

GENTIANACEAE GENTIAN FAMILY

Charles T. Mason, Jr.
Herbarium
113 Shantz Bldg.
University of Arizona
Tucson, AZ 85721

Annual or perennial herbs, rarely shrubs. LEAVES simple, mostly opposite, cauline or forming basal rosettes. INFLORESCENCES mostly cymes. FLOWERS perfect, actinomorphic; sepals and petals 4 or 5, united but often deeply parted; stamens 4 or 5, epipetalous; pistil 1, carpels 2, ovary superior, the placentation mostly parietal. FRUIT a capsule. SEEDS numerous. --80 genera, 900 spp., world-wide.

1. Corolla rotate, with 1 or 2 nectar glands on the inner surface of each lobe *Swertia*
- 1' Corolla tubular campanulate, funnelform or salverform, without nectar glands on the lobes.
 2. Anthers spirally twisted after anthesis; corolla salverform *Centaurium*
 - 2' Anthers not spirally twisted after anthesis; corolla of various shapes, not salverform.
 3. Corolla spurred *Halenia*
 - 3' Corolla not spurred.
 4. Corolla with plicae (plaits) between the lobes *Gentiana*
 - 4' Corolla without plicae between the lobes.
 5. Flowers 2-6 cm long, the corolla lobes longer than the tube.
 6. Flowers 4-merous, dark blue; cauline leaves linear-lanceolate to obovate
..... *Gentianopsis*
 - 6' Flowers 5-merous, white to lavender; cauline leaves oblong, clasping
..... *Eustoma*
 - 5' Flowers 0.5-2 cm long, the corolla lobes shorter than the tube *Gentianella*

Centaurium Hill Centaury

Annual, biennial, or short-lived perennial herbs, to 70 cm tall. LEAVES opposite and sessile, or petioled and in basal rosettes, glabrous. INFLORESCENCE cymose. FLOWERS sessile to long-pedicellate, (4-)5(-6)-merous; calyx tube 0.5-2 mm long, the lobes keeled, linear to linear-lanceolate, often scarious margined; corolla salverform, marcescent, the lobes contorted in bud, shorter than or equaling the tube; anthers spirally twisting after dehiscence; ovary 1-celled; style slender; stigma 2-lobed. FRUIT oblong-ovoid to cylindric capsules. SEEDS oblong to spherical, finely reticulate. --40-50 spp. world-wide except tropical and s Afr. (For the mythological Centaur).

1. Flowers large, showy; corolla lobes 8-12 mm long, the tube 12-20 mm long *C. calycosum*
- 1' Flowers small; corolla lobes 3-5 mm long, the tube 7-12 mm long.
 2. Basal rosette usually absent; cauline leaves prominent, 3-6 pairs, extending into the inflorescence *C. exaltatum*
 - 2' Basal rosette usually present, absent on very small plants; cauline leaves small not prominent, reduced to 1-2(-3) pairs, not extending into the inflorescence *C. nudicaule*

Centaurium calycosum (Buckl.) Fern. (calyx-like). --Annual herbs. STEMS simple or branched at the base, to 70 cm tall, the upper portion often angled and winged. LEAVES 2-5 cm long, lanceolate to ovate; basal rosette common. FLOWERS pedicellate; calyx lobes 7-12 mm long, the tube ca. 1 mm long; corolla pink, rarely white, marcescent, the tube 12-20 mm long, the lobes lanceolate, 8-12 mm long. FRUIT cylindric, 8-14 mm long. $2n = 40$. [*C. arizonicum* (A. Gray) Heller.] --In moist soil and stream beds: all

cos. except Greenlee; 300-1850 m (1000-6100 ft); Feb-Nov; CA, CO, NM, NV, TX, UT; Coah., N. L., S. L. P., Mex.

Centaurium exaltatum (Griseb.) W. F. Wight (exalted). --Annual (biennial?) herbs, 2.5-40 cm tall. STEMS angled, winged, simple or branched. LEAVES lanceolate, elliptic or oblanceolate, 8-35 mm long; basal rosette absent or present on larger (biennial?) plants. FLOWERS 1-several, pedicellate; calyx lobes 5-10 mm long, often scarious margined, the tube 1-2 mm long; corolla pink, rarely white, the lobes 3-5 mm long, the tube (7-)9-12 mm long. FRUIT cylindric, 8-10 mm long. $2n = 80$. --In moist soil and seep areas: Maricopa, Mohave, Pima, Pinal, Santa Cruz cos.; 500-1350 m (1600-4500 ft); Feb-Jun; CA, ID, NM, NV, OR, UT, WA; Baja C., Son., Mex. This and the following species are at times difficult to separate, and possibly represent one variable species.

Centaurium nudicaule (Engelm.) Robins. (naked stem). --Annual (biennial?) herbs, 3-23 cm tall. STEMS angled, winged, simple or branched at the base from a basal rosette of leaves on larger plants. LEAVES of basal rosette 4-15 mm long, oblanceolate to obovate, petiolate; cauline leaves 3-25 mm long, 1-2(-3) pairs, narrow linear lanceolate to elliptic. FLOWERS 1-several in cymes; pedicels 2.5-5 cm long; calyx lobes linear to linear-lanceolate, 3-8(-10) mm long, the tube 0.5 mm long; corolla pink, rarely white, the tube 7-10 mm long, the lobes 4-5 mm long, elliptic. FRUIT cylindric, to 10 mm long. $2n = 42$. --In moist soil and gravel areas: Maricopa, Pima, Pinal, Santa Cruz cos.; 900-1600 m (3000-5200 ft); Apr-May; Baja C., Chih., Son., Mex.

***Eustoma* Salisb. Catchfly-gentian**

Annual or short-lived perennial herbs, more or less glaucous. LEAVES opposite, sessile, entire. FLOWERS long pedicellate, solitary or in panicles; calyx deeply cleft, with 5(-6) linear-lanceolate, lobes; corolla blue, purple, violet, pink, white, or rarely yellow, campanulate, deeply divided, with 5(-6) oblong or obovate lobes, these longer than the tube; style slender; stigmas 2, broadly-lobed. FRUITS ellipsoid capsules. SEEDS small, globose. -- 3 spp.; s U. S. to n S. Amer. (Greek *eu* = good + *stoma* = throat, referring to the large throat of the corolla.) Shinnars, L. H. 1957. Southw. Naturalist 2:38-43.

Eustoma exaltatum (L) G. Don (lofty). --Herbs to 70 cm tall. LEAVES: 2-9 cm long, 0.7-3.5 cm wide; basal leaves obovate; cauline leaves clasping, oblong to oblong elliptic. FLOWERS usually paniculate; pedicels to 7 cm long; calyx lobes to 25 mm long, 0.9-1.7 times as long as the corolla tube; corolla 2-3 cm long, white to lavender, the lobes oblong to obovate, to 20 mm long and twice as long as the tube; style ca 5 mm long; stigmas as wide as long. --Wet, often alkaline or saline areas: Gila, Graham, La Paz, Maricopa, Mohave, Pima, Yavapai, Yuma cos.; 50-1000 m (200-3200 ft); Mar-Nov.; s U. S. from CA to FL, s to n S. Amer.

***Gentiana* L. Gentian**

Annual, biennial, or perennial herbs. STEMS 1-several, simple or sparsely branched. LEAVES opposite, sessile, often gradually reduced and scale-like below, rarely forming a basal rosette. FLOWERS sessile or pedicellate, solitary or in open or congested cymes; calyx of (4-)5(-6) sepals, the lobes minute to well developed, the tube usually with an intracalyxine membrane around the upper rim; corolla marcescent, (4-)5(-6)-lobed, funnellform, cylindric, fusiform, or campanulate, the lobes large and prominent to obsolete, the tube with plicate appendages (plicae) between the lobes, these entire or variously toothed or divided; stamens (4-)5(-6); pistil stipitate or sessile with glands at the base. FRUIT a capsule protruding from or included in the marcescent corolla. SEEDS numerous, usually with a marginal wing. --Ca. 200 spp; world-wide, most common in montane areas of the n hemisphere. (For *Gentius*, King of Illyria).

1. Annuals; flowers solitary, 1-1.4 cm long *G. aquatica*
- 1' Perennials; flowers clustered, rarely solitary, 2.5-4 cm long.
2. Inflorescence terminal with 1-several flowers subtended by conspicuous boat-shaped bracts;

- flowers large campanulate *G. parryi*
- 2' Inflorescence with axillary flowers below the apex; inflorescence leaves (bracts) linear; flowers narrow, funnelform or fusiform.
3. Flowers narrow funnelform; bracts exceeding the flowers..... *G. bigelovii*
- 3' Flowers broadly fusiform; bracts shorter than the flowers *G. rusbyi*

Gentiana aquatica L. (of wet habitats). --Annuals. STEMS 1-several, 1-7 cm tall. LEAVES cauline and in basal rosettes, usually with white margins; basal leaves ovate-elliptic to obovate, 3-7 mm long, 2-5 mm wide; cauline leaves linear-lanceolate, 4-5 mm long, 1-1.5 mm wide, usually imbricate before fruiting. INFLORESCENCE a single terminal flower. FLOWERS 10-14 mm long; calyx tube 4-7 mm long, the lobes 2-3 mm long, linear with white margins; corolla white to light blue, the tube 8-10 mm long, the lobes triangular 2-4 mm long; plicae small triangular points 0.2 mm long; pistil short stipitate. FRUIT cylindric, exceeding corolla; stipe elongating. SEEDS wingless, ca. 1 mm long. [*G. fremontii* Torrey]. Wet high mountain meadows: Apache, Coconino cos.; 2750-2900 m (9000-9500 ft); Jun-Aug; CA, CO, MT, WY; s Can. Eur. Asia

Gentiana bigelovii A. Gray (for J. M. Bigelow). --Perennials. STEMS 7-26 cm tall, sparsely to densely puberulent. LEAVES broadly lanceolate toward the base and becoming linear lanceolate upwards, 3-5.5 cm long, 0.4-1.5 cm wide, the margins and midribs puberulent. INFLORESCENCE dense to open spikes or spicate racemes. FLOWERS 1-3 per node, 2-2.5 cm long, sessile or short-pedicellate, in the axils of linear bracts that usually exceed the flower length; each flower subtended by 2 bracteoles; calyx puberulent, the tube 4-7 mm, the lobes linear, 2-10 mm long, 1/2 the length to exceeding the calyx tube, the sinus between lobes square; corolla narrowly funnelform, the lobes erect, 2-4 mm long with puberulent margins and often an apiculate apex, the plicae 2-or occasionally 3-lobed, 1/2 the length to equaling the corolla lobe. FRUIT narrowly cylindric, short-stipitate, included. SEEDS marginally winged. --Open oak and pine forests: Cochise, Graham, Pima cos.; 2200-2350 m (7300-7700 ft); Aug-Sep; CO, NM, TX.

Gentiana parryi Engelm. (for C. C. Parry). --Perennials. STEMS erect or decumbent, 8-42 cm tall, puberulent in rows as continuations of the leaf margins. LEAVES lanceolate to ovate, 1.5-4.5 cm long, 0.5-2 cm wide, often broadly ovate below, narrowing to lanceolate above, frequently appressed, the margins puberulent. INFLORESCENCE usually a dense apical cluster of several flowers, occasionally with a single terminal flower, rarely with axillary flowers 1 or 2 nodes below the apex; each flower arising from the axil of a boat-shaped bract, closely subtended by 2 narrower bracteoles. FLOWERS blue, occasionally white, 3-4 cm long; calyx tube entire or cut along one side, the lobes to 8 mm long and equaling the tube or reduced and nearly obsolete; corolla campanulate, 2-2.5 cm wide, the lobes 5-8 mm long, rounded, often apiculate, the plicae 1-4 mm long, often bifid. FRUIT cylindric, short-stipitate. SEEDS marginally winged. [*G. bracteosa* Greene]. --Open moist mountain meadows: Apache, Coconino, Greenlee, Navajo cos.; 2450-3500 m (8000-11,500 ft); Aug-Sep; CO, ID, NM, WY.

Gentiana rusbyi Greene ex A. Gray (for H. H. Rusby). --Perennials. STEMS 15-35 cm tall, erect or decumbent, densely puberulent or reduced to rows as continuations of leaf margins. LEAVES linear-lanceolate to lance-ovate 2.5-4 cm long, 0.5-1 cm wide, puberulent on margins and lower surface of midrib. INFLORESCENCE spicate, the flowers few to many, usually at several nodes, sessile or short pedicellate in the axils of linear-lanceolate bracts that are shorter than the flower. FLOWERS blue, rarely white, 2.5-3.5 cm long, closely subtended by 2 bracteoles; calyx tube entire or cut along one side, the lobes 9-10 mm long or reduced and obsolete, the margins puberulent; corolla fusiform, remaining closed, the lobes 2.5-7 mm long, the plicae 1-2-lobed, acute to attenuate, 1.2-3 mm long. FRUIT cylindric, short-stipitate. SEEDS marginally winged. [*G. affinis* of authors not Griseb.]. Open drier mountain meadows and rocky areas: Apache, Coconino, Greenlee, Gila, Navajo cos; 2300-2900 m (7600-9500 ft); Aug-Oct; CO, NM. Hybrids between *G. rusbyi* and *G. parryi* can be found where the 2 species grow together.

Gentianella Monench

Annual, biennial or perennial herbs. STEMS terete or rectangular and winged. LEAVES sessile and somewhat clasping or petioled, often forming a basal rosette. FLOWERS 4- or 5-merous, solitary or in cymes; calyx lobes equal, unequal or reduced to teeth; corolla funnelform, cylindrical or rotate, with or without an internal fringe (corona) at the base of the corolla lobes, the coronal hairs separate or united and forming a coronal scale; pistil stipitate or sessile, fusiform or cylindrical. FRUIT a capsule usually slightly exceeding the marcescent corolla. SEEDS smooth to papillose, globose to slightly flattened. --A large genus with over 200 spp.; world-wide except Africa. (*Gentiana* + Latin diminutive suffix *ella* = little gentian).

- 1. Calyx tube 2-5 mm long, split along 1 side forming a spathaceous sheath with 4-5 minute teeth *G. wislizenii*
- 1' Calyx tube prominent or obsolete, not spathaceous, the teeth variable.
 - 2. Leaves mostly basal, rarely cauline 1-3 nodes; flowers solitary, pedicellate; coronal hairs united below, forming 2 coronal scales at the base of each corolla lobe *G. tenella*
 - 2' Leaves mostly cauline; basal leaves soon withering; flowers in cymes; coronal hairs free or united or absent, if united forming 1 coronal scale at the base of each corolla lobe.
 - 3. Coronal hairs absent; corolla lobes ca. equaling the tube *G. microcalyx*
 - 3. Coronal hairs present, free or united to form a single scale at the base of each corolla lobe, the lobes ca. 1/2 the tube length *G. amarella*

Gentianella amarella (L.) Börner (slightly bitter?). --Annuals or biennials, 3-75 cm tall. LEAVES: basal leaves elliptic to spatulate, petiolate, often forming a weak rosette, withering early; cauline leaves sessile, lanceolate, ovate, to oblanceolate, reduced upwards. FLOWERS 4- or 5-merous, few to many, sessile or short-pedicellate in simple or compound cymes; calyx tube prominent to very reduced, the lobes equal, unequal, sometimes with 1 lobe large, foliaceous; corolla lavender, white, or yellow, cylindrical to narrowly funnelform, 1-2 cm long, the lobes ca. 1/2 the tube length, bearing free or united coronal hairs at their bases; pistil sessile or short stipitate. $2n=36$ --Ca. 7 subspp, 3 in AZ; North Temperate and Arctic regions of N. Amer., s along the mts to c Mex.; Eur., Asia.

- 1. One calyx lobes large, foliaceous and enveloping the others; coronal hairs united below, forming a scale subsp. *heterosepala*
- 1' Calyx lobes equal or unequal, not foliaceous; coronal hairs not united.
 - 2. Calyx lobes ca. 8 mm long, the margins entire, the tube ca. 3 mm long; corolla lobes ca. 7 mm long, the tube ca. 12 mm long; common subsp. *acuta*
 - 2' Calyx lobes 5-7 mm long, the margins scabrous, the tube 5-6 mm long; corolla lobes 5-6 mm long, the tube 11-13 mm long; rare subsp. *wrightii*

Subsp. *acuta* (Michx.) J. M. Gillett (acute, referring to corolla lobes). --Annuals, 3-75 cm tall. LEAVES: basal leaves oblanceolate to spatulate; cauline leaves lanceolate to ovate, somewhat clasping, 3-5 cm long. FLOWERS in simple or compound umbellate cymes; calyx variable, the lobes equal or not, but not foliaceous, 4-8 mm long, the margins entire, the tube 1-3 mm long; corolla lavender or white, cylindrical to funnelform, the lobes 2-7 mm long, the tube 7-12 mm long, the corona hairs not united. [*Gentiana acuta* Michx.; *G. strictiflora* (Rydb.) A. Nelson]. --Wet meadows and forested areas: Apache, Coconino, Graham, Greenlee, Santa Cruz cos.; 1450-3500 m (4700-11500 ft); Aug-Sep; AK, CA, CO, MT, NM, NV, OR, UT, WY; throughout Canada, s to Chih., N. L., Mex.

Subsp. *heterosepala* (Engelm.) J. M. Gillett (different sepals). --Annuals 5-45 cm tall. STEMS rectangular, simple or branched. LEAVES: basal leaves elliptic to oblanceolate; cauline leaves 3.5-4.5 cm long, lanceolate to oblanceolate, somewhat clasping. FLOWERS axillary, 1-several in simple or compound umbellate cymes; calyx deeply divided, the tube ca. 1 mm long, the lobes variable in size, 1 usually large and foliaceous often enclosing the others, the margins entire; corolla 11-18 mm long, the tube 6-11 mm long, the lobes 3-7 mm long, the coronal hairs united forming a scale. [*Gentiana heterosepala* Engelm.]. --Wet

areas in mountain forests of aspen, pine or spruce and on gravelly slopes above timberline: Apache, Coconino, Greenlee cos.; 2500-3550 m (8400-11700 ft); Jun-Sep; CO, NM, NV, UT.

Subsp. *wrightii* (A. Gray) J. M. Gillett (for C. Wright). --Annuals to 75 cm tall. STEMS rectangular, unbranched. LEAVES: basal leaves oblanceolate to spatulate; cauline leaves ovate, somewhat clasping, 1.5-3 cm long, bicolored, lighter below. FLOWERS in dense, axillary cymose clusters; calyx tube 5-6 mm long, the lobes 5-7 mm long, the margins strongly scabrous; corolla white to yellowish, 16-19 mm long, the lobes 5-6 mm long, the corona hairs not united. [*Gentiana wrightii* A. Gray]. --Wet grassy meadows: San Rafael Valley, Santa Cruz Co.; 1450 m (4700 ft); Sep; NM; Chih., Sin., Son., Mex.

Gentianella microcalyx (Lemmon) J. M. Gillett (small calyx). --Annuals 5-50 cm tall. STEMS rectangular, branched. LEAVES: basal leaves oblanceolate, petiolate, soon withering; cauline leaves ovate, somewhat clasping, 3-5 cm long gradually reduced above. FLOWERS 4-parted, in compound umbellate cymes; calyx 2-3 mm long, the lobes 1.5-2 mm long, the tube 0.5-1 mm long; corolla white or pale lavender, tubular, 8-11 mm long, the lobes ca. equaling the tube, the coronal hairs absent; stamens slightly exerted; pistil sessile or short stipitate, cylindric or fusiform. [*Gentiana microcalyx* Lemmon]. --Moist areas along streams or ponds and in pine-oak forests, abundant in burned areas: Cochise, Pima, Santa Cruz cos.; 1600-2450 m (5200-8000 ft); Aug-Oct; Chih., Coah., Dgo., Son., Mex.

Gentianella tenella (Rottb.) Börner (slender). --Annuals 1.5-18(-26) cm tall. LEAVES mostly basal, rarely cauline at 1-3 nodes, 2-15 mm long, sessile or short petioled, lanceolate to oblanceolate. FLOWERS 4-parted solitary, terminal on pedicels 0.5-10 cm long; calyx lobes 4-7 mm long, lanceolate, the tube obsolete; corolla blue, tubular, 5-13 mm long, the lobes ca. 1/3 the corolla length, the coronal hairs united below forming 2 fimbriated scales at the base of each corolla lobe; pistil sessile, ovary fusiform. $2n = 10$. [*Gentiana tenella* Rottb.]. Shallow soil among lava boulders: San Francisco Mts., Coconino Co.; 3600-3650 m (11800-12000 ft); Aug-Sep; CA, CO, NM, NV, UT, WY; n Canada, Greenland, n Europe.

Gentianella wislizenii (Engelm.) J. M. Gillett (for F. A. Wislizenius). --Annuals 3-40 cm tall. STEMS rectangular, branched. LEAVES: basal leaves oblanceolate, petiolate, soon withering; cauline leaves ovate, somewhat clasping, 1-4 cm long, gradually reduced above. FLOWERS 4-5-parted, 8-14 mm long, nearly sessile or on long pedicels, in compound umbellate cymes; calyx 2-5 mm long, split along 1 side forming a spathaceous sheath with 4-5 minute teeth along the rim; corolla white or pale lavender, tubular, the tube 6-10 mm long, the lobes 2-4 mm long, with or without coronal hairs; stamens included; pistil sessile or very short-stipitate, cylindric or fusiform. [*Gentiana wislizenii* Engelm.]. --Pine-oak and mixed coniferous forests: Apache, Cochise, Greenlee cos.; 2450-2950 m (8000-9600 ft); Chih., Dgo., Mex.

Gentianopsis Y. Ma Fringed-gentian

Annual, biennial or perennial herbs. STEMS erect, glabrous. LEAVES sessile and somewhat clasping or petioled, often forming a basal rosette. FLOWERS 4-merous, large, solitary, sessile or terminal on elongated pedicels, the buds ellipsoid or ovoid-ellipsoid, quadrangular; calyx cylindric-campanulate, the lobes usually in pairs unequal in size and shape; corolla tube cylindric-campanulate; lobes oblong, ovate-oblong, spatulate, the margins entire or the apex erose-dentate becoming fimbriate along the sides and entire toward the base; stamens 4; pistil stipitate, fusiform to cylindric. SEEDS elliptic to cylindric, densely papillate. 26 spp.; n temperate regions of N. Amer and Eurasia, s in mts to c Mex. (*Gentian* + Greek *opsis* = appearance).

1. Flowers sessile, subtended by a pair of leaf-like bracts; plants perennial with rhizomes *G. barbellata*
- 1' Flowers on long conspicuous pedicels, without leaf-like bracts; annual or short-lived perennials without rhizomes *G. macrantha*

Gentianopsis barbellata (Engelm.) Iltis (with short stiff hairs). --Perennials 5-17 cm tall, spreading

by rhizomes. LEAVES: basal leaves to 8.5 cm long, oblanceolate, long-petioled; cauline leaves 1-2 pairs, reduced, oblanceolate to linear, sessile. FLOWERS terminal, solitary or paired, rarely 3, each sessile or short pedicellate and subtended by a pair of sessile leaf-like bracts; calyx tube 0.7-1.2 cm long; calyx lobes 0.5-1 cm long, equaling or slightly shorter than the tube, triangular with attenuate apex; corolla blue, the lobes 1.6-2.7 cm long, spatulate with fimbriate sides and entire to erose-dentate apices, the tube 1.2-1.8 cm long. --Wet rocky areas, meadows and open woods: San Francisco Peaks, Coconino Co.; 2650-3650 m (8700-12000 ft); Sep-Oct; CO, NM, UT, WY.

Gentianopsis macrantha (D. Don) Iltis (large flower). Annual or biennial (or perennial?), glabrous herbs to 70 cm tall. STEM 1, branched or unbranched, or on older plants several stems arising from the base. LEAVES linear, lanceolate, or obovate, to 7.5 cm long, sessile or petioled, particularly in basal rosettes formed on older plants. FLOWERS on pedicels to 21 cm long; calyx quadrangular, keeled; lobes linear to lanceolate, often with attenuate tips, the larger lobes 1.1-3 cm long, the smaller lobes 1-2.7 cm long, the tube 0.9-1.7 cm long. Corolla blue, (2.5-)3.5-6 cm long; lobes spatulate, (0.8-)1.5-3.8 cm long, with erose-dentate apices and fimbriate margins. [*Gentiana grandis* (A. Gray) Holm, *G. thermalis* Kuntze, *Gentianella detonsa* G. Don subsp. *elegans* J. M. Gillett, *G. detonsa* subsp. *superba* (Greene) J. M. Gillett]. --Wet meadows, marshes and along streams: Cochise, Graham, Santa Cruz cos.; 1450-2850 m (4700-9400 ft); Aug-Nov; CO, ID, NM, NV, UT, WY; Chih., Dgo., Mex.

Halenia Börckh. Spurred-gentian

Glabrous, annual, biennial or perennial herbs. LEAVES opposite, entire, membranous or fleshy, sessile or petioled, 3-5-veined. INFLORESCENCES axillary or terminal, loose or dense cymes. FLOWERS: calyx 4-parted, the lobes linear, lanceolate, ovate or spatulate, usually papillate, often with small scales at the base of each lobe; corolla 4-parted, campanulate, white, yellow, green or purple, the tube of varying lengths, the lobes elliptic to ovate, obtuse to acute or apiculate, entire or erose, commonly spurred and papillate; stamens 4; pistil sessile, the stigmas 2, sessile. SEEDS globose or slightly flattened, granular or reticulate. --ca. 75 spp. N., C. and S. Amer. and Asia. (Named for J. P. Halen[ius] a collaborator with Linnaeus and author of early flora of Kamchatka). Allen, C. K. 1933. Ann. Missouri Bot. Gard. 20:119-223.

Halenia recurva (Sm.) Allen (recurved, referring to spurs). --Annuals, 25-50 cm tall; STEMS mostly unbranched. LEAVES obscurely 3-nerved; basal leaves less than 3.5 cm long, 6 mm wide, elliptic lanceolate to spatulate; cauline leaves remote, linear lanceolate, 1.5-4 cm long, 3.5 mm wide. INFLORESCENCES loose, subumbellate cymes. FLOWERS on slender pedicels, 0.5-3 cm long; calyx lobes lanceolate, to 6 mm long, papillate; corolla bright yellow, ca. 1-1.2 cm long, the tube less than 1/2 length of entire corolla; lobes ovate, papillate; spurs curved horizontal or ascending. FRUIT ovate lanceolate. SEEDS yellow-brown, subglobose, granular. --Mountain meadows and open forests: Apache, Cochise, Coconino, Graham, Greenlee cos.; 2150-3000 m (7000- 9900 ft); Jul-Sep; NM; Chih., Coah., Dgo., Jal., Mex.

Swertia L.

Annual or perennial herbs with caudex or rhizomes. STEMS erect, leafy, scapose or subscapose. LEAVES in basal rosettes or cauline, opposite or whorled, often with white margins. INFLORESCENCE cymes, racemes, or panicles. FLOWERS rotate, 4- or 5-merous; calyx deeply cleft, the lobes fused only near the base; corolla deeply parted, sometimes bearing a fringed crown (corona) at the base of the lobes, the lobes with 1 or 2 fringed nectar pits; stamens adnate to the short corolla tube; pistil sessile, the style short with 2 stigmas. (*Frasera* Walt.) --Ca 100 spp., N. Amer, Eur., Asia, Afr. (for E. Sweert, a Dutch gardener, author). Card, H. H. 1931. Ann. Missouri Bot. Gard. 18:245-280. St. John, H. 1941. Amer. Midl. Naturalist 26:1-29.

1. Plants polycarpic rhizomatous perennials; flowers blue *S. perennis*
- 1' Plants monocarpic perennials with large taproot and enlarged caudex; flowers white to greenish-white with dots.

2. Nectar pits 2, parallel, ca. 7 mm long, 1 mm wide, each outlined with a fimbriated margin; leaves not white-margined; corona present and prominent *S. radiata*
- 2' Nectar pits 1, round or elliptic and bifurcating into 2 tubes at the base, or elongate and notched at the apex; leaves white-margined; corona absent or of a few hairs.
3. Nectar pit elongate and notched at the apex, the margins fimbriate
..... *S. albomarginata*
- 3' Nectar pit round or elliptic with 2 basal tubes; orifices of the tubes fimbriate; nectar pit margins with or without hairs *S. utahensis*

Swertia albomarginata (S. Watson) O. Kuntze. (white-margined). -- Monocarpic perennials. STEMS 1, 17-55 cm tall. LEAVES in a dense basal rosette and cauline, whorled 4-6 per node on lower stem, opposite above, all with white coriaceous, entire or undulate margins; rosette leaves lanceolate to oblanceolate, 7-12 cm long. INFLORESCENCE a paniculate cyme. FLOWERS: 4-merous; calyx lobes 4-7 mm long, lanceolate to ovate, with white margins; calyx tube ca. 1 mm long; petals lanceolate to ovate to obovate, 8-12 mm long, 4-6 mm wide, whitish or yellowish with dark purple dots, each petal with a gland 4-8 mm long, with 2 lobes at the apex and fimbriate margins; stamens 4; pistil with a prominent style. FRUITS dark capsules, 8-15 mm long, the style persistent. SEEDS black, elliptic, rugose, ca. 3-4 mm long. [*Frasera albomarginata* S. Watson]. Grassland, desert scrub, pinyon-juniper and ponderosa pine forests: Apache, Cochise, Coconino, Mohave, Navajo, Yavapai cos.; 1350-2050 m (4500-6800 ft); May-Jul; s CA, sw CO, nw NM, s NV, s UT.

Swertia perennis L. (perennial). --Rhizomatous polycarpic perennials. STEMS 1, to 57 cm tall. LEAVES: basal leaves long-petioled, the petiole equal to several times longer than the 7-10 cm long, oblanceolate, elliptic to circular blade; cauline leaves reduced to sessile opposite bracts. INFLORESCENCE a cyme. FLOWERS 4- or 5-merous; calyx lobes lanceolate, 5-7 mm long; calyx tube very short to absent; corolla lobes lanceolate, to 10 mm long, 4 mm wide, blue, often with prominent veins, the tube very short to essentially absent, the nectar pits 2, circular, ca. 1 mm in diameter, with or without a few marginal hairs, the corona absent to ca. 1 mm tall; pistil 5-6 mm long at anthesis, the style short. FRUIT to 1 cm long, the tip exserted. SEEDS flat, dark brown, circular to slightly irregular, 1.5-2 mm in diameter including the wing. $2n = 18, 24, 28$. -- Wet marshy areas: Apache Co.; 2450-3000 m (8000-9900 ft); Jul-Sep; AK, s to CA, NM; Eur.

Swertia radiata (Kellogg) O. Kuntze (rayed). --Monocarpic perennials with a thick tap root and enlarged caudex. STEMS to 2.5 m tall, minutely puberulent. LEAVES in a basal rosette gradually reduced to whorled and opposite bracts upward, the basal leaves 15-45 cm long, 2.5-15 cm wide, oblanceolate, the long attenuated base narrowing into a winged petiole. INFLORESCENCE a compound cyme. FLOWERS 4-merous; sepals nearly distinct, linear-lanceolate, 15-17 mm long; petals 1.5-2 cm long, 5-8 mm wide, elliptic, white to greenish, usually with dark dots, the nectar pits 2, parallel, ca. 7 mm long, 1-3 mm wide, each outlined with hairs; a fringed corona 5-10 mm long at the base of the petals; pistil 6-20 mm long at anthesis. FRUIT to 4 cm long, the style persistent. SEEDS dark brown, flattened, somewhat rectangular, 4-6 mm long, 2-3 mm wide, with a very narrow wing. [*Frasera speciosa* Griseb.]. --Conifer forests or wet meadows: Apache, Cochise, Coconino, Gila, Graham, Greenlee, Mohave, Navajo, Pima, Yavapai cos.; 1500-2900 m (5000-9500 ft); May-Sep; CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY.

Swertia utahensis (M. E. Jones) St. John (of Utah). --Monocarpic perennials with a thickened taproot and enlarged caudex. STEMS 1 rarely more, to 1.5 m tall. LEAVES forming a basal rosette, linear lanceolate to lanceolate, 15-28 cm long, 1-4 cm wide, with white, often undulating margins; cauline leaves absent or few, opposite, reduced upward to small bracts. INFLORESCENCE a scapose panicle. FLOWERS 4-merous, pedicellate, 2-4 per node; sepals 4-6 mm long, lanceolate to ovate, often white-margined; petals oblanceolate, 10-13 mm long, greenish white with dark dots, the corona a few hairs or absent, the nectar pits 5-6 mm long, the pit round or elliptic with 2 basal tubes, the orifices of the tubes fimbriate; nectar gland

margins with or without hairs; pistil sessile, 8-9 mm long at anthesis. FRUIT 20-25 mm long, the style persistent. SEEDS irregularly rectangular, flattened, wingless, ca 6 mm long, 2-3 mm wide, dark brown, the surface rugose. [*Frasera paniculata* Torr.]—Deep sandy soils: Apache, Coconino, Mohave, Navajo cos.; 1150-1900 m (3700-6200 ft); Jun-Jul; NM, UT.



Figure 1. *Gentiana bigelovii*.

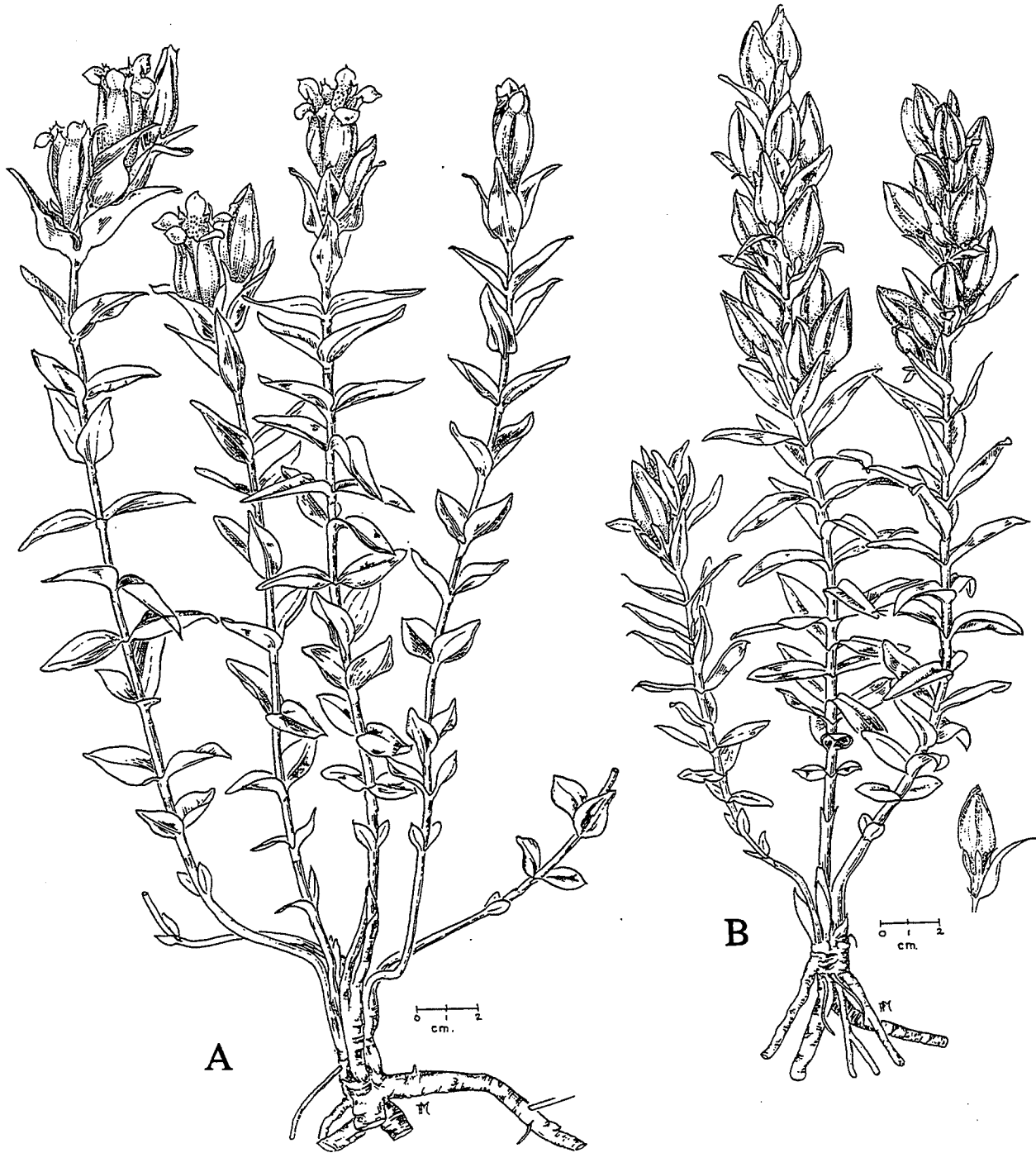


Figure 2. A, *Gentiana parryi*. B, *Gentiana rusbyi*.

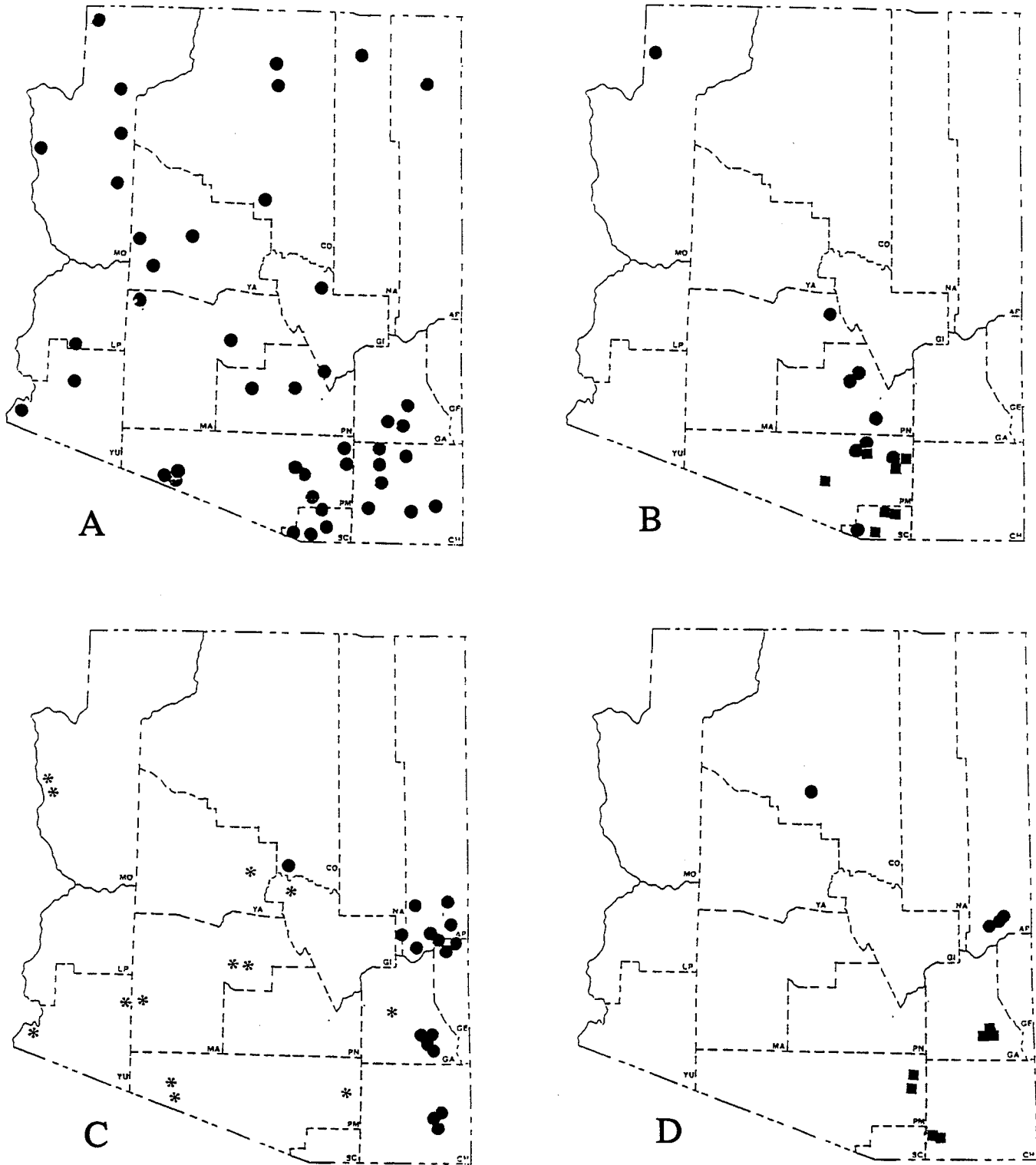


Figure 3. Distribution of: A, *Centaurium calycosum*. B, *Centaurium exaltatum* (squares); *Centaurium nudicaule* (dots). C, *Eustoma exaltatum* (stars); *Halenia recurva* (dots). D, *Gentiana aquatica* (dots); *Gentiana bigelovii* (squares).

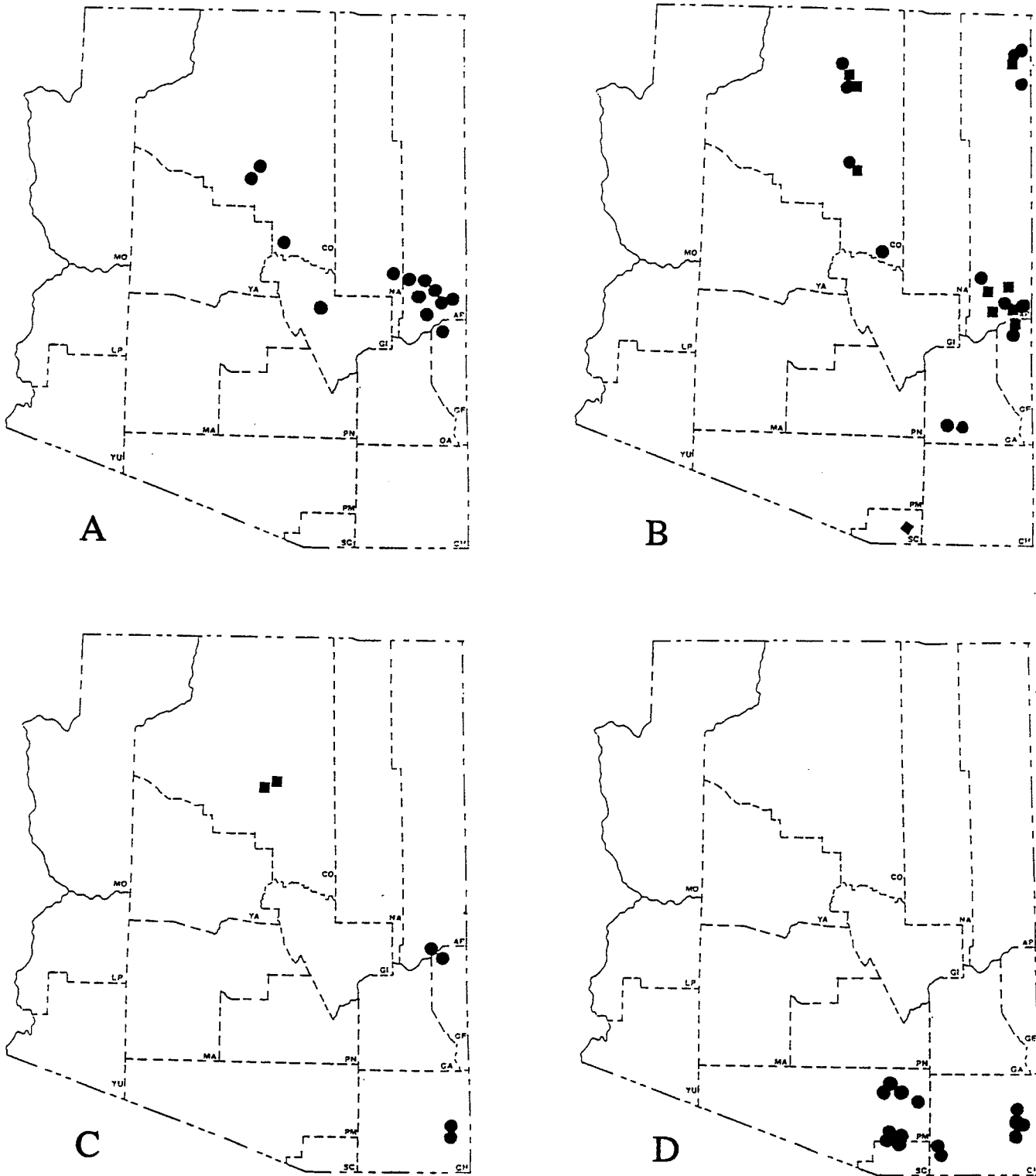


Figure 4. Distribution of: A, *Gentiana rusbyi*. B, *Gentianella amarella* subsp. *acuta* (dots), subsp. *heterosepala* (squares), subsp. *wrightii* (diamond). C, *Gentianella tenella* (squares); *Gentianella wislizenii* (dots). D, *Gentianella microcalyx*.

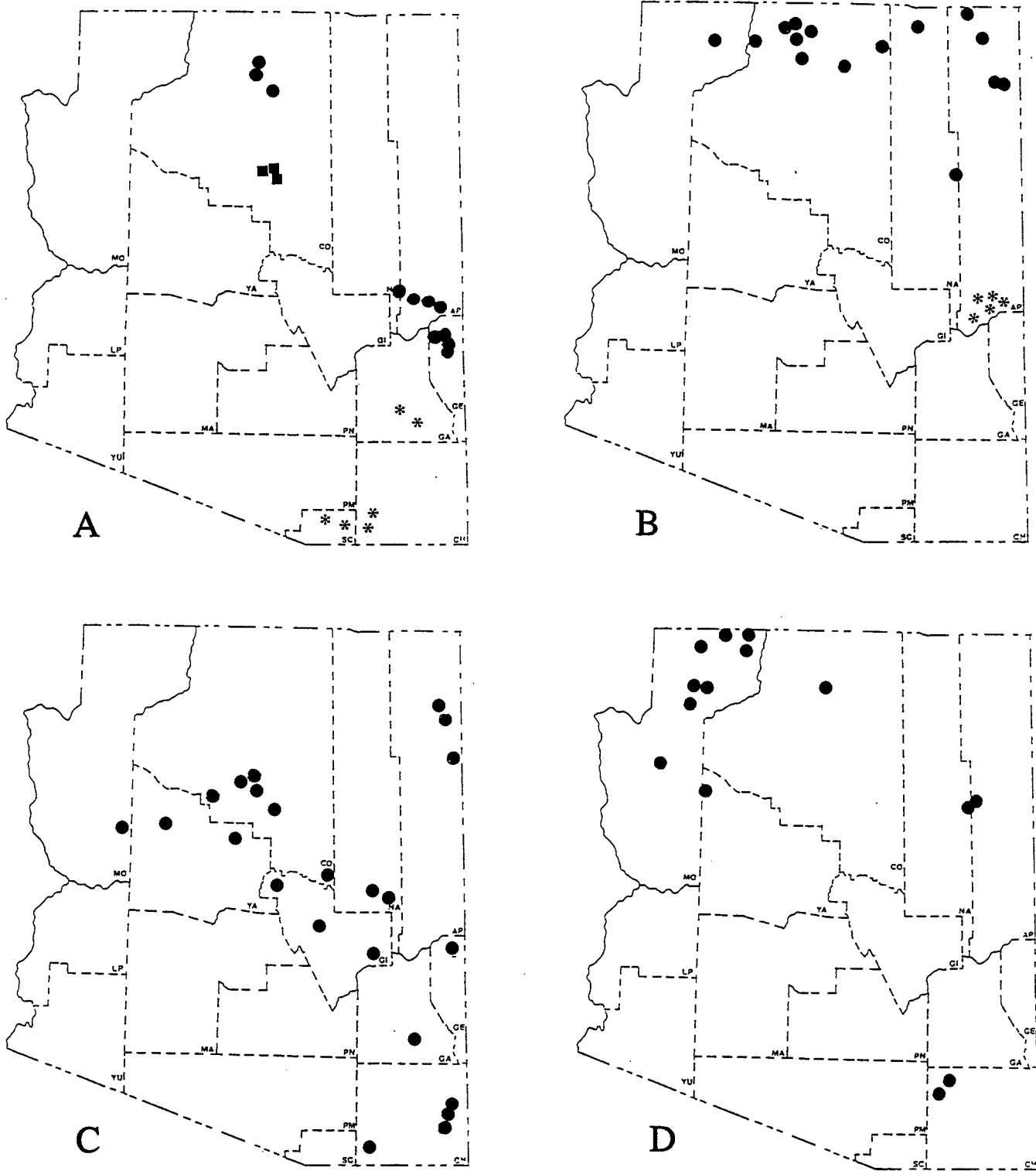


Figure 5. Distribution of: A, *Gentiana parryi* (dots); *Gentianopsis barbellata* (squares); *Gentianopsis macrantha* (stars). B, *Swertia perennis* (stars); *Swertia utahensis* (dots). C, *Swertia radiata*. D, *Swertia albomarginata*.