Open sites, washes; desert shrublands, pinyon-juniper woodlands; 430-2140 m (1400-7000 ft); Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai cos.; Apr-Nov; AZ to sw TX, s to n Mex.

Subsp. **neomexicana** Wilken (of New Mexico) —Apices of calyx lobes glabrous to sparsely short pubescent; capsules 10-15 mm long. Open sites, washes; desert and sagebrush shrublands, pinyon-juniper woodlands; 610-1980 m (2000-6500 ft); Apache, Cochise, Coconino, Mohave, Navajo, Yavapai cos.; May-Sep; UT to CO, s to n Son and n Chih.

Ipomopsis macrosiphon (Kearney and Peebles) V. E. Grant and Wilken (large tube). —Short-lived perennial, 40-80 cm tall, simple to branched; stems often woody at base, with short glandular hairs. LEAVES glabrous to short-pilose and glandular, deeply lobed. INFLORESCENCE one-sided, with subsessile to short-pedicelled flowers crowded near tips of lateral branches. FLOWER: calyx 5-6 mm long, short glandular pubescent, the lobes lanceolate, attenuate; corolla lavender to purple, the tube 30-40 mm long, the throat 2.5-3 mm wide, the lobes lanceolate, attenuate, with dark purple flecks; stamens inserted on the tube; filaments unequal; anthers included to slightly exerted; stigma slightly exceeding the anthers. CAPSULE 4.5-7 mm long; seeds 5-9 per locule. $2n=14$. [*Gilia aggregata* (Pursh) Sprengel var. *macrosiphon* Kearney & Peebles] —Sandy to gravelly soils, coniferous forest;

Apache, Graham, Pima cos.; 2290-2870 m (7500-9400 ft); Jul-Aug. Known elsewhere only from the Sacramento Mts. of NM.

Ipomopsis macombii (Torrey) V. E. Grant (John N. Macomb, surveyor). —Short-lived perennial, 20-75 cm tall, simple to branched at base; stems short pilose to woolly. LEAVES glabrous to sparsely short pilose or glandular, the lower deeply lobed, the upper entire or few lobed. INFLORESCENCE usually one sided, with subsessile flowers crowded near tips of short, lateral branches. FLOWER: calyx 4-7 mm long, short-glandular pubescent, the lobes lanceolate, acuminate; corolla purplish, the tube 15-25 mm long, curved slightly downward, the throat 2-3 mm wide, the lobes obovate, apiculate, sometimes with white or dark purple flecks; stamens inserted on the tube; filaments unequal; anthers included to slightly exerted; stigma slightly exceeding the anthers. CAPSULE 5-7.5 mm long; seeds 1-3 per locule. $2n=14$. [*Gilia macombii* Torrey]. —Sandy to gravelly soils, oak woodland, coniferous forest; Cochise, Pima, Santa Cruz cos.; 1430-2690 m (4700-8800 ft); Jul-Nov; NM to TX, n Mex.

Ipomopsis multiflora (Nuttall) V. E. Grant (many flowers). —Short-lived perennial, 15-50 cm tall, simple to branched at base; stems with short to long, glandular to non-glandular hairs. LEAVES glabrous to sparsely short pilose or glandular, the lower deeply lobed, the upper entire to few lobed. INFLORESCENCE somewhat diffuse to one sided, with subsessile flowers crowded on short, lateral branches. FLOWER: calyx 4-8 mm long, short-glandular pubescent, the lobes short aristate; corolla pale violet to purplish, the tube 5-15 mm long, the throat 1-2.5 mm wide, the lobes subequal, the lower 3 partly united, often with purple flecks; stamens inserted on the upper tube or throat; filaments unequal; anthers exerted; stigma slightly exceeding the anthers. CAPSULE 4.5-7 mm long; seeds 2-8 per locule. [*Gilia multiflora* Nuttall; *Gilia polyantha* Rydberg var. *whitingii* Kearney & Peebles]. —Open sites, desert shrublands, woodlands; Apache, Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai cos.; 670-2590 m (2200-8500 ft); Jul-Oct; s CO, NM, TX, and n Mex. Plants with short corolla tubes (5-8 mm long) included in the calyx have been called *Gilia polyantha* Rydberg var. *whitingii* Kearney and Peebles, which may represent a distinct species. Typical *I. polyantha* (Rydberg) V. E. Grant, endemic to s CO, differs by its taller (40-70 cm), often solitary stems, uniformly glandular pubescence, glabrous to sparsely pubescent calyx lobes, and white corollas with equal lobes.

Ipomopsis polycladon (Torrey) V. E. Grant (many branches). —Annual, 4-12 cm tall, usually with ascending to spreading branches; stems with short glandular hairs and some nonglandular curly hairs. LEAVES subglabrous to short glandular pubescent, coarsely toothed to lobed, the lobes ovate. INFLORESCENCE a congested terminal head, bracteate, the outer bracts leaf-like; flowers sessile to subsessile. FLOWER: calyx 3-6 mm long, the lobes lanceolate, acuminate; corolla white, the tube 3-5 mm long, the throat 0.5-1 mm wide, the lobes rounded; stamens inserted on the throat between the lobes; filaments subequal; anthers and stigma slightly exerted. CAPSULE 4-5 mm long; seeds 1-3 per locule. $2n=14$. [*Gilia polycladon* Torrey] —Sandy or gravelly soils, washes, desert shrublands, pinyon-juniper woodland; Apache, Coconino, Graham, Greenlee, Mohave, Navajo cos.; 890-1700 m (2900-5600 ft); Apr-Jun; e CA to s ID, s to TX, n Mex.

Ipomopsis pumila (Nuttall) V. E. Grant (dwarf). —Annual, 3-18 cm tall, simple to branched; stems short glandular to short woolly. LEAVES subglabrous to short woolly, often glandular, lower deeply lobed, upper lobed to entire. INFLORESCENCE a congested

terminal head, bracteate, the bracts entire to toothed; flowers subsessile. FLOWER: calyx 3-6 mm long, the lobes lanceolate, acuminate; corolla lavender to purplish, the tube 4-8 mm long, the throat 0.5-1 mm wide, the lobes acute to rounded; stamens inserted on the throat between the lobes; filaments subequal; anthers and stigma slightly exserted. CAPSULE 3-5.5 mm long; seeds 2-5 per locule. $2n=14$. [*Gilia pumila* Nuttall] —Sandy soils, desert shrublands, pinyon-juniper woodland; Apache, Coconino cos.; 1490-1920 m (4900-6300 ft); Mar-Jun(Oct); UT to WY, s to TX, n Mex.

Ipomopsis spicata (Nuttall) V. E. Grant (spike, referring to inflorescence). — Perennial, herbaceous to woody at base, 5-15 cm tall, simple to branched at base; stems with short, white, woolly-villous hairs. LEAVES subglabrous to short woolly, entire to trifid, the central lobe longest. INFLORESCENCE a dense terminal head, bracteate; flowers subsessile to sessile. FLOWER: calyx 4-6 mm long, glandular, the lobes sharply acute; corolla cream, brownish when dry, the tube 5-7 mm long, the throat 0.5-1 mm wide, the lobes acute; stamens equally or unequally inserted on the tube; filaments subequal, short; anthers and stigma included to exserted. CAPSULE 3-5 mm long; seeds 1 per locule. $2n=14$. —5 subspp. and 2 vars.; w N. Amer.

Subsp. ***tridactyla*** (Rydberg) Wilken & R. L. Hartm. (three fingers, referring to leaflet number) —Stems several, branched at base. FLOWER: stamens unequally inserted, the anthers included. —Sandstone outcrops, gravelly soils, ponderosa pine woodland; Coconino co.; 2600 m (8530 ft); Jun-Aug; s UT, n AZ. Known from only one location in AZ, on the rim of Grand Canyon (*C. M. Hoak 18031*).

Ipomopsis tenuituba (Rydberg) V. E. Grant (narrow tube). —Short-lived perennial, 35-100 cm tall, simple to branched at base; stems often woody at base, with short glandular hairs, nonglandular below. LEAVES subglabrous to sparsely short-pilose, deeply lobed. INFLORESCENCE narrow, one-sided, with subsessile to short-pedicelled flowers on lateral branches. FLOWER: calyx 4-6 mm long, short glandular pubescent, the lobes acute to acuminate; corolla white to lavender, the tube 25-35 mm long, the throat 2-4 mm wide, the lobes lanceolate to ovate, acuminate to apiculate, often with pink to lavender flecks; stamens inserted unequally on the tube; filaments unequal; anthers included to slightly exserted; stigma slightly exserted. CAPSULE 5-8 mm long; seeds 6-12 per locule. $2n=14$. [*Gilia tenuituba* Rydberg] —2 subspp., OR to ID, s to CA and AZ.

Subsp. ***latiloba*** V. E. Grant and Wilken (wide lobes) —Corolla lobes broadly lanceolate, 4-6 mm wide; anthers slightly exserted. —Open sites, meadows, coniferous forest; Apache, Coconino, Yavapai cos.; 2140-2760 m (7000-9050 ft); Jul-Sep. s UT to n AZ. Hybrids with *I. aggregata* subsp. *formosissima*, intermediate in corolla size and color, are known from the Kaibab Plateau, San Francisco Peaks, and the White Mountains.

Ipomopsis thurberi (Torrey) V. E. Grant (George Thurber, botanist). —Short-lived perennial, 35-100 cm tall, simple to branched at base; stems often woody at base, short glandular above, short pilose below. LEAVES subglabrous to sparsely glandular, deeply lobed. INFLORESCENCE one-sided, with subsessile to short-pedicelled flowers on lateral branches. FLOWER: calyx 6-10 mm long, short-glandular pubescent, the lobes attenuate; corolla lavender to bluish purple, the tube 35-50 mm long, the throat 4-6 mm wide, the lobes ovate to obovate, acuminate to apiculate; stamens inserted unequally on the tube; filaments unequal; anthers exserted; stigma slightly exserted. CAPSULE 8-10 mm long; seeds 5-9 per locule. $2n=14$. [*Gilia thurberi* Torrey]. —Sandy to rocky soils, desert shrublands,

woodlands, coniferous forest; Cochise, Pima, Santa Cruz cos.; 1220-2440 m (4000-8000 ft); Aug-Oct; AZ to TX, n Mex.

Langloisia Greene

Annual, compact, much branched, the branches rigidly spreading to ascending. LEAVES alternate, subsessile, linear to oblanceolate, pinnately toothed to lobed, the teeth and lobes with 1-3 bristles. INFLORESCENCE terminal, compact to subcapitate, bracteate, the bracts leaflike, reduced in size. FLOWERS actinomorphic, subsessile; calyx tube membranes ruptured in fruit, the lobes bristle-tipped; corolla funnelform; stamens equally inserted on the upper tube; filaments equal in length, straight; anthers mostly exerted; style exerted, with 3 stigmatic branches. CAPSULE ellipsoid, triangular in x-section, dehiscent, the 3 valves separating completely with age; seeds 2-10 per locule, gelatinous when wet. $2n=14$. —1 sp.; w U.S. (August Langlois, Louisiana botanist). Timbrook, S. 1986 Madrono 33: 157-174.

Langloisia setosissima (Torrey & Gray) Greene (very setose) —Stems 3-10 cm tall, compact; stems leafy throughout, pubescent with branched hairs. LEAVES oblong to mostly oblanceolate, toothed to lobed, 1-2.5 cm long, the teeth and lobes with 2-3 bristles in the proximal half, the distal half with 1-2 bristles per lobe. FLOWERS: calyx 5-10 mm long, pubescent; corolla funnelform, the tube 10-13 mm long, the lobes white to lavender; stamens equal; anthers exerted; pollen white to blue. CAPSULE 5-8 mm long. —2 subspp.; OR and ID, s to CA and AZ.

Subsp. **setosissima** —Corolla lobe length $1/3$ to $1/2$ the tube length, uniformly colored or purple-streaked; filaments 1-3 mm long. —Washes and bajadas, desert shrublands and woodlands: Coconino, La Paz, Maricopa, Mohave, Pima, Yavapai, Yuma cos.; 500-5000 ft; Feb-Jun-(Aug); sw CA to sw UT, n Son. *L. setosissima* subsp. *punctata* (Coville) Timbrook, which occurs in se CA and not documented in AZ, is characterized by filaments longer than 3 mm and purple- and yellow-dotted corolla lobes.

Leptosiphon Bentham

Annuals or perennials; stems simple to much branched, erect to decumbent, leafy. LEAVES opposite, rarely alternate above, palmately lobed, the lobes confluent with the rachis, linear, flat to terete, acute to weakly spinulose. INFLORESCENCE terminal and compact or axillary, glabrous to pubescent or glandular. FLOWERS pedicelled, actinomorphic; calyx tube membranes usually ruptured or distended in fruit, the lobes equal, linear to attenuate, often mucronate; corolla white to yellow or lavender; stamens equally inserted on the corolla throat or tube; anthers slightly exerted or included; filaments equal in length; style included to exerted. CAPSULE ovoid to oblong; seeds 1-several per locule. —Ca. 30 spp. in sw N. Amer. and S. Amer. (Greek: lepto = narrow + siphon = tube).

1. Perennial; corolla salverform, internal corolla glabrous, external corolla tube glandular pilose.....*L. nuttallii*
- 1' Annual; corolla rotate, with a ring of hairs in the corolla between the tube and throat, external corolla tube glabrous.....*L. aureus*

Leptosiphon aureus (Nuttall) J. M. Porter and L. A. Johnson (golden). —Annual, 3-15 cm tall, usually branched throughout; stems ascending, glabrous to pilose or glandular.

LEAVES: 3-5, linear, mucronate, 3-8 mm long, glabrous to glandular. INFLORESCENCE open, the flowers 1-3, mostly terminal. FLOWERS pedicelled, the filiform pedicels 4-13 mm long; calyx glabrous, campanulate, 3-8 mm long, the lobes equalling the tube, the hyaline membranes as wide as the herbaceous ribs; corolla diurnal, closed at night, rotate, 6-15 mm long, white or bright yellow, the throat maroon to orange, with a ring of hairs between the tube and the throat; stamens inserted on the throat; style slightly exerted. [*Linanthus aureus* (Nuttall) E. Greene] —2 vars.; CA to sw UT, NM and n Mex.

1. Corolla tube and lobes yellow, the throat orange subsp. *aureus*
 1' Corolla tube and lobes white, the throat maroon subsp. *decorus*

Subsp. *aureus* —Corolla lobes equalling the throat, yellow, the throat orange. —Sandy to gravelly soils, washes and bajadas, desert shrubland or woodland: Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai cos.; 450-1860 m (1480-6100 ft); Mar-Jun. Range of the species.

Subsp. *decorus* (A. Gray) J. M. Porter and L. A. Johnson (elegant). —Corolla lobes often longer than the throat, white, the throat maroon. —Sandy to gravelly soils, washes and bajadas, desert shrubland: Maricopa, Mohave, Pima, Yavapai cos.; 450-1070 m (1480-3500 ft); Mar-Jun. Range of the species.

Leptosiphon nuttallii (A. Gray) J. M. Porter and L. A. Johnson (Thomas Nuttall, naturalist). —Suffrutescent perennial to 3 dm tall, branching at the base; stems erect, glabrous to short pubescent. LEAVES: lobes (4-)5-9, linear to oblong, spinulose, 10-20 mm long, short pubescent. INFLORESCENCE compact, the flowers 2-5 in terminal, bracteate clusters. FLOWERS subsessile; calyx glabrous to pubescent, narrowly campanulate, 7-10 mm long, the lobes longer than the tube, the membranes mostly herbaceous, the hyaline part narrow, often obscure; corolla diurnal, salverform, 8-15 mm long, the tube and lobes white, the throat yellow; stamens inserted on the throat; style slightly exerted. $2n=18$. [*Linanthus nuttallii* (A. Gray) Milliken, including subsp. *tenuilobus* R. Patterson, *Linanthastrum nuttallii* (A. Gray) Ewan] —3 subsp.; w N. Amer. Reports of *Linanthus nuttallii* subsp. *floribundus* (Gray) Munz [*Linanthus floribundus* (A. Gray) Milliken] from AZ are incorrect.

Subsp. *nuttallii*. —Leaf lobes linear to linear-lanceolate. —Sandy to rocky soils, meadows, coniferous forest, oak woodland; Mts. of Apache, Coconino, Gila, Graham, Mohave, Navajo, Pima, Navajo cos.; 1650-1600 m (5400-8500 ft); May-Sep. WA to CO, s to CA, NM, and nw Mex.

***Linanthus* Bentham**

Annuals or perennials; stems simple to much branched, erect to decumbent, leafy. LEAVES mostly opposite, sometimes alternate above, simple to deeply palmately lobed, the lobes confluent with the rachis, linear, flat to terete, acute to weakly spinulose. INFLORESCENCE terminal and compact or axillary, glabrous to glandular. FLOWERS sessile to short pedicelled, actinomorphic; calyx tube membranes ruptured or distended in fruit, the lobes equal, linear to attenuate, often mucronate; corolla white to yellow or lavender, sometimes bluish; stamens equally inserted on the corolla throat or tube; anthers exerted or included; filaments equal in length; style included to exerted. CAPSULE ovoid to oblong; seeds 1-several per locule. —Ca. 24 spp. in w N. Amer. (Greek: linon = flax + anthos = flower).

1. Perennial; leaves firm to rigid, sharply acute to spinulose
 2. Plants with erect stems; sepals, petals, and stamens 5 *L. pungens*
 - 2' Plants cespitose, mat-like; sepals, petals, and stamens usually 4 *L. cespitosus*
- 1' Annual; leaves herbaceous, thin
 3. Calyx lobes 3 to 5 times longer than the tube; stamens inserted at the base of the tube; flowers open during the day
 4. Leaves palmately lobed; flowers terminal, clustered *L. demissus*
 - 4' Leaves simple, entire; flowers solitary, axillary and terminal *L. filiformis*
 - 3' Calyx lobe length equal to or less than the tube; stamens inserted on the tube or throat; flowers closed during the day, open at dusk or night
 5. Calyx 4-5 mm long, the tube glandular *L. jonesii*
 - 5' Calyx 8-16 mm long, the tube glabrous
 6. Filaments short pubescent and swollen at base; corollas 12-20(25) mm long *L. dichotomus*
 - 6' Filaments glabrous at base; corollas 8-16 mm long *L. bigelovii*

Linanthus bigelovii (A. Gray) Greene (John Bigelow, surgeon, U.S.-Mexican Boundary Survey). —Annual, 6-30 cm tall, simple or with 1-5 widely spaced, dichotomous branches above the base, glabrous. LEAVES mostly simple, sometimes with 3 lobes, linear, 1-3.5 cm long, glabrous. INFLORESCENCE open, the flowers 1-3, axillary and terminal. FLOWERS sessile to subsessile; calyx glabrous, narrowly campanulate, 8-13 mm long, the lobes equalling the tube, the hyaline membranes usually wider than the herbaceous ribs; corolla nocturnal, closed during the day, funnellform, 8-16 mm long, white to cream, the lobes tinged with purple; stamens inserted on the upper tube; filaments glabrous; style included. $2n=18$. —Sandy to rocky soils, washes and bajadas, desert shrubland and woodland; Coconino, Gila, Graham, La Paz, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai, Yuma cos.; 60-1400 m (200-4600 ft); Feb-May; s CA to s UT.

Linanthus cespitosus (Nuttall) J. M. Porter and L. A. Johnson (cespitosus). —Perennial, 3-5 cm tall, cespitose, mat-like, much branched throughout; stems ascending to erect, glandular and pilose. LEAVES opposite, densely crowded, palmately lobed, the 3-5 lobes linear to narrowly oblong, glabrous to pubescent, spinulose, the upper leaves subtending clusters of short leaves. FLOWERS sessile; calyx glabrous, narrowly campanulate, 2-7 mm long, the lobes slightly unequal, shorter than the tube, the hyaline membranes narrower than the herbaceous ribs; corolla nocturnal, closed during the day, salverform, 10-20 mm long, cream to yellow (bluish in AZ), the throat sometimes tinged lavender, the lobes 4(5); stamens 4(5), inserted on the upper tube; stigmas 2-3; ovary with 2-3 locules. [*Leptodactylon cespitosum* Nuttall] —Rocky soils, cliff faces, shrubland and woodland; Yavapai Co., 900-1200 m (3000-4000 ft); May-Jun. NV to NE, s to CO. Arizona plants differ in their bluish corollas, higher proportion of 5 corolla lobes, and may represent a distinct species.

Linanthus demissus (A. Gray) Greene (humble). —Annual, 2-10 cm tall, much branched throughout; stems ascending to decumbent, glandular and short pilose. LEAVES: lobes 3-5, linear, mucronate, 5-11 mm long, glabrous to short pubescent. INFLORESCENCE compact, the flowers in terminal, bracteate clusters. FLOWERS subsessile; calyx glandular, campanulate, 4-7 mm long, the lobes free to near the base; corolla diurnal, white to cream, the lobes white with purple flecks or streaks at the base;

stamens inserted at the base of the tube; style slightly exerted. $2n=18$. —Washes, bajadas, desert shrublands and woodlands: La Paz, Maricopa, Mohave, Pinal, Yavapai, Yuma cos.; 270-900 m (900-3000 ft); Feb-May; s CA to sw UT.

Linanthus dichotomus Benth. (dichotomous). Evening Snow. —Annual, 5-20 cm tall, simple or with 1-5 dichotomous branches, glabrous. LEAVES mostly simple, sometimes with 3 lobes, 1-3.5 cm long, glabrous. INFLORESCENCE open, the flowers 1-2, axillary and terminal. FLOWERS mostly sessile; calyx glabrous, narrowly campanulate, 9-15 mm long, the lobes equalling the tube, the hyaline membranes usually wider than the herbaceous ribs; corolla nocturnal in AZ, closed during the day, funnelform, 12-20-(25) mm long, white to cream, the lobe margins often tinged purplish; stamens inserted on the lower tube; filaments swollen and short pubescent at the base; style included. $2n=18$. —2 vars. from CA to NV.

Var. ***dichotomus***. —Corolla nocturnal, closed during the day. —Washes and bajadas, desert shrublands and woodlands: La Paz, Maricopa, Mohave, Pinal, Yuma cos.; 150-1200 m (500-4000 ft); Feb-May; s CA to NV.

Linanthus filiformis (Parry ex A. Gray) M. Porter and L. A. Johnson (filiform). —Annual, 4-15 cm tall, branched throughout; stems glabrous to sparsely glandular. LEAVES glabrous to sparsely glandular, gradually reduced upwards, entire, linear to filiform. INFLORESCENCE open, with 1-2 pedicelled flowers in axils or at tips of branches. FLOWERS: calyx 2-5 mm long, glabrous, the lobes 1-4 mm long, acuminate to linear-lanceolate; corolla diurnal, funnelform, 4-7 mm long, yellow, the lobes much longer than the inconspicuous tube and throat; stamens inserted on the tube; anthers exerted; stigma slightly exceeding the anthers. CAPSULE 2-4 mm long, broadly ovoid. [*Gilia filiformis* Parry ex A. Gray] —Sandy washes, rocky slopes, desert shrubland; Mohave Co. (Colorado River Valley); 150-1350 m (500-4500 ft); Feb-May; s CA to sw UT, s to AZ.

Linanthus jonesii (A. Gray) Greene (M. E. Jones, geologist and engineer). —Annual, 4-10 cm tall, much branched throughout; stems ascending to erect, glandular. LEAVES entire to deeply palmately lobed, the lobes 10-20 mm long, glabrous. INFLORESCENCE compact, the flowers 1-3, terminal to axillary. FLOWERS subsessile; calyx glandular pubescent, narrowly campanulate, 4-5 mm long, the lobe length less than the tube, the hyaline margins about as wide as the herbaceous ribs; corolla nocturnal, closed during the day, funnelform, 4-7 mm long, cream, the throat and tube tinged with purple; stamens inserted on the throat; style included to slightly exerted. —Washes, desert shrublands: La Paz, Pinal, Yuma cos.; 120-300 m (400-1000 ft); Feb-Apr; se CA.

Linanthus pungens (Torrey) J. M. Porter and L. A. Johnson (sharp-pointed). Prickly Phlox. —Subshrub, 1-4 dm tall, branching mostly below the middle; stems ascending to erect, glandular and pilose. LEAVES opposite below, alternate above, palmately to pinnately lobed, the 3-9 lobes linear to narrowly oblong, glabrous to pubescent, spinulose, the upper leaves subtending clusters of short leaves. FLOWERS: calyx 6-10 mm long, glabrous to sparsely pubescent, the lobes slightly unequal, usually shorter than the tube; corolla nocturnal, closed during the day, salverform, 14-20(25) mm long, cream to light yellow-orange, the throat often tinged lavender or purple; stamens 5, inserted on the upper tube; stigmas 3; ovary with 3 locules. [*Leptodactylon pungens* (Torrey) Rydberg, including subsp. *pungens* and subsp. *brevifolium* (Rydberg) Wherry] —Sandy to rocky soils, shrubland, coniferous forest and woodland; Apache, Coconino, Navajo cos.; 1700-2100 m (5600-7000 ft); May-Sep. B.C. to MT, s to CA and NM.

Loeselia L.

Annual to short-lived perennial; stems usually much branched, erect to prostrate, leafy. LEAVES cauline, alternate in AZ, simple, serrate, spinulose to spinose. INFLORESCENCE axillary, flowers solitary or crowded, bracteate, glabrous to glandular; bracts entire, closely subtending each flower, the outer 2-3 herbaceous to membranous, the inner 2-3 translucent and conspicuously veined. FLOWERS subsessile (sometimes appearing pedicelled because bracts resemble sepals), actinomorphic to slightly zygomorphic; calyx tube membranes slightly distended in fruit, the lobes usually equal; corolla actinomorphic to slightly bilabiate, white, bluish, or red; stamens equally to unequally inserted on the upper tube or throat; filaments equal to subequal in length, glabrous; anthers usually exserted; style usually exserted. CAPSULE ellipsoid to ovoid; seeds 1-3 per locule. —Ca. 13 spp.; AZ and TX, s to n S. Amer. (for Johannes Loesl, German botanist and physician).

Loeselia glandulosa (Cav.) G. Don. (glandular). —Short-lived perennial, 22-70 cm tall; stems erect to ascending, branched throughout, glandular. LEAVES alternate, 8-30 mm long, elliptic to linear-lanceolate, sparsely glandular, the tips acute, the margins serrate, the teeth aristate. INFLORESCENCE with 1-5 subsessile flowers on the upper branches, each flower closely subtended by 1 leaf and 5-6 bracts, the bracts 5-8 mm long, narrowly oblong to linear-lanceolate, the tips aristate. FLOWER: calyx 5-7 mm long, mostly translucent, the herbaceous ribs narrow, the tips short-aristate; corolla 9-12(20) mm long, funnelform, bluish violet to lavender, the tube equal to the lobes, the upper 2 lobes erect, the lower 3 spreading; stamens inserted equally, exserted; filaments bent upward; stigma exserted, located among or exceeding the anthers. CAPSULE 3.5-4.5 mm long, ellipsoid. —Canyons, rocky slopes; 1130-1620 m (3700-5200 ft); Aug-Oct (Jan); Santa Cruz Co.; AZ and TX, s to C. Amer. Turner, B. L. *Phytologia* 76: 318-337. 1994.

Loeseliastrum (A. Brand) Timbrook

Annual, compact, much branched, the branches rigidly spreading to ascending. LEAVES alternate, subsessile, linear to oblanceolate, pinnately toothed to lobed, the teeth and lobes with 1 terminal bristle. INFLORESCENCE terminal, compact to subcapitate, bracteate, the bracts leaflike, reduced in size. FLOWERS zygomorphic, subsessile; calyx tube membranes ruptured in fruit, the lobes bristle-tipped; corolla 5-merous, bilabiate; stamens subequally inserted on the upper tube; filaments unequal in length, curved; anthers mostly exserted; style exserted, with 3 stigmatic branches. CAPSULE ovoid, with 3 rounded lobes in x-section, dehiscent, the 3 valves separating completely with age; seeds 2-10 per locule, gelatinous when wet. $2n=14$. —2 spp.; w U.S. (from the Greek, resembling *Loeselia*). Timbrook, S. 1986 *Madrono* 33: 157-174.

L. schottii (Torrey) Greene (Arthur Schott, naturalist, Mexican Boundary Survey). —Stems 3-12 cm tall, the upper stems sparsely leafy below, pubescent. LEAVES mostly oblong, toothed to shallowly lobed, 1-3 cm long, the teeth and lobes with 1 bristle, the distal half also ciliate. FLOWERS: calyx 4-6 mm long, the lobes pilose and glandular; corolla bilabiate, the tube 5-10 mm long, the upper lip with 3 lobes, the lower lip with 2 lobes, the lobes white to deep lavender with maroon streaks at the base of the upper lobes; stamens unequal, curving upward; anthers slightly included to exserted; pollen yellow. CAPSULE 2-5 mm long. —Washes and bajadas, desert shrublands and woodlands: La Paz, Maricopa,

Mohave, Yavapai, Yuma cos.; 200-4500 ft; Mar-May; CA to sw UT, nw Mex. Reports of *L. matthewsii* (A. Gray) Timbrook in AZ are incorrect.

Microsteris Greene

Annuals; stems erect to ascending, often much branched. LEAVES mostly opposite, often alternate above and in the inflorescence, simple, entire, linear to elliptic or lanceolate. INFLORESCENCE terminal, the flowers 1-3. FLOWERS pedicelled to subsessile; calyx tube membranes ruptured in fruit, the lobes equal; corolla salverform, white to bluish; stamens unequally inserted on the tube; filaments short, usually equal in length, glabrous; anthers and style usually included. CAPSULE ovoid to ellipsoid; seeds 1(2-3) per locule, conspicuously gelatinous when wet. $2n=14$. —1 sp.; N. Amer. and s S. Amer. (micro + star = steris, for small, star-like corolla).

Microsteris gracilis (Dougl. ex Hook.) Greene (slender). —Annual with 1-3 erect stems, 3-15 cm tall, often branched below, the lower stems ascending or spreading. LEAVES linear to elliptic or narrowly oblanceolate, pubescent and glandular, 1-2(-4) cm long, 2-5 mm wide. INFLORESCENCE: flowers 1-2, subsessile to pedicelled at tips of terminal branches, sometimes axillary; pedicels glandular. FLOWERS: calyx 3-8 mm long; corolla white to bluish lavender, the throat sometimes yellow tinged, the tube 4-8 mm long, the lobes 1-2 mm long, obtuse to retuse; stamens inserted on the upper tube and throat; stigmas located among the lower stamens. SEEDS gelatinous when wet. [*Phlox gracilis* (Hook.) Greene]. —Open, sandy to gravelly sites; Apache, Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Pima, Pinal, Santa Cruz, Yavapai cos.; 300-2450 m (1000-8000 ft); Mar-Aug; w N. Amer., S. Amer.

Navarretia Ruiz & Pavon

Annuals; stems erect to prostrate. LEAVES mostly alternate, sometimes opposite below, twice pinnately lobed in AZ, the lobes narrow, rigid, and spinulose. INFLORESCENCE terminal and axillary, compact, capitate, bracteate, the bracts pinnately to palmately lobed, villous to glandular, spinulose. FLOWERS actinomorphic, sessile; calyx membranes usually remaining intact in fruit, the lobes usually unequal, linear to acuminate, spinulose; corolla (4)5-merous, salverform to funnellform, white, yellow or blue; stamens inserted at the same level on the upper tube or throat; filaments mostly equal in length; anthers included in the throat or exerted; style included or slightly exerted, the stigmatic lobes 2-3, short or obscure. CAPSULE ovoid to ellipsoid, dehiscent to indehiscent; seeds 1-7 per locule, gelatinous when wet. —ca 30 spp. of w N. Amer.; 1 sp. in s S. Amer. (for Francisco Fernandez Navarrete, Spanish botanist, physician).

1. Corolla yellow; calyx lobes glabrous to sparsely short pubescent; stems reddish brown
..... *N. breweri*
- 1' Corolla white to bluish; calyx lobes basally villous; stems white to tan or yellow green
..... *N. intertexta*

Navarretia breweri (A. Gray) Greene (William H. Brewer, botanist, geologist). —Plants 3-7 cm tall; stems mostly erect, simple or branching above, reddish brown, densely pubescent. LEAVES 8-18 mm long, glabrous to short pubescent, the rachis flattened, the lobes linear, the lateral lobes 2-6, mostly simple. INFLORESCENCE terminal, compact,

subcapitate, the bracts similar to the cauline leaves. FLOWERS subsessile; calyx 7-10 mm long, the tube glandular short pubescent, the lobes simple; corolla salverform, yellow, 6-8 mm long; stamens inserted on the upper tube below the sinuses; filaments 1-2 mm long; anthers exerted; style exerted; stigmatic lobes mostly 3, situated below the anthers. CAPSULE broad ovoid, mostly 3-locular, dehiscent, 3-5(-8) mm long; seeds 1-2(-3) per locule. —Infrequent on rocky or clay soils of flats: Coconino Co. (Navajo Mt.); 2290-2560 m (7500-8400 ft); Jun; WA and ID, s to CA and n AZ.

Navarretia intertexta (Bentham) Hook. (interwoven). —Plants 3-25 cm tall; stems erect to decumbent, simple to branching near the base, white, tan or yellow green, short pubescent below, sparsely to densely villous above. LEAVES 8-22 mm long, the rachis flattened, the lobes 4-8, linear, simple or some forked. INFLORESCENCE terminal, compact, subcapitate, the bracts similar to the upper cauline leaves. FLOWERS subsessile; calyx 6-8 mm long, the tube short pubescent to villous, especially at the top, the lobes simple or some forked; corolla white to bluish, 4-7 mm long; stamens inserted on the upper tube; filaments 1-1.5 mm long; anthers exerted; style slightly exerted; stigmatic lobes mostly 2, situated below the anthers. CAPSULE mostly 1-2-locular, indehiscent except when wet; seeds 4-8 per locule. —2 subspp.; w N. Amer.

Subsp. **propinqua** (Suksdorf) A. G. Day (near to, referring to typical subsp.) —Plants 3-9 cm tall; stems and floral bracts sparsely villous. —Ephemerally moist sites, edges of drying ponds or reservoirs, sagebrush shrubland, pine forest: Coconino, Navajo cos.; 1830-2560 m (6000-8400 ft); Jun-Sep (Oct); s Can. to CO and Baja C. Reports of *Navarretia minima* Nuttall from AZ are incorrect.

Phlox L.

Perennial, often cespitose; stems erect to decumbent, often much branched. LEAVES mostly opposite, often alternate only in the inflorescence, simple, entire, linear to elliptic or lanceolate. INFLORESCENCE terminal, the flowers 1-3. FLOWERS pedicelled to sessile; calyx tube membranes ruptured in fruit, the lobes equal; corolla salverform, white to red, blue or purple; stamens unequally inserted on the tube; filaments short, usually equal in length, glabrous; anthers and style usually included. CAPSULE ovoid to ellipsoid; seeds 1(2-3) per locule, usually not gelatinous when wet. $2n=14,28,42$. —70 spp.; N. Amer., 1 sp. in s S. Amer., 1 sp. in Siberia. (Greek: phlox = flame, from the brightly colored corollas). Wherry, E. 1955. The Genus Phlox. The Morris Arboretum.

1. Plants compact to matted, mostly less than 1 dm high; flowers subsessile to sessile
 2. Stems, leaves subglabrous to loosely hairy; calyx membranes ridged to slightly distended below *P. austromontana*
 - 2' Stems, leaves short hirsute to canescent or woolly; calyx membranes flat or transversely wrinkled below
 3. Stems and leaves short hirsute *P. griseola*
 - 3' Stems densely short pilose to woolly *P. canescens*
- 1' Plants open; stems ascending to erect, mostly 1-6(8) dm tall; flowers pedicelled
 4. Corolla lobes retuse to emarginate.
 5. Vegetative and floral shoots widely spaced, from long slender horizontal rhizomes; corolla lobes erose to emarginated, only slightly if at all notched *P. cluteana*

- 5' Vegetative and floral shoots arising from a single, thick, ascending rhizome; corolla lobes deeply retuse
- 6. Stamens inserted on the upper tube; styles 7-15 mm long; stigmas located among the anthers..... *P. amabilis*
- 6' Stamens inserted on the mid tube; style 2-5 mm long; stigmas located below the anthers *P. woodhousei*
- 4' Corolla lobes rounded to truncate
 - 7. Calyx membranes distended to ridged below *P. longifolia*
 - 7' Calyx membranes flat or transversely wrinkled
 - 8. Corolla salverform; ovary with 2-3 ovules per locule; stems 1-3 dm.....
..... *P. nana*
 - 8' Corolla narrowly funnellform; ovary with 1 ovule per locule; stems 2-6(-8) dm *P. tenuifolia*

Phlox amabilis A. Brand (lovely). —Perennial with 1-5 erect stems from a short, deep seated rhizome, rarely suffrutescent; stems 8-25 cm tall, sparsely glandular, the lower internodes evident. LEAVES linear-oblong to narrowly elliptic, flat, acute to obtuse, 1-4(5) cm long, 2-5(8) mm wide, the upper leaves glandular and short-villous. INFLORESCENCE: flowers 2-3; pedicels glandular. FLOWERS: calyx 8-10 mm long, the membranes flat; corolla bright pink to red-purple, the tube 10-17 mm long, the lobes 5-10 mm long, retuse to emarginate; stamens inserted on the upper tube; stigmas usually located among the stamens. —Open sites, coniferous forest and woodland: Coconino, Mohave, Navajo, Yavapai cos.; 1000-2400 m (3500-7800 ft); Mar-Jun; sc UT, n AZ.

Phlox austromontana Coville (of the western mountains). —Compact, matted, taprooted perennial, with 8-many decumbent to ascending stems; stems 6-10(15) cm long, the lower internodes obscured by the leaves. LEAVES linear, firm, thick, grayish green, mucronate, glabrous to sparsely pubescent proximally, 8-15(-18) mm long, 1-2 mm wide. INFLORESCENCE: flowers solitary, subsessile. FLOWERS: calyx 6-10(-12) mm long, the membranes weakly ridged to distended; corolla white to light lavender, the tube 8-18 mm long, the lobes 5-8 mm long, obovate, obtuse; stamens inserted on the upper tube; stigmas located below most of the stamens. [subsp. *densa* (A. Brand) Wherry, subsp. *prostrata* (E. Nelson) Wherry]. —Rocky soils, slopes, coniferous forest and woodland: Apache, Cochise, Coconino, Graham, Maricopa, Mohave, Navajo, Pima, Yavapai cos.; 800-2800 m (2500-9000 ft); Apr-Jul; NV & ID s to Baja C. The name *P. diffusa* subsp. *subcarinata* Wherry, which occurs in CA, has been misapplied to collections of *P. austromontana* in AZ.

• **Phlox canescens** Torrey and A. Gray (canescent). —Compact, matted perennial with many decumbent stems; stems 2-5 cm tall, the internodes obscured by the leaves, densely pubescent to woolly. LEAVES linear, firm, thick, green, subulate, 6-10(-12) mm long, 1-2 mm wide, the margins and midrib often thick, glabrous to densely cobwebby woolly below. INFLORESCENCE: flowers solitary, sessile to subsessile. FLOWERS: calyx 5-9 mm long, the membranes flat or wrinkled, the lobe margins glabrous, glandular or woolly; corolla white to light lavender, the tube 8-12 mm long, the lobes 4-7 mm long, obtuse; stamens inserted on the upper tube; stigma located among the stamens. [*P. hoodii* Richardson subsp. *canescens* (Torrey and A. Gray) Wherry]. —Gravelly soils, rocky slopes and ledges, coniferous woodland: Apache, Coconino, Navajo cos.; 1950-2700 m (6400-8800 ft); Apr-May(Aug); WA s to CA and AZ.

Phlox cluteana A. Nelson (William N. Clute, botanist). —Perennial with 1-2 stems from long, slender rhizomes, forming colonies of scattered flowering and vegetative shoots; stems 8-15(-20) cm tall, the internodes evident, the upper internodes often longer than the leaves, glabrous to glandular and short villous. LEAVES linear, elliptic or narrowly lanceolate, flat, acute to obtuse, glabrous to ciliate, sometimes glandular, 1-5 cm long, 2-5 mm wide. INFLORESCENCE: flowers 2-3; pedicels glandular. FLOWERS: calyx 6-10 mm long, the membranes flat; corolla pink to deep red-purple, the tube 15-17(-20) mm long, the lobes 8-10 mm long, emarginate; stamens inserted on the upper tube; uppermost anthers slightly exerted; stigmas located in the upper tube among the upper stamens. —Open sites, coniferous forest: Coconino (Navajo Mt.) and Apache (Lukachukai Mts.) cos.; 2300-2800 m (7500-9000 ft); (Apr-)Jun-Jul; sc UT.

Phlox griseola Wherry (grayish).—Compact, matted perennial with many decumbent to erect stems; stems 2-5(8) mm long, the internodes obscured by the leaves. LEAVES subulate, grayish green, the margins and midrib thick, densely short hirsute to woolly below, 5-10(-12) mm long, 1-2 mm wide. INFLORESCENCE: flowers solitary, sessile. FLOWERS: calyx 7-10 mm long, the membrane flat, the lobe margins short hirsute; corolla white to lavender, the tube 8-12 mm long, the lobes 5-6 mm long, obtuse; stamens inserted on the upper tube; stigmas located below most of the stamens. —Open, sandy to rocky sites, coniferous woodland: Mohave Co.; 1200-1300 m (4000-4200 ft); Apr-May; s NV to sw UT.

Phlox longifolia Nuttall (long-leaved). —Taprooted perennial with 3-8(10) erect to ascending stems, often suffrutescent; stems 1-3(4) dm tall, sometimes loosely clumped, the internodes evident, glabrous to glandular and short villous. INFLORESCENCE: flowers 2-3, pedicelled; pedicels glandular to short pilose. FLOWERS: calyx 7-12 mm long, the membranes carinate to ridged at the base; corolla white to deep pink, the tube 12-30 mm long, the lobes 5-12(-15) mm long, obovate, obtuse; stamens inserted on the upper tube; stigmas located among the stamens. [Subsp. *compacta* (A. Brand) Wherry, *cortezana* (A. Nelson) Wherry, *longipes* Wherry, *P. grayi* Wooton & Standley, *P. stansburyi* (Torrey) Heller]. —Sandy to rocky soils, open sites, shrublands and woodlands; Apache, Cochise, Coconino, Gila, Mohave, Navajo, Yavapai cos.; 980-2070 m (3200-6800 ft); Apr-Jun; British Columbia to MT, s to e CA and NM. Geographic and ecological variation with respect to habit, leaf size, and floral morphology is complex throughout the range of the species and in much need of study.

Phlox nana Nuttall (dwarf) —Taprooted perennial with 1-7 ascending to erect stems; stems 1-3 dm tall, the internodes evident. LEAVES linear to narrowly lanceolate, flat, acute, 1-5(-8) cm long, 1-4(-5) mm wide, glabrous to pubescent, the upper often glandular. INFLORESCENCE: flowers 1-3, pedicelled; pedicels sparsely to moderately glandular. FLOWERS: calyx 11-18 mm long, the membrane flat or wrinkled; corolla white to bright pink, the tube 12-18 mm long, the lobes 10-15 mm long, obtuse; stamens inserted on the mid tube; stigmas located below most of the anthers; ovary with 2-3 ovules per locule. [*P. n.* subsp. *glabella* (Gray) A. Brand; *P. triovulata* Thurber]. —Open rocky slopes, desert shrublands, woodlands: Cochise Co.; 1100-1550 m (3600-5100 ft); Apr-Jun(-Sep); AZ to TX.

Phlox tenuifolia E. E. Nelson (narrow leaf). —Perennial with 1-6 stems, suffrutescent; stems 3-6(-8) dm tall, the internodes evident, pilose to short villous. LEAVES linear to narrowly lanceolate, flat, 2-5 cm long, 1-3 mm wide, glabrous to sparsely pilose. INFLORESCENCE: flowers 2-3; pedicelled; pedicels sparsely glandular to short pilose.

FLOWERS: calyx 7-12 mm long, the membranes flat; corolla narrowly funnelform, white to lavender, the tube 7-16 mm long, the lobes 3-5 mm wide, obtuse to truncate; stamens inserted on the upper tube; stigmas located among the anthers. —Open to shaded sites, canyons, rocky ravines, shrublands or woodlands: Cochise, Gila, Graham, Maricopa, Pima, Pinal, Yavapai cos.; 400-1500 m (1400-4800 ft); Feb-May, Aug-Sep; AZ to NM and n Chih.

Phlox woodhousei (A. Gray) E. E. Nelson (S. W. Woodhouse, horticulturist, physician). —Perennial with 1-4 stems from a deep seated rhizome, sometimes suffrutescent; stems 6-15 cm tall, the lower internodes evident. LEAVES linear-oblong to narrowly lanceolate, flat, acute to obtuse, glandular and short villous, 1.5-4 cm long, 3-5 mm wide. INFLORESCENCE: flowers 2-3, pedicelled; pedicels glandular, short villous. FLOWERS: calyx 7-9 mm long, the membrane flat; corolla usually bright pink, the tube 10-15 mm long, the lobes 6-10 mm long, retuse to emarginate; stamens inserted on the mid tube; stigmas located well below the stamens. [var. *oculata* A. Nelson]. —Open sites, shrubland, coniferous forest and woodland: Apache, Coconino, Gila, Navajo, Yavapai cos.; 1200-2450 m (4000-8000 ft); Apr-Jun(-Sep); AZ to nw NM.

Polemonium L. Jacob's Ladder, Sky Pilot

Perennial herbs in AZ; stems erect to decumbent. LEAVES alternate, pinnately lobed to compound; leaflets sessile, entire or divided into 2-5 lobes. INFLORESCENCE terminal, open to compact and capitate or rarely axillary and then solitary. FLOWERS actinomorphic; calyx herbaceous, becoming membranous, not ruptured in fruit, the lobes rounded to attenuate; corolla rotate to funnelform or salverform, white, yellow, blue or bluish violet; stamens equally inserted on the corolla tube; filaments equal in length, basally pilose; anthers included to exserted; style included to exserted, with 3 stigmatic branches. CAPSULE globose to ovoid, dehiscent; seeds 1-20 per locule, gelatinous or not when wet. $2n=18,36$. —ca 28 spp.; w N. Amer., 1 spp. in s S. Amer., several spp. in Eurasia. (for Polemon, a Greek philosopher or perhaps from the Greek word, polemos, meaning strife). Grant, V. 1989. Bot. Gazette 150: 158-169.

1. Corolla tubes 20-35 mm long; calyx lobes attenuate.....*P. pauciflorum*
- 1' Corolla tubes less than 20 mm long; calyx lobes rounded, acute or acuminate
 2. Inflorescence capitate to obovoid; leaflets divided into 3-5 lobes*P. viscosum*
 - 2' Inflorescence open, cymose to paniculate; leaflets entire
 3. Flowering stems 5-10 dm tall, with 10-15 internodes*P. foliosissimum*
 - 3' Flowering stems less than 3 dm tall, with 3-6 internodes*P. pulcherrimum*

Polemonium foliosissimum A. Gray (leafy) Leafy Jacob's Ladder. —Perennial with 1-5 leafy stems to 1 m tall, glabrous to pilose or villous. LEAVES 3-10 cm long, 0.8-2 cm wide, glabrous to sparsely glandular; leaflets 15-27, lanceolate to elliptic or ovate, 5-25(-28) mm long, 5-7(-10) mm wide. INFLORESCENCE open to congested, branched. FLOWERS: pedicels 2-8 mm long; calyx 5-8 mm long, the tube and lobes equal in length; corolla bluish-violet to white or light yellow, campanulate, 10-15 mm long, the lobes rounded and longer than the tube; anthers exserted; style exserted, usually exceeding the stamens. CAPSULE 4-6 mm long; seeds 3-5 per locule. Populations vary geographically with respect to leaflet shape and corolla color. Vars. *foliosissimum* and *flavum* intergrade at several localities in the White Mts. —NV and ID, s to AZ and w NM.

1. Corollas bluish violet to lavender var. *foliosissimum*
- 1' Corollas white to light yellow, sometimes tinged with lavender
 2. Corolla white to cream, the lobes usually rounded; leaflets elliptic to narrowly ovate var. *alpinum*
 - 2' Corollas light yellow, sometimes tinged with lavender; leaflets narrowly lanceolate to ovate var. *flavum*

Var. **foliosissimum** —STEMS glandular pubescent. LEAVES: leaflets 15-29. elliptic to narrowly ovate. FLOWERS: corollas bluish violet to lavender, the lobes rounded to acute. [*P. robustum* Rydberg]. —Open sites, meadows, and along streams, coniferous forests; Apache, Cochise (Huachuca Mts.), Coconino, Greenlee, Navajo cos.; 2150-3050 m (7000-10000 ft); Jun-Aug (Oct). Range of the species.

Var. **alpinum** A. Brand —STEMS glandular pubescent. LEAVES: leaflets 11-25, elliptic to narrowly ovate. FLOWERS: corollas white to cream, the lobes usually rounded. [subsp. *albiflorum* (Eastwood) A. Brand]. —Rocky, open sites; coniferous forest; Coconino, Apache cos. 1610-2440 m (5280-8000 ft); Jun-Aug; se ID to sw WY, s to AZ.

Var. **flavum** (Greene) Anway —STEMS glandular, short pubescent above, glabrous below. LEAVES: leaflets 17-25, narrowly lanceolate to ovate. FLOWERS: corollas light yellow, sometimes tinged with lavender, the lobes acute to acuminate. [*P. filicinum* Greene, *P. flavum* Greene]. —Canyons, shaded sites, coniferous forest, oak woodland; Apache, Cochise (Chiricahua Mts.), Graham, Greenlee, Pima cos.; 2040-2740 m (6700-9000 ft); Jun-Aug; AZ to NM.

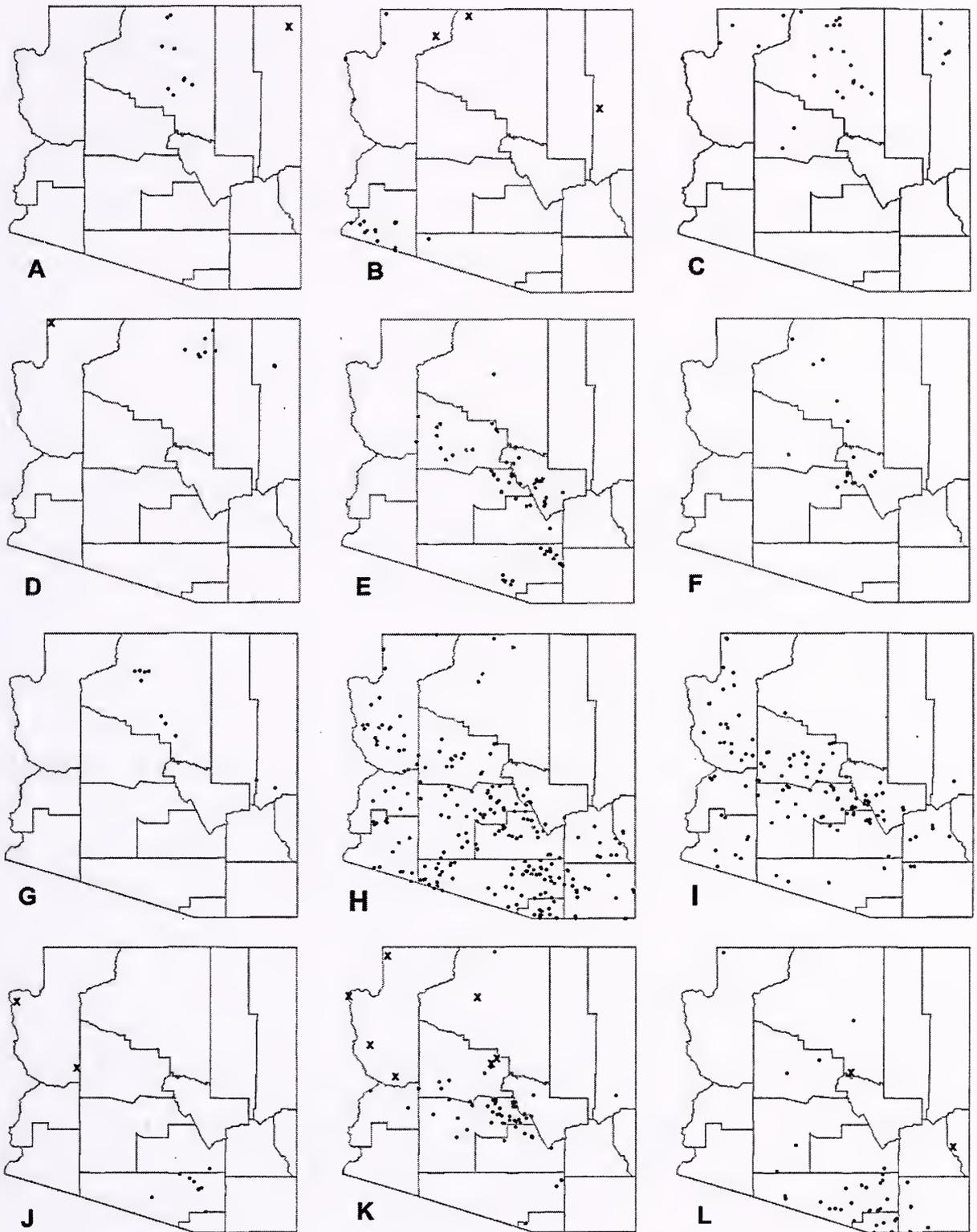
Polemonium pauciflorum S. Watson (few-flowered). —Perennial with 1-several leafy stems, 2-8 dm tall, glandular and sparsely to densely pilose. LEAVES 9-20 cm long, 1.5-6 cm wide, viscid; leaflets 11-25, lanceolate to narrowly ovate, 10-30 mm long, 5-10 mm wide. INFLORESCENCE open, branched. FLOWERS: pedicels 15-40 mm long; calyx tube 8-10 mm long, the lobes attenuate, 8-18 mm long; corollas yellow, often tinged or streaked with red, funnellform to salverform, the tubes 20-35 mm long, the lobes ovate to obovate; anthers included in the throat to slightly exserted; style included to slightly exserted, usually exceeding the stamens. CAPSULE 8-15 mm long; seeds 11-20 per locule. —Gravelly or rocky slopes, canyons, conifer and oak forests: Cochise Co. (Chiricahua Mts.); 1520-2720 m (5000-8900 ft); Jul-Sep. AZ to w TX and n Mex.

Polemonium pulcherrimum Hooker (very beautiful) —Perennial with several stems, 5-40 cm tall, glabrous to sparsely pilose glandular, each with 1-4 leaves. LEAVES 3-11 cm long, 0.5-2 cm wide, villous to glandular pilose; leaflets 11-25, ovate to elliptic, 3-15 mm long, 2-7 mm wide. INFLORESCENCE congested to open and elongate. FLOWERS: pedicels 1-8 mm long; calyx tube 2-3 mm long, the lobes lanceolate to ovate, 2-3 mm long; corollas blue-violet, with a yellow or white throat, rotate, the tube 2-5 mm long, the lobes ovate to obovate; anthers slightly exserted; style included to slightly exserted, usually equalling the stamens. CAPSULE 3-4 mm long; seeds 1-3 per locule. —3 subsp.; AK s to AZ and NM.

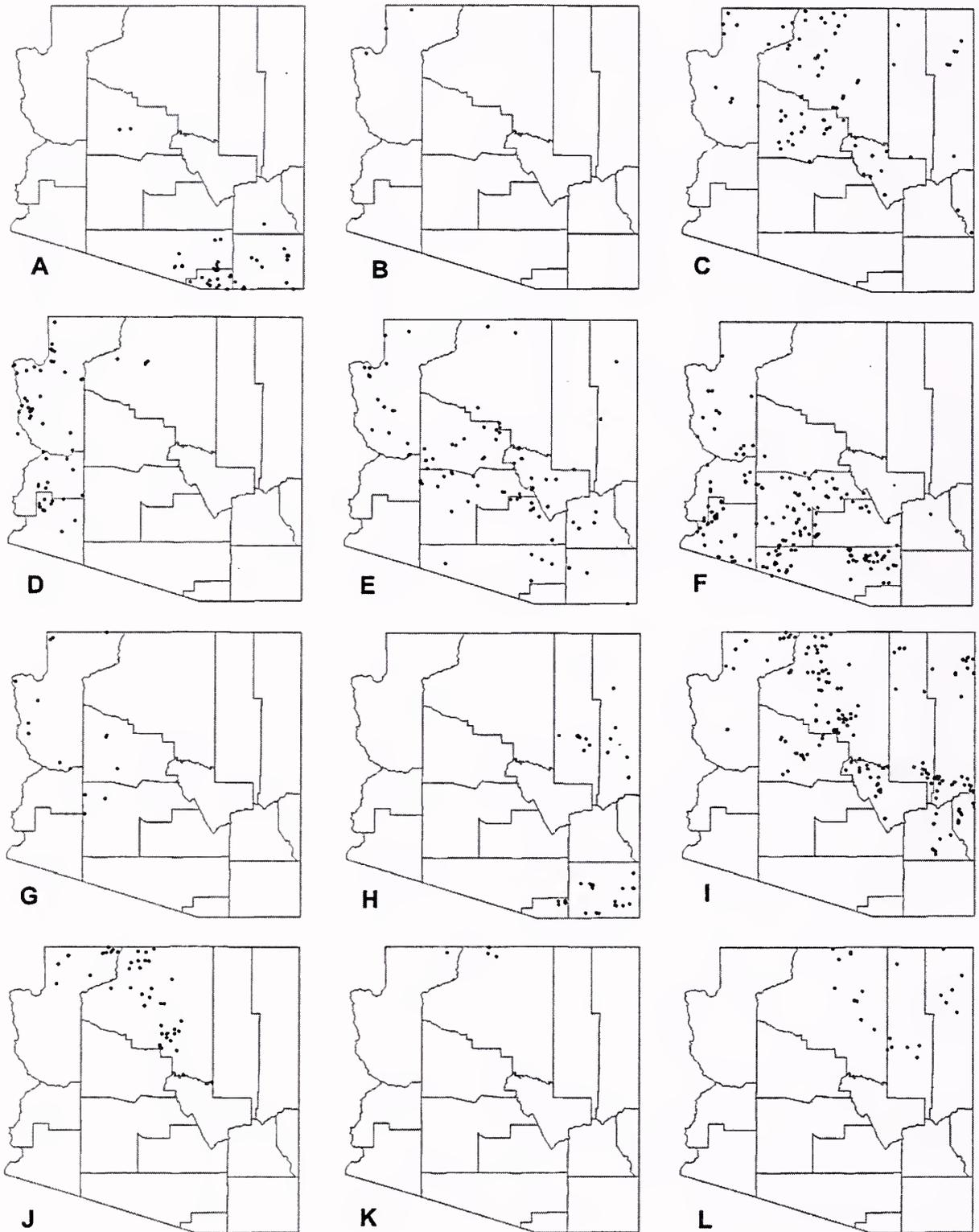
Subsp. **delicatum** (Rydberg) A. Brand (delicate). —Plants 10-25 cm tall; leaves 5-12(-14) cm long, the leaflets 17-25, 5-15 mm long, 3-7 mm wide; calyx lobes mostly longer than the tube; corolla lobes obovate. [*P. delicatum* Rydberg]. —Crevices, rocky slopes,

subalpine conifer forests, talus above timberline: Apache, Coconino cos.; 3050-3840 m (10000-12600 ft); Jun-Aug. e NV to WY, s to AZ and n NM.

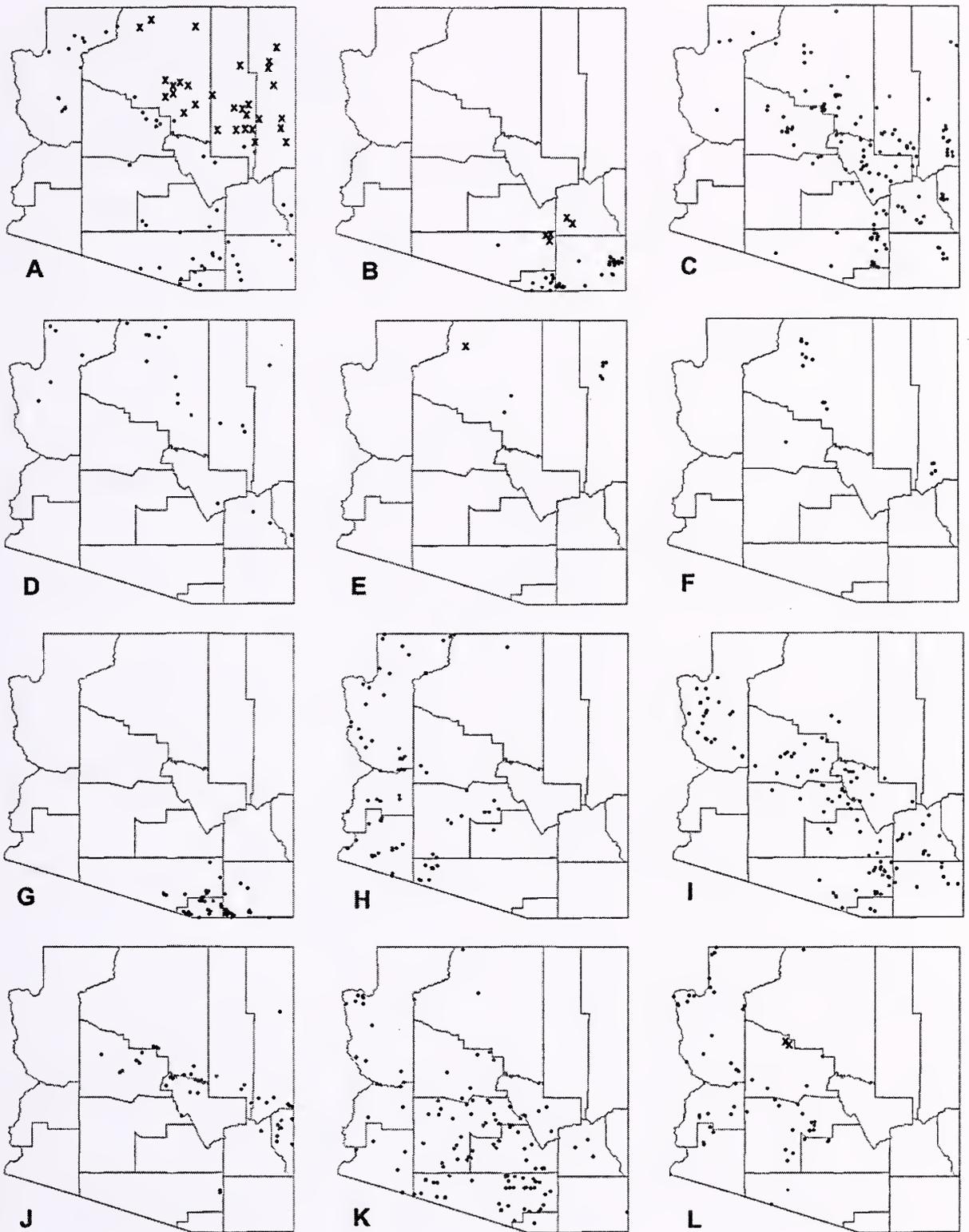
Polemonium viscosum Nuttall (sticky). Sky Pilot. —Perennial herb with 1-4 stems to 20 cm tall, from an underground, branching caudex. LEAVES 5-11 cm long, less than 1 cm wide, glandular short pubescent; leaflets 13-39, each usually divided into 3-5 lobes. INFLORESCENCE capitate to slightly obovoid. FLOWERS subsessile, the pedicels 1-3 mm long; calyx 6-10 mm long, the lobes shorter than the tube; corolla pale blue to bluish violet, rarely white, funnelform, 15-20 mm long, the lobes rounded, shorter than the tube; anthers included in the throat to slightly exserted; style usually exserted. CAPSULE 4-5 mm long; seeds 4-5 per locule. [*P. lemmonii* A. Brand]. —Infrequent on talus at or above timberline, Coconino Co. (San Francisco Peaks); 3050-3860 m (10000-12650 ft); Jun-Aug; WA to MT, s to AZ and n NM.



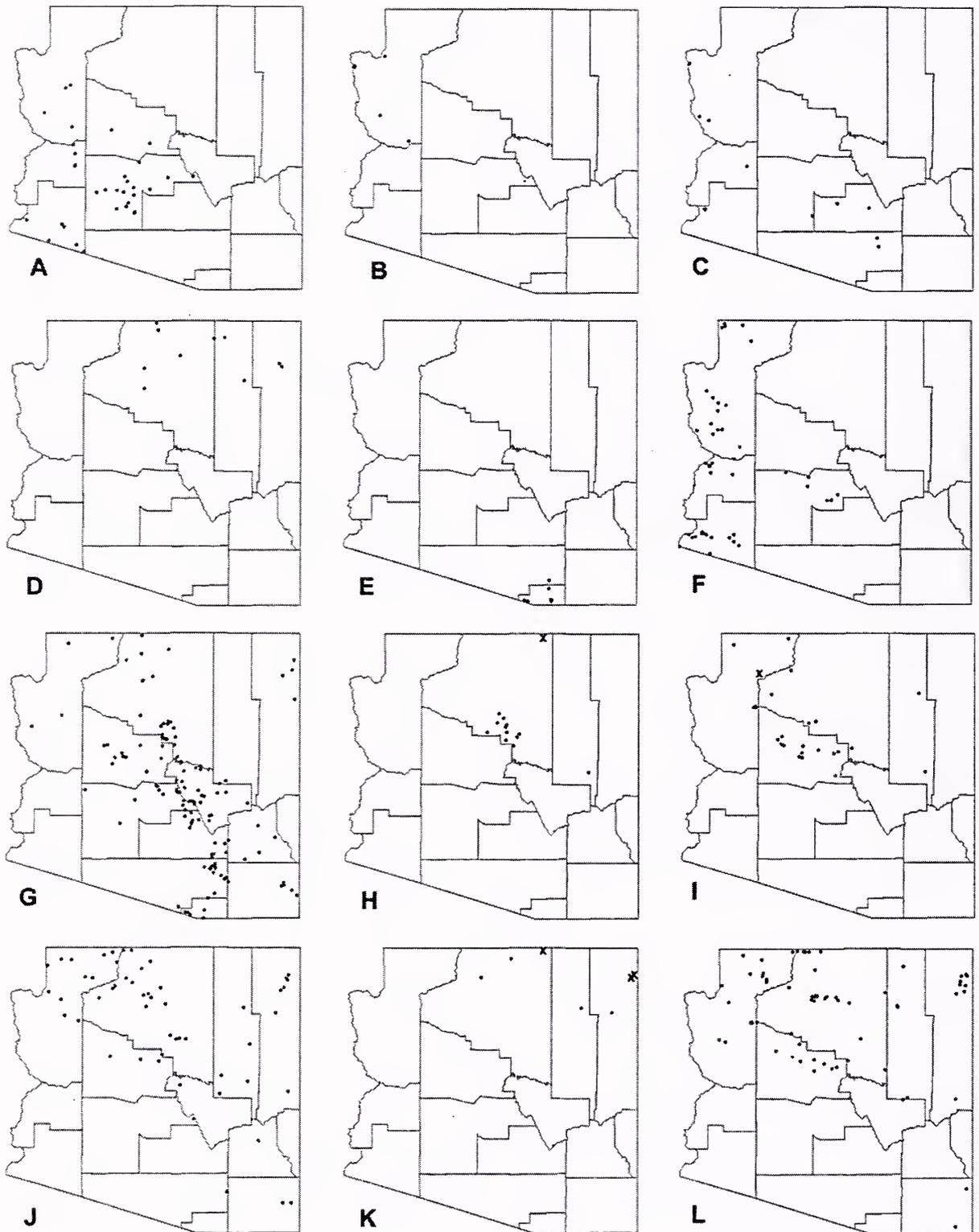
Polemoniaceae Fig. 1. A, *Aliciella hutchinsifolia* (●), *Aliciella haydenii* (x). B, *Aliciella latifolia* (●), *Aliciella triodon* (x). C, *Aliciella leptomeria*. D, *Aliciella subnuda* (●), *Aliciella lottiae* (x). E, *Allophyllum gilioides*. F, *Collomia grandiflora*. G, *Collomia linearis*. H, *Eriastrum diffusum*. I, *Eriastrum eremicum*. J, *Gilia capitata* (●), *Gilia cana* (x). K, *Gilia flavocincta* ssp. *flavocincta* (●), *Gilia clokeyi* (x). L, *Gilia flavocincta* spp. *australis* (●), *Gilia clivorum* (x).



Polemoniaceae Fig. 2. A, *Gilia mexicana*. B, *Gilia minor*. C, *Gilia ophthalmoides*. D, *Gilia scopulorum*. E, *Gilia sinuata*. F, *Gilia stellata*. G, *Gilia transmontana*. H, *Giliastrum acerosum*. I, *Ipomopsis aggregata*. J, *Ipomopsis arizonica*. K, *Ipomopsis congesta*. L, *Ipomopsis gunnisonii*.



Polemoniaceae Fig. 3. A, *Ipomopsis longiflora* ssp. *australis* (●), ssp. *neomexicana* (x). B, *Ipomopsis macombi* (●), *Ipomopsis macrosiphon* (x). C, *Ipomopsis multiflora*. D, *Ipomopsis polycladon*. E, *Ipomopsis pumila* (●), *Ipomopsis spicata* (x). F, *Ipomopsis tenuituba*. G, *Ipomopsis thurberi*. H, *Langlosia setosissima*. I, *Leptosiphon aureus*. J, *Leptosiphon nuttallii*. K, *Linanthus bigelovii*. L, *Linanthus demissus* (●), *Linanthus cespitosum* (x).



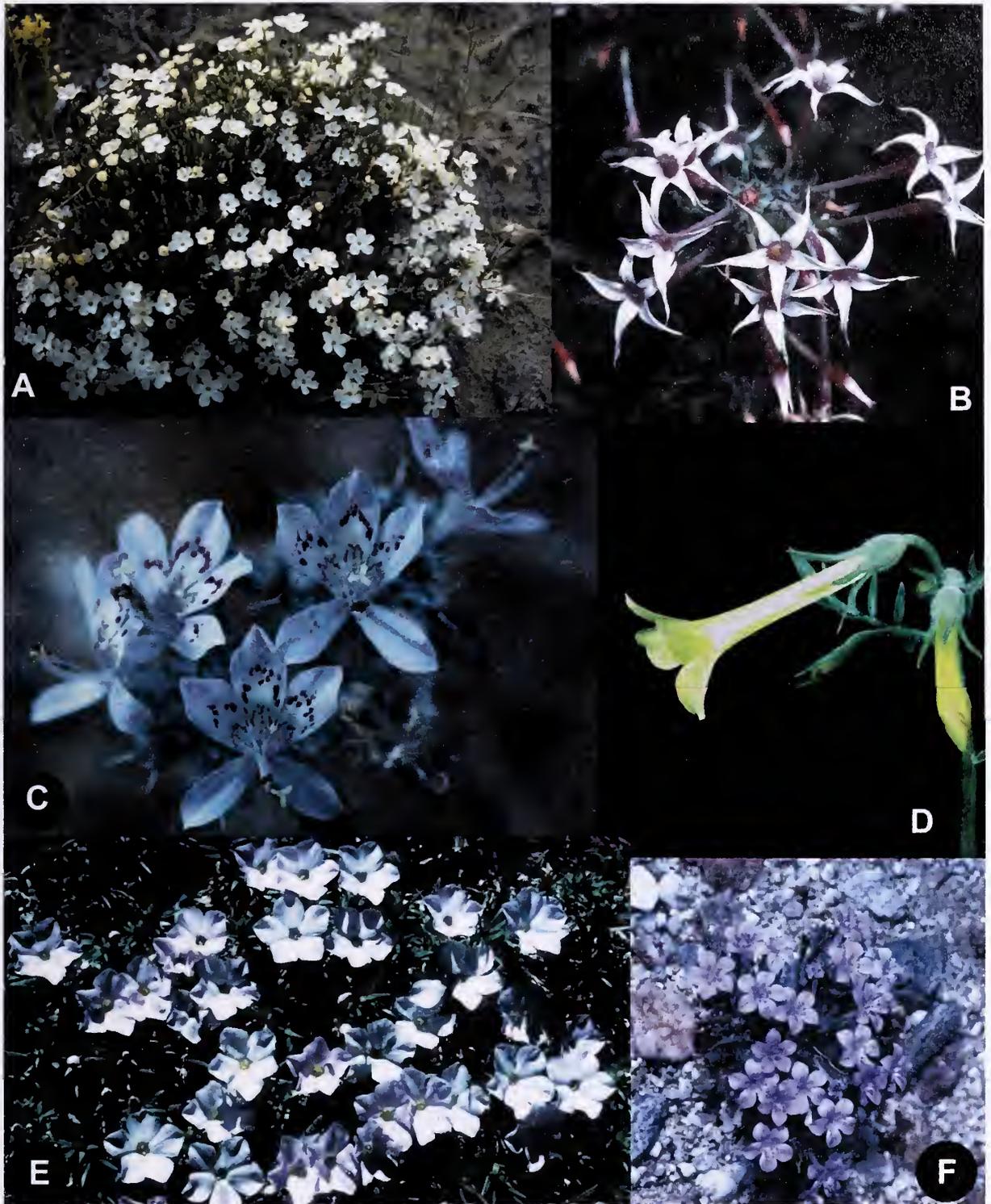
Polemoniaceae Fig. 4. A, *Linanthus dichotomus*. B, *Linanthus filiformis*. C, *Linanthus jonesii*. D, *Linanthus pungens*. E, *Loeselia glandulosa*. F, *Loeseliastrium schottii*. G, *Microsteris gracilis*. H, *Navarettia intertexta* (●), *Navarettia breweri* (×). I, *Phlox amabilis* (●), *Phlox griseola* (×). J, *Phlox austromontana*. K, *Phlox canescens* (●), *Phlox cluteana* (×). L, *Phlox longifolia*.



Polemoniaceae Fig. 5. A, *Phlox nana*. B, *Phlox tenuifolia*. C, *Phlox woodhousei*. D, *Polemonium foliosissimum*. E., *Polemonium pauciflorum* (●), *Polemonium viscosum* (x). F, *Polemonium pulcherrimum*.



Polemoniaceae Fig. 6. A, *Aliciella subnuda*. B, *Ipomopsis multiflora*. C, *Collomia linearis*. D, *Ipomopsis aggregata* var. *formosissima*. E, *Ipomopsis arizonica*. F, *Leptosiphon aureus*. Photos by D. Wilken.



Polemoniaceae Fig. 7. A, *Linanthus pungens*. B, *Ipomopsis tenuituba*. C, *Loeseliastrum schottii*. D, *Polemonium pauciflorum*. E, *Phlox austromontana*. F, *Langlosia setosissima*.

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