

THE GENTIANAS OF  
CANADA  
ALASKA  
AND GREENLAND

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**THE GENTIANAS OF CANADA  
ALASKA AND GREENLAND**

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Ottawa, Ontario

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## INTRODUCTION

During recent years there has been increasing interest in the cultivation of indigenous plant species. Much of this interest has concerned potential forage species but many native species are also of considerable ornamental value. The Gentianaceae and Menyanthaceae include a number of them. Wilkie (1950), in his excellent book on the species of *Gentiana* in cultivation, indicated, by omitting them, that few American species of that genus are in cultivation and that few other genera of the Gentianaceae have been exploited in horticulture.

This synopsis of the Gentianaceae and Menyanthaceae of Canada, Alaska and Greenland may help to stimulate general interest in the ornamental value of our native plants.

The Gentianaceae comprise 65 to 70 genera and more than a thousand species. The family is distributed throughout both temperate and tropical regions of the world. The larger genera are widely distributed but most of the smaller ones have a rather restricted range. A number of the genera contain showy species. Most of the perennial species of *Gentiana* and their hybrids that are cultivated are from southern Asia, the center of origin of many species of this genus. Species of *Gentianella* are attractive and could be cultivated with proper treatment. South America has nearly 200 species of *Gentianella* (but only one of *Gentiana*), many having yellow or red corollas rather than the blues we usually associate with gentians. Certainly many species of other genera might well be worth cultivating.

The Menyanthaceae comprise a small group of aquatic plants of both temperate and tropical regions. The family is included here because it has been regarded as a subfamily of the Gentianaceae (e.g., Gilg, 1895) although many recent authors regard it as a separate family. *Villarsia* and *Fauria* species resemble the water plantains in growth habit and in their preference for a boggy or marshy habitat. *Villarsia* species are chiefly Australian. *Nymphoides* species occur in both temperate and tropical regions; all are submerged aquatics with floating leaves.

In this synopsis, the species is considered to be a morphologically distinct plant population. Subspecies are subpopulations that are geographically contiguous within the range of the species. No new species are reported here but for consistency a few changes in rank have been necessary.

Because Canada is a political division, its southern border cuts across the natural ranges of many plant species. There are conflicting reports in the floristic literature concerning whether or not certain species occur in Canada, and in addition many reports of occurrence are incorrect. For example, *Gentiana alba* Muhl. was listed by Macoun. I examined most of the specimens cited by him, and they were evidently misidentified; it is practically certain that the species does not occur in Canada. The present paper deals with only those species of which I have seen herbarium material, but some of the maps include distribution information from recently published revisions.

Original keys are provided. Descriptions are based on Canadian material except where otherwise stated. Synonymy is given but, when it is extensive and has already been given elsewhere, only the principal citations appear. Type specimens are cited when known and their locations shown by standard herbarium abbreviations; an exclamation point means that I have seen the specimen. Common names follow the synonymy.

The range of each species is indicated for the United States as well as Canada insofar as material was available. The distributions for some species are necessarily incomplete south of the Canadian border since it was not practical to borrow from the numerous United States herbaria, or to deal with the taxonomic complications that might arise through the complete inclusion of that material. I examined specimens from the following Canadian herbaria:

DAO	Plant Research Institute, Central Experimental Farm, Ottawa, Ontario
CAN	National Museum of Canada, Ottawa, Ontario
TRT	Botany Department, University of Toronto, Toronto, Ontario
MT	Institut Botanique, Université de Montréal, Montréal, Québec
MTJB	Jardin Botanique de Montréal, Montréal, Québec
UBC	University of British Columbia, Vancouver, B.C.
V	Provincial Museum, Victoria, B.C.

Grateful acknowledgment is made to the curators of the above herbaria for making material available for study. I am indebted to Dr. Douglas M. Post, San Francisco State College, San Francisco, California, for the distribution map of *Frasera caroliniensis* which he generously supplied. Thanks are due also to my colleagues in the Plant Research Institute for their constructive criticism and advice. Mrs. Marion Platek, bio-Graphic Unit, Research Branch, Ottawa, prepared the drawings.

## KEY TO THE FAMILIES

- A. Leaves sessile, simple and opposite; corolla aestivation imbricate; terrestrial, infrequently bog plants .....Gentianaceae
- AA. Leaves petiolate, simple or trifoliate and alternate; corolla aestivation induplicate-valvate; aquatic or bog plants .....Menyanthaceae

### GENTIANACEAE Gentian Family

Glabrous annual, biennial or perennial herbs, rarely shrubs or vines with opposite, rarely alternate, entire, exstipulate leaves. Flowers bisexual, regular, 4-12-lobed or parted, borne in simple or aggregate axillary cymes, or solitary and terminal. Calyx tubular or variously divided. Corolla commonly rotate, funnelform, salverform or clavate, marcescent. Stamens equal to the number of corolla lobes and alternate with them. Ovary superior, 1-celled or incompletely 2-celled. Style simple or none. Ovules numerous, placenta parietal. Capsule splitting into two valves. Seeds various, smooth, papillose or winged.

Worldwide, chiefly temperate plants.

### Key to the Genera

- A. Leaves well developed; autophytes.
  - B. Anthers remaining straight after dehiscence.
    - C. Nectary glands at the base of the ovary; corolla tube with plicae in the sinuses of the lobes; calyx tube usually with an inner membranaceous rim .....Gentiana
  - CC. Nectary glands at the base of the corolla tube alternate with the stamens; corolla tube without plicae in the sinuses; calyx without an inner membrane.
    - D. Corolla tube spurred, foveate, or squamellate at the base.
      - E. Stigmas decurrent along the carpel sutures.....Lomatogonium
    - EE. Stigmas terminal.
      - F. Corolla lobes sinistrally convoluted in the bud, spurless, with one or two foveae accompanied by squamellae at the base of each corolla lobe.
        - G. Flowers 5-merous; style absent; corolla lobes with two foveae .....Swertia
      - GG. Flowers 4-merous; style present; corolla lobes with one fovea .....Fraseria
    - FF. Corolla lobes dextrorsely convoluted in the bud, each with a spur at the base of the corolla tube, rarely spurless, the orifice without squamellae .....Halenia
  - DD. Corolla tube bearing glands at the base, alternate with the stamens, never foveate or squamellate..Gentianella

- BB. Anthers becoming recurved or strongly spiral after dehiscence.
  - H. Calyx and corolla 5-12-parted, the corolla rotate; stamens inserted in the corolla throat, the anthers moderately recurved or contorted after anthesis .....*Sabatia*
  - HH. Calyx and corolla 4-5-parted, the corolla tubular; stamens inserted in the upper part of the corolla tube, the anthers strongly contorted after anthesis .....*Centaurium*
- AA. Leaves scale-like; semisaprophytes .....*Bartonia*

*Gentiana* L. Sp. Pl. 1: 227. 1753.

Calyx 5-4-parted, tubular, usually with an inner membranaceous rim, or spatheiform, the lobes free. Corolla marcescent, tubular, campanuliform, funnelform, or clavate, without basal interstaminal glands, and with plicae present between the lobes. Stamens 5-4, inserted on the corolla tube; the anthers frequently united in a ring, or free, extrorsely dehiscent. Ovary unilocular or falsely bilocular. Nectary glands at the base of the ovary alternate with the stamens. Stigmas 2, terminal. Capsule 2-valved, septicidal.

Annual, biennial or perennial herbs of arctic, temperate and high alpine regions of the world.

Type species (native of Europe): *G. lutea* L. Sp. Pl. 1: 227. 1753.

Key to the Species

- A. Perennials.
  - B. Flowers yellowish green, rarely white; seeds irregularly winged or ridged.
    - C. Flowers 3.5-5.0 cm long, the tube yellow-green with lines of purple flecks; leaves linear to linear-oblongate...1. *G. algida*
    - CC. Flowers 1.0-2.0 cm long, the tube glaucous green, rarely white, without flecks; leaves elliptic to spatulate....2. *G. glauca*
  - BB. Flowers blue, purple or white; seeds wingless or, if winged, the wings in one plane.
    - D. Calyx of two spathes, the lobes merely teeth at the margin of the spathe; corolla lobes reniform .....3. *G. platypetala*
    - DD. Calyx tubular, the lobes usually well developed.
      - E. Seeds wingless; plants of the Rockies and westward.
        - F. Plicae entire; flowers one to three, or also axillary; capsule stipitate .....4. *G. sceptrum*
        - FF. Plicae deeply bifid; flowers solitary, capsule sessile .....5. *G. calycosa*
      - EE. Seeds winged; plants of the plains and eastward.
        - G. Corolla lobes shorter than or equal to the erose plicae .....6. *G. andrewsii*
        - GG. Corolla lobes longer than the plicae.
          - H. Corolla lobes erect, the margins involute; plicae 1-3-toothed.....7. *G. linearis*

- HH. Corolla lobes spreading, the margins flat; plicae bidentate to lacerate-ciliate.
- J. Corolla 3.4-4.5 cm long; calyx lobes nearly as long as the tube .....8. *G. puberula*
- JJ. Corolla 1.8-3.0 cm long; calyx lobes half as long as the tube or frequently shorter, occasionally absent. ....9. *G. affinis*

AA. Annuals.

- K. Flowers terminal and solitary; gynophore short or extremely elongate; plants branched from the base.
  - L. Leaves green-margined, recurving; gynophore elongate, the capsule frequently exerted completely from the marcescent corolla .....10. *G. prostrata*
  - LL. Leaves white-margined, scarcely recurving; gynophore very short, the capsule included .....11. *G. aquatica*
- KK. Flowers in terminal simple cymes and axillary; gynophore short or absent, the capsule included; plants branched throughout, rarely simple.
  - M. Flowers about 1 cm long, corolla lobes one third as long as the tube; calyx campanulate, the lobes half as long as the tube; seeds smooth .....12. *G. douglasiana*
  - MM. Flowers 1.7-2.5 cm long, corolla lobes one fifth as long as the tube; calyx tubular, the lobes one quarter as long as the tube; seeds appearing faceted .....13. *G. nivalis*

1. *Gentiana algida* Pallas

Figure 1

*G. algida* Pall. Fl. Ross. 2: 107. t. 95. 1788. (Type: LE)

*G. Romanzowii* Ledeb. ex Bunge in Nouv. Mem. Soc. Nat. Mosc. 1: 215. t. 11. f. 1. 1829. (Mém. Soc. Nat. Mosc. 7). (Type: Chamisso & Eschscholtz, LE)

*G. frigida* Haenke  $\beta$  *algida* (Pall.) Froel. Gen. Diss. 39. 1796; Griseb. Sp. Gent. 279. 1839;  $\gamma$  *algida* (Pall.) Ledeb. Fl. Ross. 3: 65. 1847-49.

*Pneumonanthe algida* (Pall.) Schm. in Roem. Archiv. f. Bot. 1: 10. 1796.

*G. frigida*  $\beta$  *Romanzowii* (Ledeb. ex Bunge) Ledeb. Fl. Ross. 3: 65. 1847-49.

*G. algida*  $\alpha$  *sibirica* Turcz. in Vestn. estestv. Nauk. 1355. 1860.

*G. algida*  $\beta$  *Romanzowii* (Ledeb.) Kusn. in Acta Hort. Petrop. 15: 263. 1904.

*Dasystephana Romanzovii* (Ledeb.) Rydb. in Bull. Torr. Bot. Cl. 33: 148. 1906.

Common Name: Whitish Gentian.

Perennial, erect or ascending, 5-20 cm high, simple or with a loose rosette of leaves borne on an offshoot, stem somewhat winged and yellow-green. Roots sparingly branched from a crown of marcescent leaf bases. Basal leaves linear-spatulate, obtuse, forming a loose rosette, frequently longer than the median, the median linear to linear-lanceolate, connate, 2-12 cm long, 0.2-0.5 cm wide. Flowers solitary or in a terminal cyme

with or without axillary flowers. Calyx 5-parted, tubular, 1.5-2.3 cm long, the oblong-linear lobes irregular, as long as the tube or slightly shorter. Corolla funnelform, 3.5-5.0 cm long, the tube yellowish green with lines of purple flecks, the purple or occasionally yellow lobes speckled within, acute, scarcely longer than the slightly speckled, irregularly toothed, yellow plicae. Stamens inserted in the lower third of the corolla tube, anthers oblong, about 3.5 mm long, free. Pistil stipitate, the gynophore 0.8 cm long, the ovary oblong, 1.5 cm long, stigmas oblong, recurved, borne on a style about 2-3 mm long that tapers into the ovary. Capsule elliptic-oblong, 3-4 mm wide, the dark-brown seeds with irregular hyaline crests or wings, about 1.5 mm long.

North American range: Pribilof Islands, Bering Sea, Aleutian chain, coastal and interior Alaska, western Yukon with a considerable disjunction to Montana, Wyoming and Colorado. Alpine slopes. Flowering from late July to late August; fruiting in September.

As Hultén (1945) stated, there is no evident difference between the Alaskan, Wyoming-Colorado and Siberian populations. Several well-prepared sheets from the U.S.S.R. could not be distinguished from our North American material. Lack of collection cannot provide an explanation for the gap in the North American distribution, because this striking species could scarcely have been overlooked. Undoubtedly *G. algida* at one time had a continuous range throughout the Canadian Rockies and has either been unable to migrate back after the retreat of the glaciers or has had insufficient time to do so.

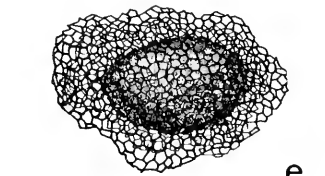
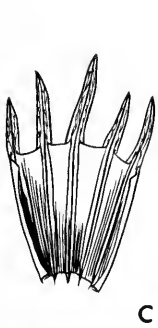
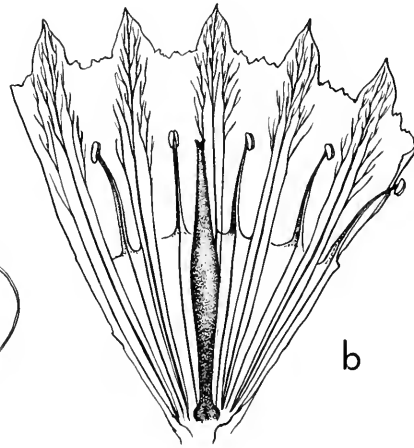
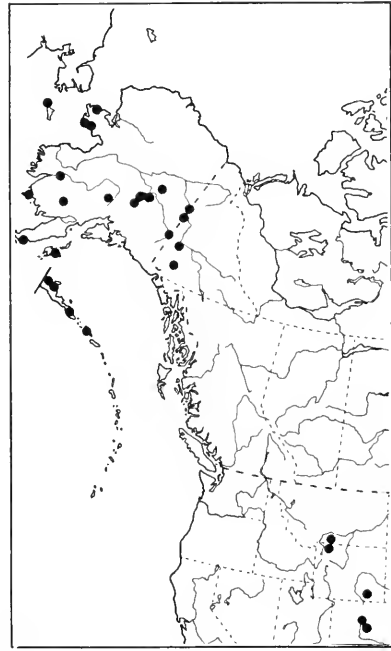
*Gentiana algida* is closely related to *G. frigida* Haenke of Europe. As can be seen from the synonymy, Grisebach made it a variety of *G. frigida*. Regel (1880), who grew both species at the Kaiser Botanic Garden in Berlin, considered that Grisebach was wrong in this decision and stressed the fact that the two species were quite dissimilar. The point cannot be decided here because of lack of material and pertinent literature. If they are united, there remains the nomenclatural problem of which name should be taken up because both species were originally described in 1788.

The name *G. Romanzovii* Ledebour has been applied to our American material. The type collection of this species came from St. Laurent Bay in Siberia, a location directly west of Alaska. It is probably synonymous with *G. algida* Pall. and is so considered here.

Roach (1953) described, from Colorado, a *forma hexaloba* of *G. Romanzovii* that has flowers with six parts to the whorl. Forms of this nature are relatively common in the gentians.

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Figure 1. *Gentiana algida* Pall. a, plant,  $\times 0.8$ . b, corolla,  $\times 1.8$ . c, calyx,  $\times 1.8$ . d, fruit,  $\times 0.8$ . e, seed.



2 mm

MP

## 2. *Gentiana glauca* Pallas

### Figure 2

*G. glauca* Pall. Fl. Ross. 2: 104. t. 93. f. 2. 1788. (Type: LE)

*Pneumonanthe glauca* (Pall.) Schm. in Roem. Archiv. f. Bot. 1: 10. 1796.

*Dasystephana glauca* (Pall.) Borckh. in Roem. Archiv. f. Bot. 1: 26. 1796;  
Rydb. in Bull. Torr. Bot. Cl. 40: 464. 1913, superfl. comb.

*Coelanthé glauca* (Pall.) G. Don, Gen. Syst. 4: 185. 1837.

Common Names: Glaucous Gentian, Pale Gentian.

Perennial, the stem and separate (winter) rosettes arising from a short slender rhizome, stem erect, 4-15 cm tall. Basal leaves obovate-spatulate, to 2 cm long, 1 cm wide, forming rosettes, the cauline leaves elliptic, 0.5-1.0 cm long, in 2-4 pairs. Flowers in simple terminal cymes enveloped by the upper leaves, with or without lower axillary flowers. Calyx 5-parted, tubular, 5-7 mm long, the lobes lanceolate, acute, about half as long as the tube, green or strongly purpled. Corolla 5-parted, tubular, 1.0-2.0 cm long, glaucous blue, blue-green, or yellow-green throughout, rarely white, the lobes about 2.5 mm long, oblong, obtuse to rounded, the plicae entire. Stamens inserted in the lower third, slightly winged, the oblong anthers about 1.2 mm long, free. Pistil stipitate, the gynophore about 0.5 cm long, the ovary ovoid, about 1 cm long, the stigmas small, sessile. Capsule slightly exserted beyond the marcescent corolla. Seeds 0.75-1.0 mm long, pale tan, irregularly crinkle-winged.

From Kamtchatka and the islands of the Bering Sea including St. George Island in the Pribilof group, throughout Alaska, Yukon to south-central British Columbia as far east as the Alberta border. An alpine species occurring from 2,000 to 6,300 feet, in meadows, open rocky and sandy places. Flowering from late June until mid-August; fruiting from mid-July until late August and perhaps into September.

This attractive species usually has glaucous greenish-blue or greenish-yellow flowers. Jordal (1952) named the greenish-yellow color form *G. glauca* Pall. f. *chlorantha* Jord. (Type: Jordal 2415 MICH). A variety, *Paulense*, was described from St. Paul Island, Alaska (Kellogg, 1876). No opinion on its status can be given here because the type (*Burleigh*, CAS) has not been seen.

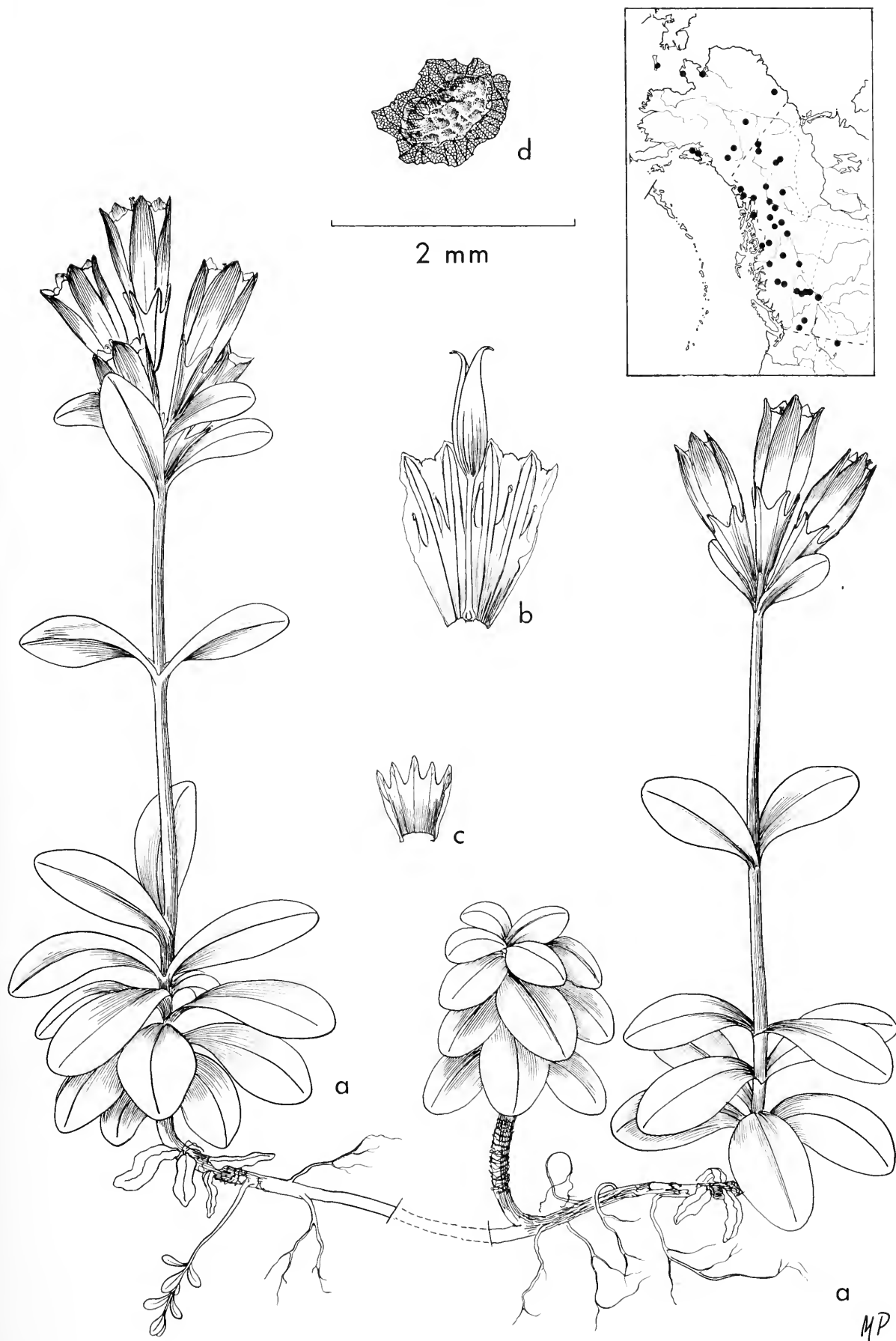
Hultén (1947) described the Asiatic portion of the range of this species and provided (1930) a map of its distribution in Kamtchatka. His distribution data, together with those given here, indicate that the species has moved southwards on Asiatic as well as American fronts in post-Pleistocene time.

This species probably could be cultivated easily and would make a fine garden subject.

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Figure 2. *Gentiana glauca* Pall. a, plant,  $\times 1.25$ . b, corolla with capsule,  $\times 1.25$ . c, calyx,  $\times 1.25$ . d, seed.





### 3. *Gentiana platypetala* Griseb.

#### Figure 3

*G. platypetala* Griseb. in Hook. Fl. Bor.-Am. 2: 58. 1838. (Type: *Chamisso*, probably LE)

*Pneumonanthe platypetala* (Griseb.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

*G. Covillei* Nels. & Macbr. in Bot. Gaz. 65: 65. 1918, ex char. (Type: *Walker 935*)

Common Name: Broad-petalled Gentian.

Perennial, 1-3 dm tall, with one to several ascending to erect, smooth stems arising from a horizontal rhizome. Leaves ovate to elliptic, obtuse, somewhat clasping, 1.5-3.2 cm long, 0.8-2.2 cm wide, becoming smaller and somewhat scale-like towards the base of the stem, the upper pairs closely enveloping the solitary flower, the margins smooth, the middle and lateral veins prominent. Flower sessile. Calyx doubly spathose, the spathes roseate, about half as long as the corolla tube, united in the lower third, one bearing two ovate-lanceolate acute lobes, 1-2 mm long, the other bearing three. Corolla tubular to funnelform or poculiform, 3.0-(3.5)-3.8 cm long, the exterior blue, the interior speckled green, the lobes reniform, mucronate, dichotomously veined, the plicae low, acute, irregularly single-toothed. Stamens inserted in the lower third, the wings incurved and tapering towards the tip of the filament, the anthers lanceolate, 4.5 mm long, free. Pistil sessile, the ovary oblong-ovate, constricted to the prominent nectaries, broadening below, 2.2 cm long, the stigmas sessile, oblong, 1.5 mm long, becoming revolute. Capsule elliptic-oblong, as long as the marcescent corolla tube, dehiscent from the tip. Seeds not winged but frequently irregularly lamellate and contorted, light brown.

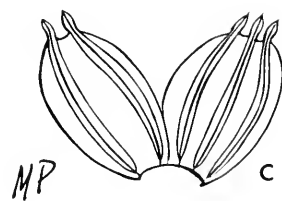
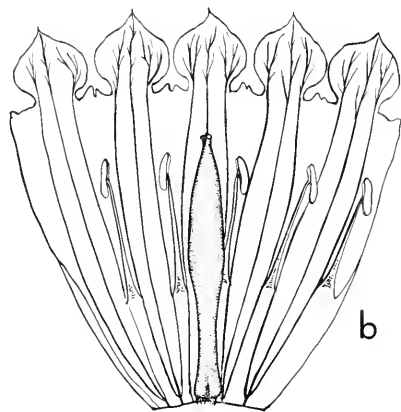
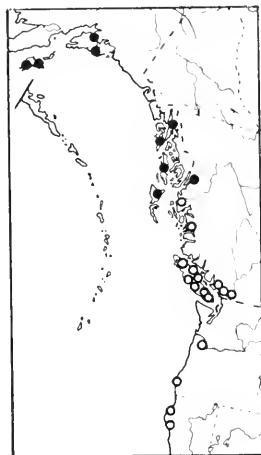
Southern coastal Alaska from Kodiak Island to Sitka, in the Queen Charlotte Islands and Alice Arm, B.C., restricted to alpine grassy meadows in a narrow zone just above treeline, at about 2300 feet. Flowering from the second or third week of July and throughout August; fruiting in late August and into September.

The most striking morphological feature of this species is its calyx, which is split into two spathes, one bearing two teeth and the other three. These spathes occur in a number of species of *Gentiana* and are apparently formed by an extreme development of the intracalycular membrane, a structure shown by Kusnezow to have developed through an invagination of the inner epidermal layer. The development of the intercalycular membrane presumably causes stresses that tend to cause the calyx to split during the initial stages of development. The teeth are the tips of the lobes of the calyx.

In his description of the species in Hooker's Flora, Grisebach did not make it clear whether or not he was describing this type of calyx. His description of the same species in the Species Gentianearum (Grisebach, 1839) and later in the treatment in De Candolle's Prodrromus (Grisebach

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Figure 3. *Gentiana platypetala* Griseb. a, plant,  $\times 0.5$ . b, corolla,  $\times 0.75$ . c, calyx,  $\times 0.75$ . Map: *G. platypetala*, solid dots; *G. sceptrum*, open circles.



in DC, 1845) is an obviously paraphrased account. The only other species that could be confused with *G. platypetala* is *G. sceptrum*, which was also described by Grisebach in Hooker's Flora. The type of *G. platypetala*, however, came from the island of Sitka within its present known range and not within that of *G. sceptrum*. The latter species, as it is now known, extends only as far north as Prince Rupert.

Nelson and MacBride were apparently not convinced that Grisebach had described the Alaskan plant (*G. platypetala*) for they redescribed it as *G. Covillei*. However, the solitary flower and the distinctive roseate coloration of the calyx, both characters emphasized by Grisebach, suggest that he was referring to Alaskan material. Grisebach's failure to mention the spathose nature of the calyx is difficult to understand because it is such a conspicuous feature of the species.

No attempt has been made to cultivate this striking species here.

#### 4. *Gentiana sceptrum* Griseb.

##### Figure 4

*G. Sceptrum* Griseb. in Hook. Fl. Bor.-Am. 2: 57. t. 145. 1838. (Type: Douglas, Kew; photo, DAO)

*G. Menziesii* Griseb. l.c. p. 59, ex char. (Type: Menzies, K)

*G. Orfordii* Howell, Fl. N.W. Am. 1: 446. 1901. (Type: Howell in 1892)

*Pneumonanthe sceptrum* (Griseb.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

*P. Menziesii* (Griseb.) Greene, l.c. 1904.

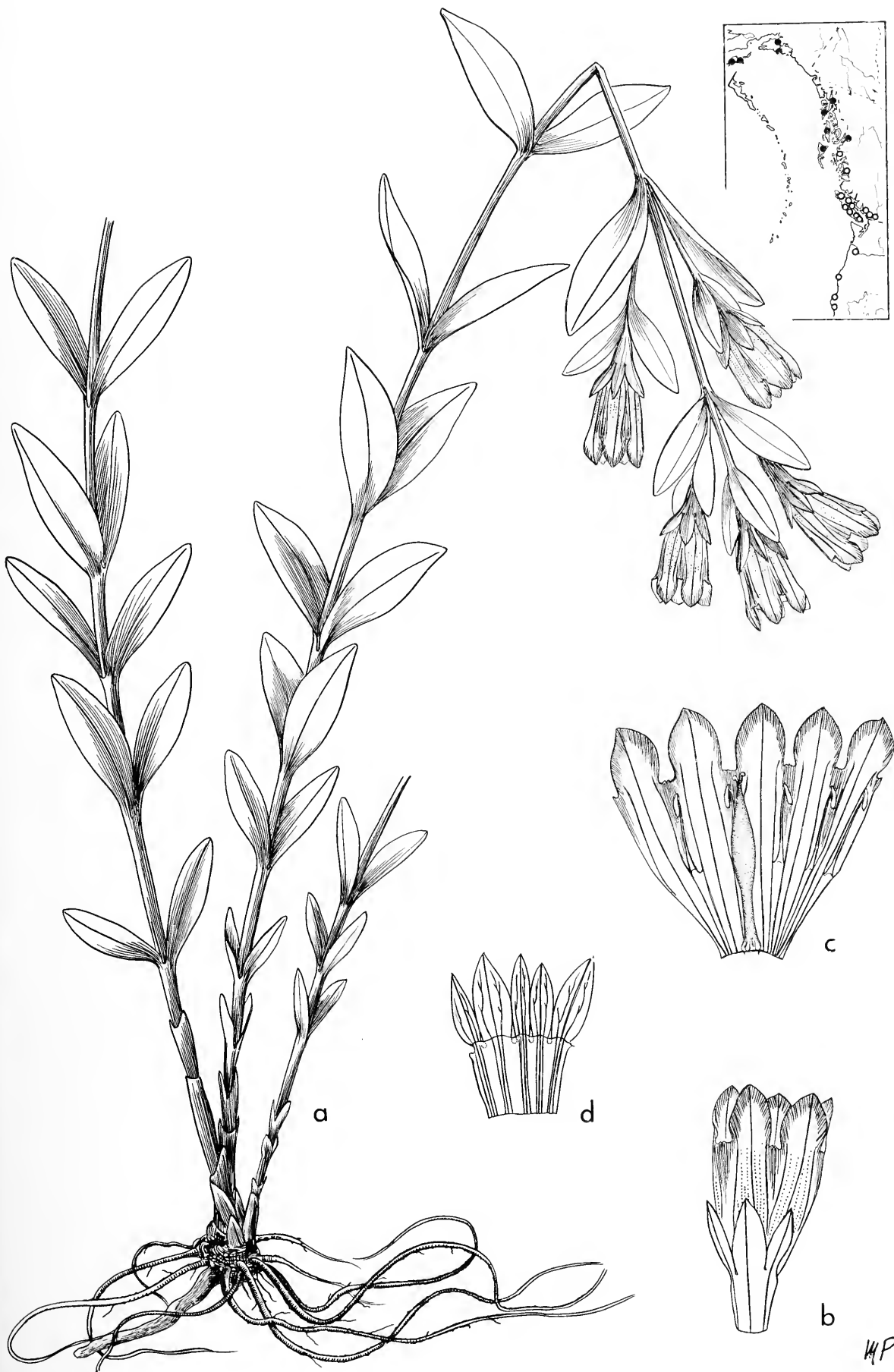
*Dasystephana Menziesii* (Griseb.) Arthur in Torreya 19: 49. 1919.

Common Names: King's Gentian, Scepter Gentian, Swamp Gentian.

Perennial, 2-6 dm tall, with one to several erect to ascending, smooth, simple to occasionally branched stems arising from a stout root-stalk. Leaves lanceolate to linear-lanceolate, rarely ovate-lanceolate, somewhat clasping, 1.5-7.0 cm long, 0.8-1.8 cm wide, becoming smaller and scale-like towards the base of the stem, the upper pair bract-like, frequently subtending the one to three flowers, the margins smooth, the mid- and lateral veins prominent. Flowers sessile or, if bractless, pedicellate. Calyx tubular, the tube about 1 cm long, the lobes foliaceous, ovate-elliptic, acute, varying considerably in development, up to one and one half times as long as the tube, the intracalycular membrane extremely well developed, irregularly margined, 1.5 mm broad. Corolla tubular to funnelform, 3.0-4.0 cm long, deep blue or with green speckles within, the lobes oblong to reniform, acute, reticulately veined, the plicae entire. Stamens inserted in the lower half of the corolla tube, the wings poorly developed, anthers 3-4 mm long, free. Pistil stipitate, the gynophore about 3.5 mm long, the ovary oblong, 2.3 cm long, style to 1.5 mm long, the stigmas about 1 mm long, becoming revolute. Capsule elliptic-oblong, as long as the marcescent corolla, dehiscent above. Seeds not winged,

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Figure 4. *Gentiana sceptrum* Griseb. a, plant,  $\times 0.5$ . b, single flower,  $\times 1$ . c, corolla,  $\times 1$ . d, calyx,  $\times 1$ . Map: *G. platypetala*, solid dots; *G. sceptrum*, open circles.



somewhat irregular or contorted, tapering to the ends, never lamellate, light brown.

Coastal British Columbia from about Prince Rupert to Vancouver Island, coastal Washington and Oregon as far south as Mendocino County, California. Meadows and boggy lake margins. Flowering from late July until early September; fruiting in late August to September.

This species poses a problem that may be difficult to resolve without further field studies. The calyx lobes are more elongate in specimens from the southern portion of its range than they are in more northerly collections. In contrast, the corolla lobes are broader and virtually identical with those of *G. platypetala* in the northern portion of the range. For this reason the two species have been plotted on one map (Figure 4) to indicate the proximity and contiguity of their ranges. It is possible that these taxa should be considered two subspecies of one species.

### 5. *Gentiana calycosa* Griseb.

No figure

*G. calycosa* Griseb. in Hook. Fl. Bor.-Am. 2: 58. t. 146. 1838. (Type: Tolmie s.n., K; photo, DAO)

*G. calycosa*  $\beta$  *stricta* Griseb. l.c. (Type: Tolmie s.n., K)

*G. calycosa* [var.] *monticola* Rydb. in Bull. Torr. Bot. Cl. 24: 252. 1897, based on *G. calycosa stricta* Griseb.

*Pneumonanthe calycosa* (Griseb.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

*Dasystephana monticola* Rydb. in Bull. Torr. Bot. Cl. 40: 464. 1913.

*D. obtusiloba* Rydb. in Bull. Torr. Bot. Cl. 40: 464. 1913, ex char. (Type: Vreeland 1162, NY)

*D. calycosa* (Griseb.) Rydb. l.c. 1913.

*G. calycosa* ssp. *typica* Maguire in Madrono 6: 151. 1942.

*G. obtusiloba* (Rydb.) Hultén, Fl. Alaska & Yuk. 8: 1308. 1948.

*G. calycosa* var. *obtusiloba* (Rydb.) C. L. Hitchc. in Vasc. Pl. Pacific N. W. 4: 68. 1959.

Common Names: Mountain Bog Gentian, Explorer's Gentian.

Perennial, 1-3 dm tall, with tufts of stems arising from a tough, simple to many-branched rhizome system. Leaves broadly elliptic to ovate, 1.0-2.5 cm long, 0.9-1.4 cm wide, the middle and lateral veins quite prominent, basal leaves usually absent or reduced to scales but when present spatulate, about 1.0 cm long, 0.3 cm wide. Flowers sessile, solitary and terminal, closely subtended by the upper pair of leaves. Calyx tubular, the tube about 0.5 cm long, the lobes broadly foliaceous, elliptic-obovate, constricted at the rounded sinus, obtuse, about twice as long as the tube, the intracalycular membrane broad, distinctly roseate. Corolla tubular to narrowly funnelform, 1.5-3.5 cm long, deep roseate purple without, yellowish green within, the lobes ovate, the margins frequently inrolled, the plicae bidentate to somewhat lacerate. Stamens inserted in the lower half of the tube, wings poorly developed, the anthers 4.5 mm long, free. Pistil indistinctly stipitate, the ovary oblong, about 1.2 cm long, style very short, the stigmas about 1 mm long, finally revolute. Capsule up to 2.4 cm long,

sessile, included in the marcescent corolla, dehiscent above. Seeds not winged, somewhat irregular, tapering to the ends, light brown.

British Columbia to California east to Alberta and Montana. Rocky alpine slopes and meadows near treeline. Flowering from mid-July to early September.

The type of *G. calycosa* Griseb. is a Tolmie collection from Mt. Rainier, Washington. There is a photograph of it in the DAO herbarium. Also in the DAO herbarium is a specimen collected by Leschke in 1951 from the type locality.

From Canada there are several collections at DAO from Waterton Lakes Park, Alberta, and from King Edward Peak, B.C. Further collections from the same area are in the U.B.C. herbarium. All of this material matches the type photograph.

Hitchcock (1959) placed *G. Gormanii* Howell, Fl. N.W. Am. 1: 446, 1901, in the synonymy of *G. calycosa*. When Howell described *G. Gormanii*, he cited no specimen but gave the range as "northeastern Washington to Alaska." His description of the calyx, "calyx-lobes only 2, broadly ovate, acute or acuminate, longer than the tube," and his statement of the range in Canada rather suggest that *G. Gormanii* for the most part refers to *G. platypetala*.

No map or illustration is given of *G. calycosa* because it is not of widespread occurrence in Canada and because adequate U.S. material was lacking in this study.

#### 6. *Gentiana andrewsii* Griseb.

##### Figure 5

*G. andrewsii* Griseb. in Hook. Fl. Bor.-Am. 2: 55-6. 1838; Gen. & Sp. Gent. 287. 1839. (Type: Cleghorn, K)

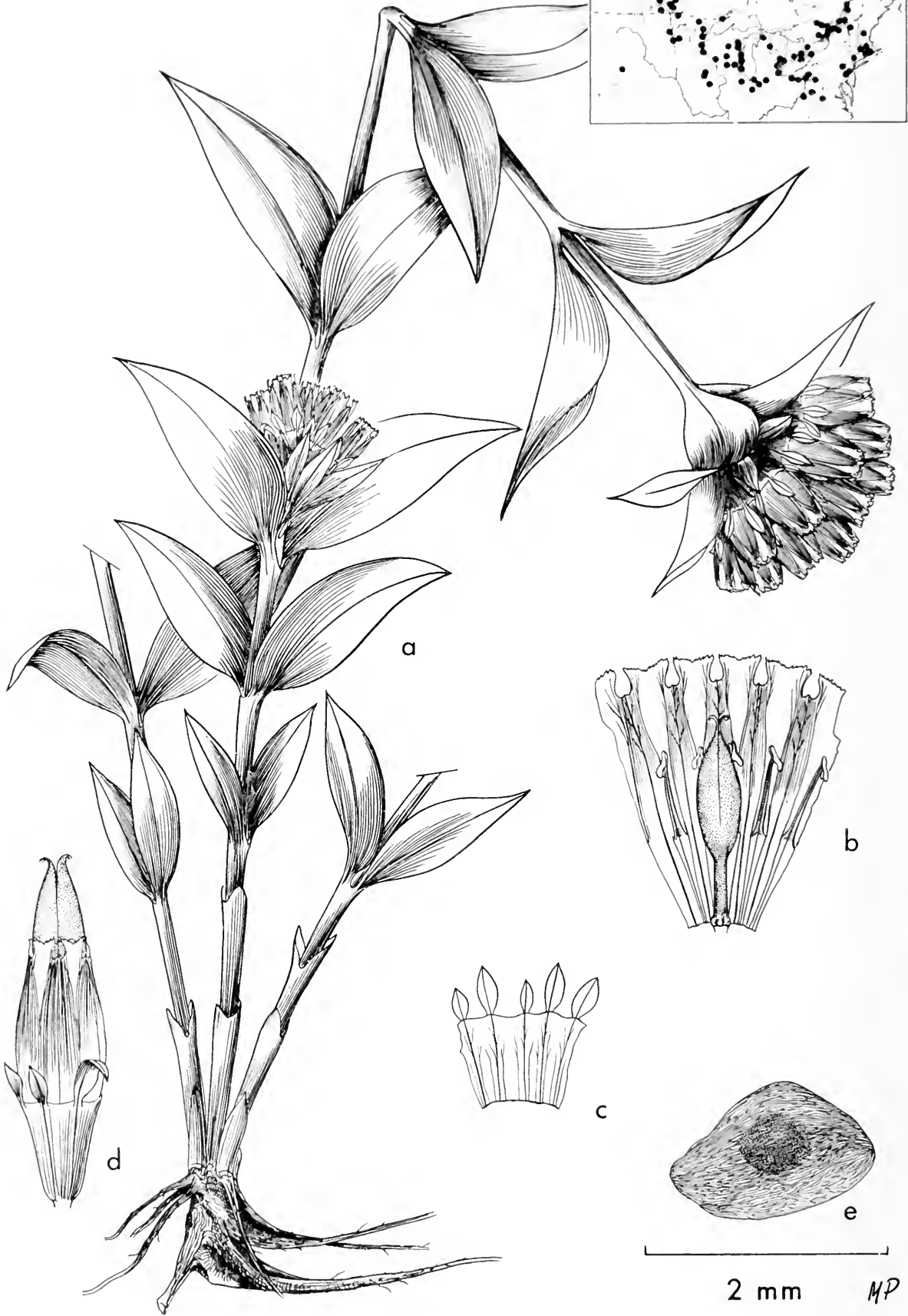
*G. andrewsii* Griseb.  $\beta$  *intermedia* Kusn. in Act. Hort. Petrop. 15: 191. 1898, ex char. (Type: Congdon)

*Dasystephana andrewsii* (Griseb.) Small, Fl. se U.S. 930, 1336. 1903.

*G. alba* Muhl. f. *andrewsii* (Griseb.) Farwell in Am. Midl. Nat. 11: 265. 1929.

Common Names: Andrew's Gentian, Closed Gentian.

Perennial, 4-8 dm tall; stems numerous, simple, ascending from a central rootstalk. Basal leaves obsolete or reduced to triangular to ovate bracts, median leaves ovate to lanceolate, acute to acuminate, 5-15 cm long, 1-4 cm wide. Flowers sessile in dense terminal clusters with smaller clusters or one or two flowers in the axils of the median leaves, each flower subtended by a pair of bracts. Calyx tubular, the tube about 1 cm long, the lobes varying in size, foliaceous, ovate to lanceolate, usually spreading, the margins ciliate. Corolla ellipsoid to clavate, 3.5-4.0 cm long, blue, occasionally white, the lobes to somewhat lacerate plicae longer than the apiculate lobes. Stamens inserted in the lower third of the tube, winged, the anthers 3.5-4.0 mm long, connivent and extrorse. Pistil stipitate, the gynophore about 7 mm long, the ovary ellipsoid, 1.5 cm long, style absent, stigmas recurved. Capsule extending beyond the marcescent corolla. Seeds about 2 mm long, flattened, oblong, broadly winged all around, light brown.





Northern Appalachians north to about Three Rivers, Quebec, west to Manitoba and North Dakota. A species of low elevation found in shady mixed woods, in wet places such as springs and along riverbanks. In the west found on prairie. Flowering from about the third week of August until the second week of October; fruiting the latter half of September onwards.

Some authors (Gleason, 1952; Fernald, 1950) have considered that there are two species, *G. andrewsii* Griseb. and *G. clausa* Raf.; others (e.g. House, 1923) regarded them as one and used the latter, earlier name. Certainly plants in the eastern portion of the Canadian range tend to have broader leaves and fewer internodes than those in the west. However, distribution maps of this and other species of section *Pneumonanthe* show that ranges either overlap or are suspiciously contiguous. The species of this section have a common chromosome number which indicates that a firm genetic barrier between neighboring populations may not exist. The whole of section *Pneumonanthe* evidently needs revision. Since this was impossible in a treatment that deals primarily with Canadian material, the name *G. andrewsii*, currently used for the Canadian plant, has been retained.

The distribution of *G. andrewsii* suggests an Appalachian center of origin. Following the retreat of the glaciers in post-Pleistocene time the species appears to have moved around the ends of the Great Lakes, which have been a barrier to northward migration.

A white-flowered form of this species was originally described by Britton in 1890. When House subsequently transferred this form to *G. clausa* Raf., he based the combination not only on Britton's name but on *G. andrewsii* var. *albiflora* Gray. House probably quoted this latter name from a herbarium specimen annotated by Gray, who apparently never published a description.

The synonymy then is as follows:

*G. andrewsii* Griseb. f. *albiflora* Britton in Bull. Torr. Bot. Cl. 17: 125. 1890.  
(Type: Turnure, N.Y.)

*G. clausa* Raf. f. *albiflora* (Britton) House in Bull. N.Y. State Mus. 243-4: 18. 1923.

*Dasystephana andrewsii* (Griseb.) Small f. *albiflora* (Britton) Moldenke, Obs. Fl. Warren Penn. Suppl. 1: 15. 1944.

This species will transplant easily and both white- and blue-flowered phases are attractive for the perennial border.

#### 7. *Gentiana linearis* Froel.

*G. linearis* Froel. Gen. Diss. 37. 1796.

Perennial, 2-5 dm tall, with 1-several simple, smooth stems arising from a slender, fleshy, several-branched, yellow rootstalk. Leaves lanceolate to elliptic- or ovate-lanceolate, or linear, acute, the base rounded to

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Figure 5. *Gentiana andrewsii* Griseb. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . d, flower with capsule,  $\times 1$ . e, seed.

attenuate or clasping, the margins smooth, the midvein prominent, the two lateral veins less prominent, the upper leaves and the stem occasionally roseate. Flowers sessile, solitary or several, terminal or also axillary, the terminal flowers enveloped in a more or less compact involucre of upper leaves, each flower subtended by a pair of bracts, the bracts free or occasionally fused partly to the calyx of an adjacent flower, the tube including the well-developed intracalycular membrane about 1.0-1.5 cm long, the lobes lanceolate, 0.4-1.2 cm long, the margins smooth or denticulate. Corolla clavate to narrowly funnelform, blue or roseate purple, occasionally white with green lobes, the plicae 1-3-toothed, acute, the lobes 0.5-1.0 cm long, erect, with distinctly inrolled margins. Stamens and pistil similar to *G. andrewsii*, the filaments broadly winged, the anthers connivent in twos or threes, perhaps separating later in some flowers. Pistil stipitate, the gynophore becoming 1.5 cm long. Seeds broadly winged all around.

#### Key to the Subspecies

- Flowers in a loose terminal cluster and frequently axillary, enveloped in narrowly lanceolate bracts; leaves narrowly lanceolate, the base attenuate .....7a. *G. linearis* ssp. *linearis*  
 Flowers in a compact terminal cluster closely enveloped in ovate bracts; leaves broad-lanceolate, the base clasping.....7b. *G. linearis* ssp. *rubricaulis*

#### 7a. *G. linearis* Froel. ssp. *linearis*

##### Figure 6

*G. saponaria* L.  $\beta$  *linearis* (Froel.) Griseb. in Hook. Fl. Bor.-Am. 2: 56. 1838; Sp. Gent. 287. 1839.

*Pneumonanthe linearis* (Froel.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

*Dasystephana linearis* (Froel.) Britton in Britton & Brown, Ill. Fl. ed. 2. 3: 13. f. 3359. 1913.

Common Name: Narrow-leaved Gentian.

From Pennsylvania, West Virginia and Maine through southern and central Quebec to James Bay. Habitat conditions not unduly different from those of *G. andrewsii*. Flowering from about the third week of July throughout August until early September; fruiting from late August until early October; flowers and fruit often occurring simultaneously.

A white-flowered form (f. *blanchardii*) has been described by Fernald (1917).

#### 7b. *G. linearis* Froel. ssp. *rubricaulis* (Schwein.) stat. nov.

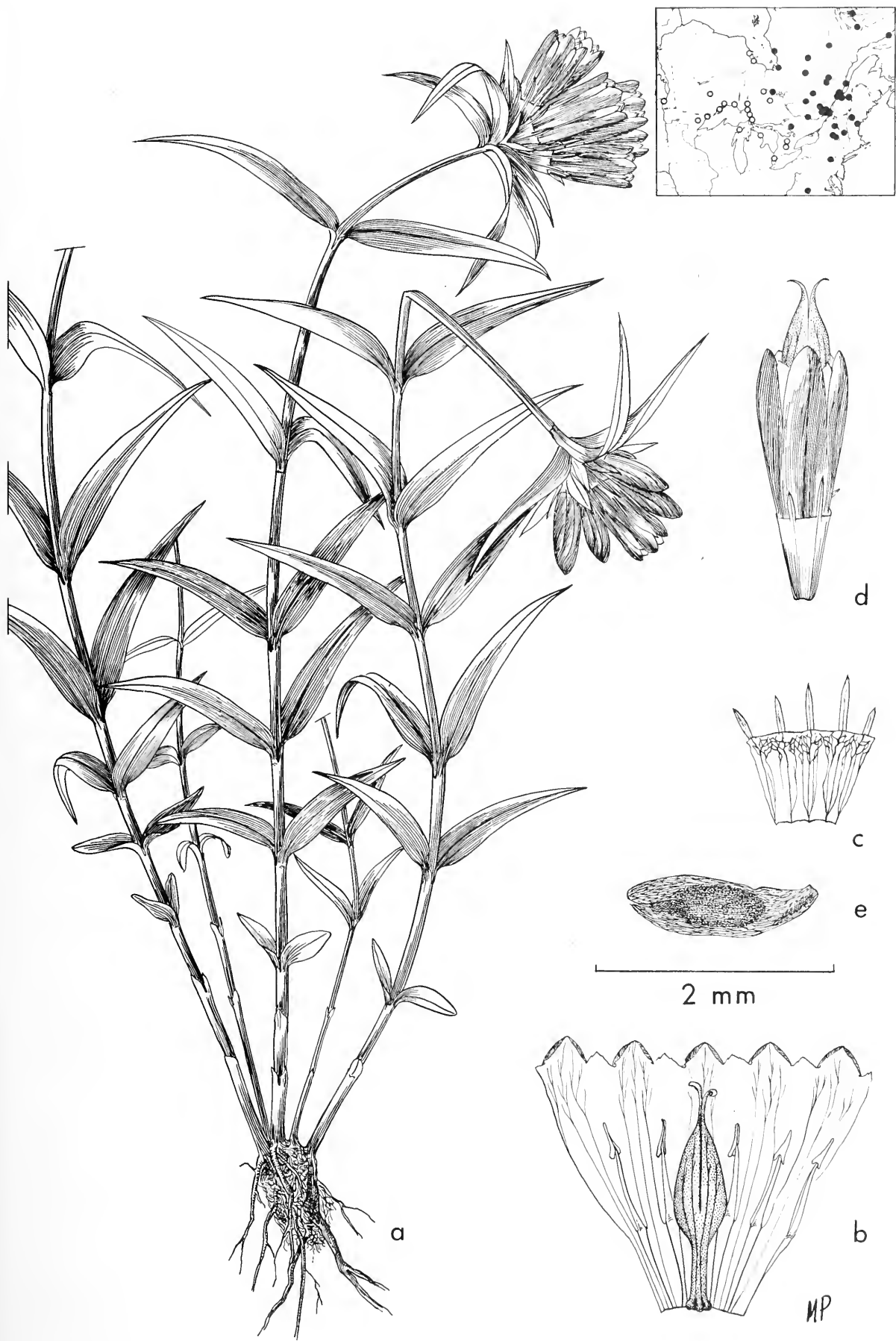
##### Figure 7

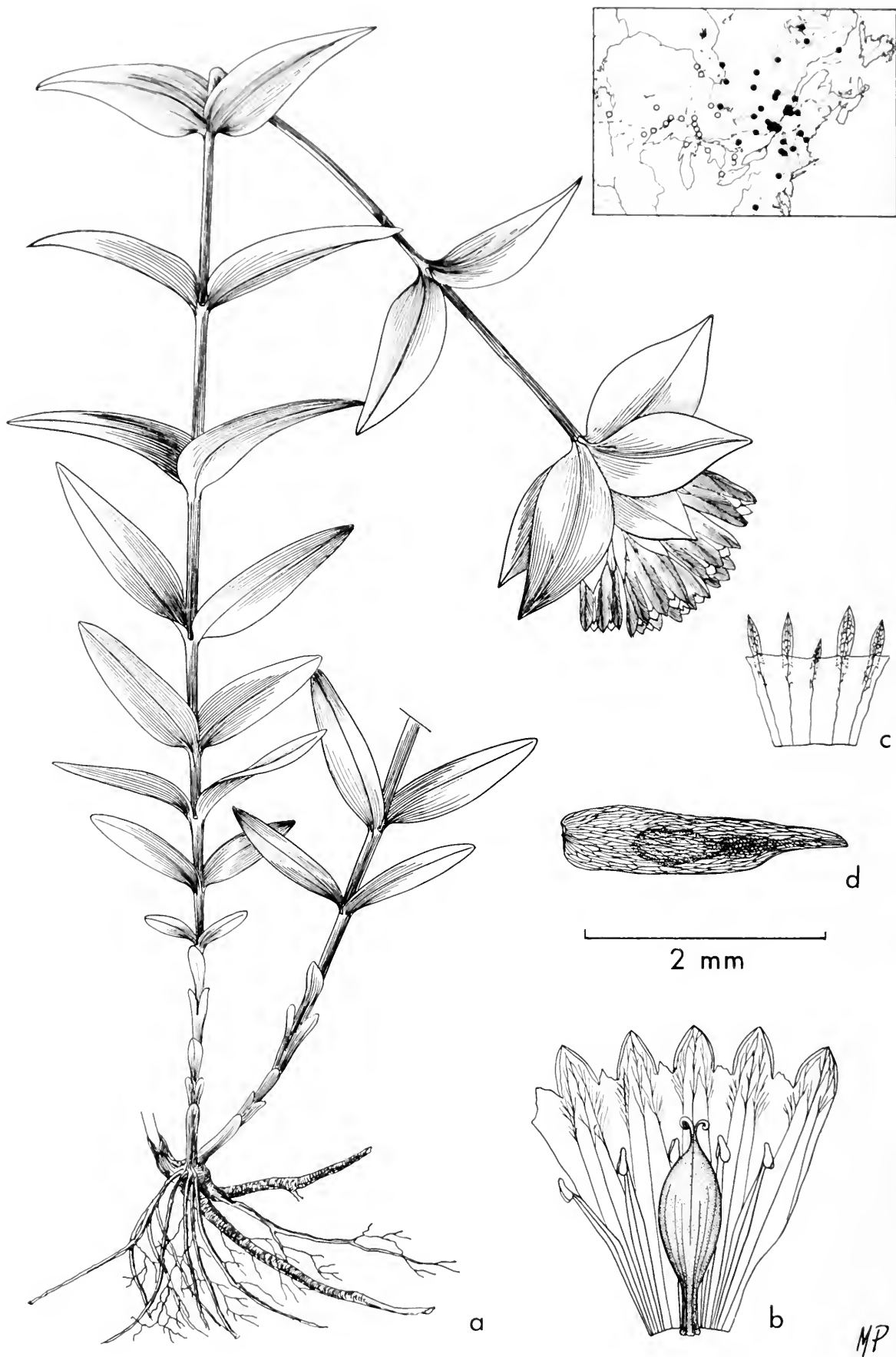
*G. rubricaulis* Schwein. in Keating's Narr. Long's Exped. 2: 384. 1824. (Type: Long, GH)

*G. linearis* var. *lanceolata* Gray, Syn. Fl. N. Am. 2: 123. 1878, based on *G. rubricaulis* Schwein.

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Figure 6. *Gentiana linearis* Froel. ssp. *linearis*. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . d, flower with capsule,  $\times 1$ . e, seed. Map: *G. linearis* ssp. *linearis*, solid dots; ssp. *rubricaulis*, open circles.





*G. linearis* var. *latifolia* Gray in Proc. Amer. Acad. 22: 309. 1887. (Type: Whitney, GH)

*G. grayi* Kusn. in Act. Hort. Petrop. 13: 59. 1893, ex char.

*Dasystephana grayi* (Kusn.) Britt. in Britt. & Br. Ill. Fl. ed. 2. 3: 13. 1913.

*G. linearis* f. *rubricaulis* (Schwein.) Louis-Marie in Rev. d'Oka 34: 11. 1960.

Common Name: Red-stemmed Closed Gentian.

Chiefly about the Great Lakes region from southern Ontario to Manitoba and north to James Bay. Habitats similar to *G. andrewsii*. Flowering from early August until mid-September; fruiting during September.

The synonymy of *G. linearis* Froel. and *G. rubricaulis* Schwein. was clarified by Fernald (1935). The Canadian ranges of the two populations are contiguous. Specimens from the vicinity of Sudbury, Ontario, are intermediate in several characters (e.g., width of inflorescence bracts, leaf-shape, toothing of plicae). For this reason the populations are considered to be subspecies. Their relationship to the closely allied Appalachian *G. saponaria* L. has not been established.

*G. linearis* ssp. *rubricaulis*, which is essentially distributed about the Great Lakes, also occurs on the shores of James Bay at the mouth of the Albany River. As the watershed of the Albany is only a few miles from Lake Superior, the plant could easily have been carried over the divide. Oddly, there are no records from along the Albany River above its mouth. This puzzling gap could be explained either by the lack of collection or the absence of suitable habitats. In contrast, subspecies *linearis*, evidently with an Appalachian center, has spread over much of southern Quebec and reached James Bay along the Nottoway or some temporary postglacial river system.

Neither subspecies has been cultivated but both would be amenable to transplanting.

## 8. *Gentiana puberula* Michx.

### Figure 8

*G. puberula* Michx. Fl. Bor.-Am. 1: 176. 1803. (Type: Michaux, P)

*G. saponaria* L. var. *puberula* (Michx.) Gray Man. ed. 1. 360. 1848.

*Dasystephana puberula* (Michx.) Small, Fl. se. U.S. 930, 1336. 1903.

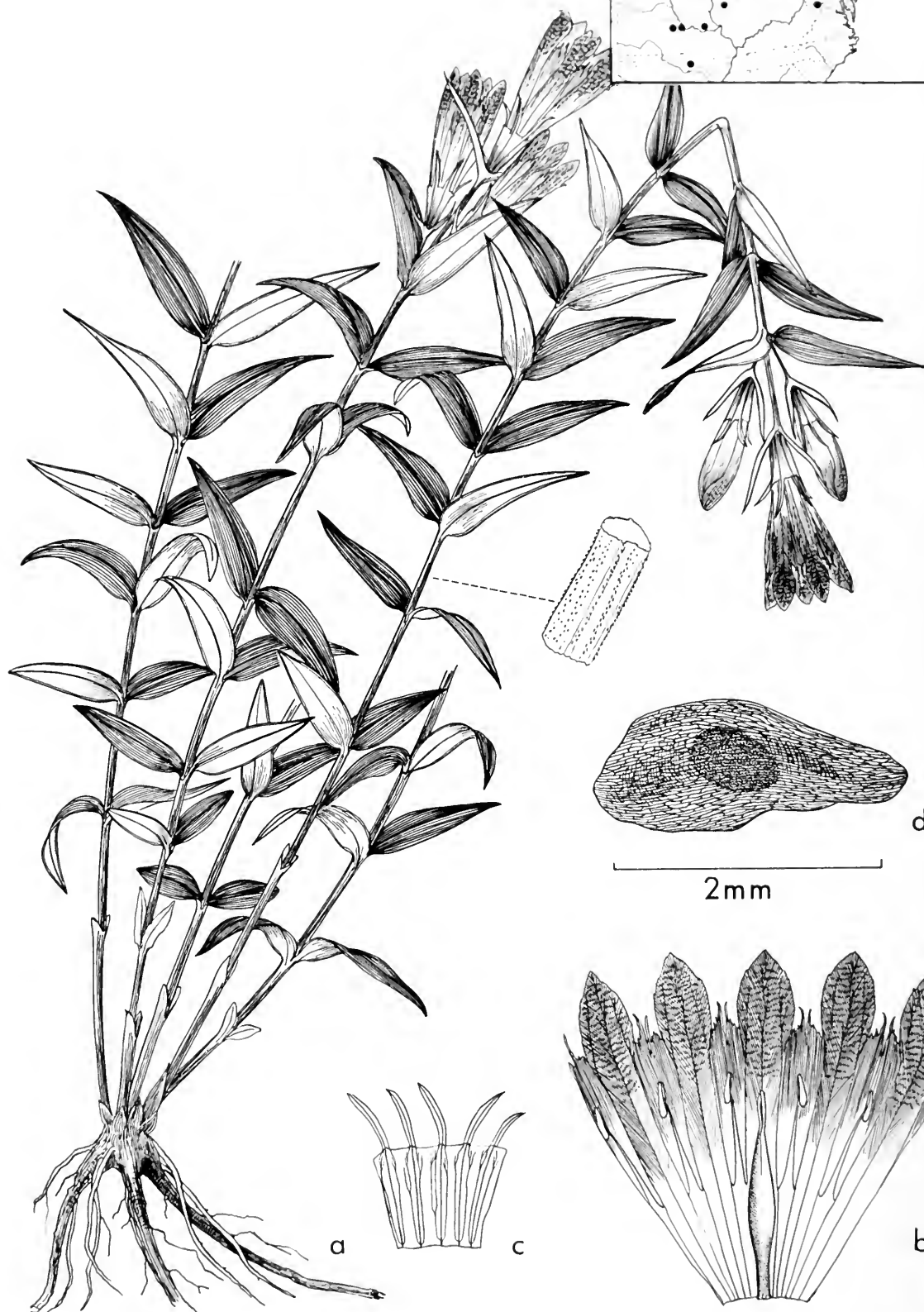
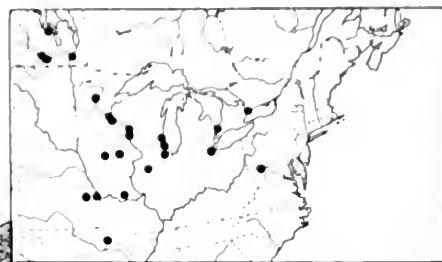
*Pneumonanthe puberula* (Michx.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

Common Name: Downy Gentian.

Perennial, 2-5 dm tall, with simple stems, puberulous above and arising from a slender rootstalk, the internodes short and more or less equal with numerous nodes. Leaves lanceolate to oblong-lanceolate, acute, 2.3-4.4 cm long, 0.4-1.6 cm wide, the margins smooth, frequently inrolled, dark-green to purple-green above, pale below. Flowers few to several in

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Figure 7. *Gentiana linearis* Froel. ssp. *rubricaulis* (Schwein.) Gillett. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . d, seed. Map: *G. linearis* ssp. *linearis*, solid dots; ssp. *rubricaulis*, open circles.



a dense terminal cluster, with or without axillary flowers. Calyx tubular, the tube about 1.2 cm long, the linear lobes variable but usually 0.6-1.0 cm long. Corolla 3.2-4.5 cm long, slenderly funnelform, pale or rarely dark blue, the lobes oblong, 0.5-1.0 cm long, acute, the plicae with cilia to 5 mm long. Stamens inserted in the lower third of the tube, winged, the anthers about 3 mm long, free and extrorse. Pistil stipitate, the gynophore about 4 mm long, tapering, the ovary ellipsoid, 2.0-2.5 cm long, the style 1-2 mm long, stigmas recurving. Capsule included in the marcescent corolla. Seeds 1.0-2.2 mm long, flattened and broadly winged at the ends, narrowly so along the sides, light brown.

Southern Ontario to Manitoba south of the Great Lakes through the states of Indiana, Illinois, Minnesota and Wisconsin, south to Missouri and Arkansas.

Flowering from mid-August to early October; fruiting in September and October.

The map shows enough of the United States range to indicate that the Ontario and Manitoba populations are connected south of the Great Lakes.

*G. puberula* intergrades somewhat with *G. affinis* in Manitoba but there is insufficient evidence to reduce it to a subspecies.

#### 9. *Gentiana affinis* Griseb.

##### Figure 9

*G. affinis* Griseb. in Hook. Fl. Bor.-Am. 2: 56. 1838. (Type: *Drummond*, Kew; photo, DAO)

*G. forwoodii* A. Gray in Proc. Am. Acad. 19: 86. 1883. (Type: *Forwood* in 1882, GH! photo, DAO)

*G. affinis*  $\beta$  *parvidentata* Kusn. in Acta. Hort. Petrop. 15: 201. 1898. (Type: *Suksdorf* 937)

*G. affinis*  $\gamma$  *Forwoodii* (Gray) Kusn. l.c. 202. 1898.

*Pneumonanthe affinis* (Griseb.) Greene, Leaf. Bot. Obs. & Crit. 1: 71. 1904.

*Dasystephana affinis* (Griseb.) Rydb. in Bull. Torr. Bot. Cl. 33: 149. 1906.

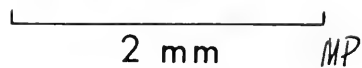
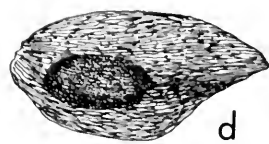
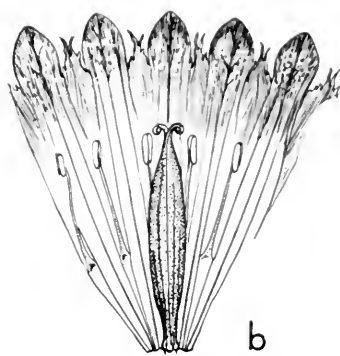
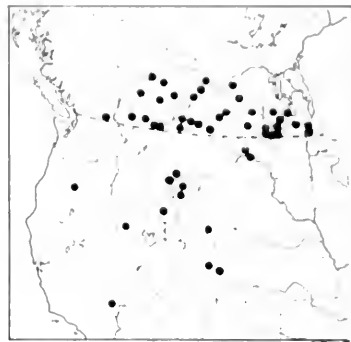
*G. affinis* var. *major* Nels. & Macbr. in Bot. Gaz. 55: 376. 1913. (Type: *Nelson & Macbride* 2178, isotype DAO)

Common Names: Oblongleaf Gentian, Large Gentian.

Perennial, 2.0-3.5 dm tall, with numerous hirsute-scabrous, striate, curved stems ascending from a stout crown bearing simple or profusely branched stout yellow taproots. Leaves relatively uniform throughout, 1.7-3.0 cm long, 0.4-0.9 cm wide, the basal elliptic-oblong, obtuse, frequently reduced, the upper becoming more lanceolate, acute, the margins scabrous. Flowers in racemiform cymes, the basal flowers pedicellate, the upper crowded and subsessile, each flower subtended by one to several pairs of narrow bract-like leaves. Calyx 5-8 mm long, tubular or somewhat

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Figure 8. *Gentiana puberula* Michx. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . d, seed.





spathose, the sinal membrane scarcely curved, the lobes equal or slightly shorter than the tube or irregular, oblong-lanceolate, acute, the midribs and margins scabrous (occasionally the lobes reduced to small teeth or absent). Corolla funnelform to tubular, 1.8-3.0 cm long, green to deep blue, the interior green-speckled below the oblong, obtuse to acute blue lobes, the plicae shorter than the lobes, usually bearing two equal triangular fimbriae but frequently lacerate. Stamens inserted in the lower third of the corolla tube, the wings broad below the insertion and at the base, the anthers oblong, ca. 3 mm long, free. Pistil stipitate, the relatively indistinct gynophore 3-4 mm long tapering into the ovary. Ovary oblong, 8-9 mm long, the style distinct, about 2 mm long, the stigmas small, oblong. Capsule as long as the marcescent corolla, dehiscent at the tip, the stigmas persistent and recurving. Seeds flattened, elliptic, broadly winged and reticulate.

Manitoba and North Dakota to British Columbia, south to Nevada and Arizona. Sedge meadows, saline soils and coulee slopes. Flowering from mid-July to September; fruiting from mid-August to early October. Unfortunately the map in Figure 9 gives inadequate information of the U.S. distribution of this taxon, a reflection merely of the limitation of the material available in this study.

*G. affinis* as observed in southern Saskatchewan is associated with *Potentilla fruticosa* L.; hence the cinquefoil is useful as an indicator species to locate the smaller gentian, which has attractive although not especially showy flowers. The interior of the corolla lobes is blue with green speckles while its exterior is whitish green. The plicae and the cilia are a clear blue.

Typically *G. affinis* has a tubular calyx bearing well-defined calyx lobes, but there is a tendency towards shortening of the lobes or their complete disappearance in some areas. This phenomenon is accompanied by a splitting of the calyx tube to form two roseate-colored spathes similar to those described for *G. platypetala*. An extreme condition where the calyx is virtually lobeless has been described as *G. forwoodii* Gray, the type specimen coming from the Wind River Mountains of Wyoming. Many intermediate conditions of lobing exist throughout the range of the species. Kusnezow reduced *G. forwoodii* to varietal status and then described a variety, *parvidentata*, to take care of the forms with shortened but still evident lobes. This complex however, is best treated as one large species, probably also involving *G. bigelowii* Gray and *G. interrupta* Greene, described from Arizona and Colorado respectively.

## 10. *Gentiana prostrata* Haenke

### Figure 10

*G. prostrata* Haenke, in Jacq. Coll. 2: 66. t. 17. f. 2. 1788.

*Hippion prostratum* (Haenke) Schmidt, in Roem. Archiv. f. Bot. 1: 3-23. 1796.

*Ericoila prostrata* (Haenke) Borkh. in Roem. Archiv. 1: 23-32. 1796.

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Figure 9. *Gentiana affinis* Griseb. a, plant,  $\times 0.5$ . b, corolla,  $\times 1.25$ . c, calyx,  $\times 1.25$ . d, seed.

*Gentiana prostrata* var. *americana* Engelm. in Trans. Acad. Sci. St. Louis 2: 217. 1863.

*Chondrophylla americana* (Engelm.) Nels. in Bull. Torr. Bot. Cl. 31: 245. 1904.

*C. prostrata* (Haenke) Anderson in Proc. Iowa Acad. Sci. 25: 445. 1918.

Common Names: Moss or Prostrate Gentian.

Annual, 1-25 cm tall, branched from the base with numerous curved, ascending branches. Leaves ovate to spatulate, subconnate, vaginate with obtuse, mucronate tips, recurving, the margins green, entire, the lower leaves spatulate and generally forming a rosette. Flowers solitary and terminal, erect or slightly turned to one side but not nodding. Calyx 4-5-parted, tubular, to 12 mm long, the lobes about half as long as the tube, acute, the keels apparent but scarcely prominent, purpled. Corolla tubular, salverform when expanded, to 18 mm long, the tube white to blue, the clear-blue lobes ovate acuminate, the plicae broadly triangular, half as long as the lobes, 2-3-toothed. Stamens inserted at the middle of the tube, the filaments flattened, anthers oblong, 0.5 mm long, free. Pistil short stipitate, the gynophore elongating as much as twice the length of the corolla in fruit, the ovary oblong, to 1 cm long, the style short or absent, stigmas oblong. Capsule to 1.5 cm long, oblong, obtuse, the valves recurving at the tip. Seeds curved, smooth, without wings.

From Kotzebue (fide Ledebour) and Norton Sound, the northern slopes of the Brooks Range, Unalaska (Ledebour), southeast Alaska, southern Yukon, southwestern Alberta, British Columbia, and Wyoming, with a pronounced gap in distribution between the Yukon border and Jasper Park, Alberta (possibly a collection gap since this area has not been thoroughly surveyed). Flowering throughout July and August; fruiting in August.

Englemann considered the American plants to have perianth parts in fours and described them as var. *americana* to distinguish them from the supposedly 5-parted perianth of the European plant. He wrote: "In the European plant, which I have been unable to compare, they are said to be 5-parted." Variation in the American population samples at hand indicates that 4-parted flowers occur in diminutive alpine forms and 5-parted ones in larger, low-elevation forms.

### 11. *Gentiana aquatica* L.

#### Figure 11

*G. aquatica* L. Sp. Pl. 1: 229. 1753.

*G. humilis* Stev. in Mém. Soc. Nat. Mosc. 3: 258. 1812, not Salisb. Prodr. 137. 1796.

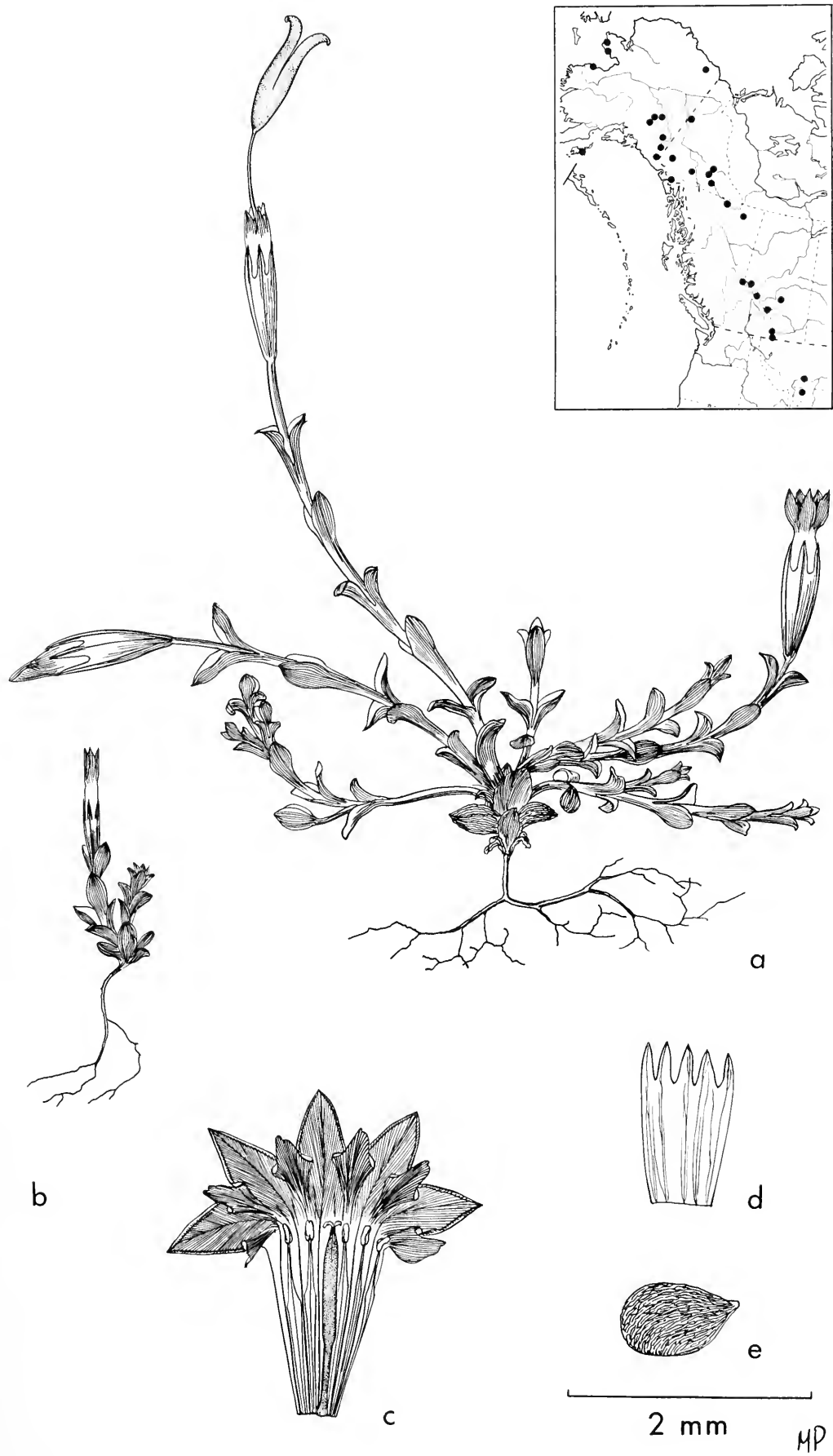
*G. Fremontii* Torr. in Frem. 1st Exped. Rept. 94. 1845. (Type: *Fremont s.n.*, NY! photo, DAO)

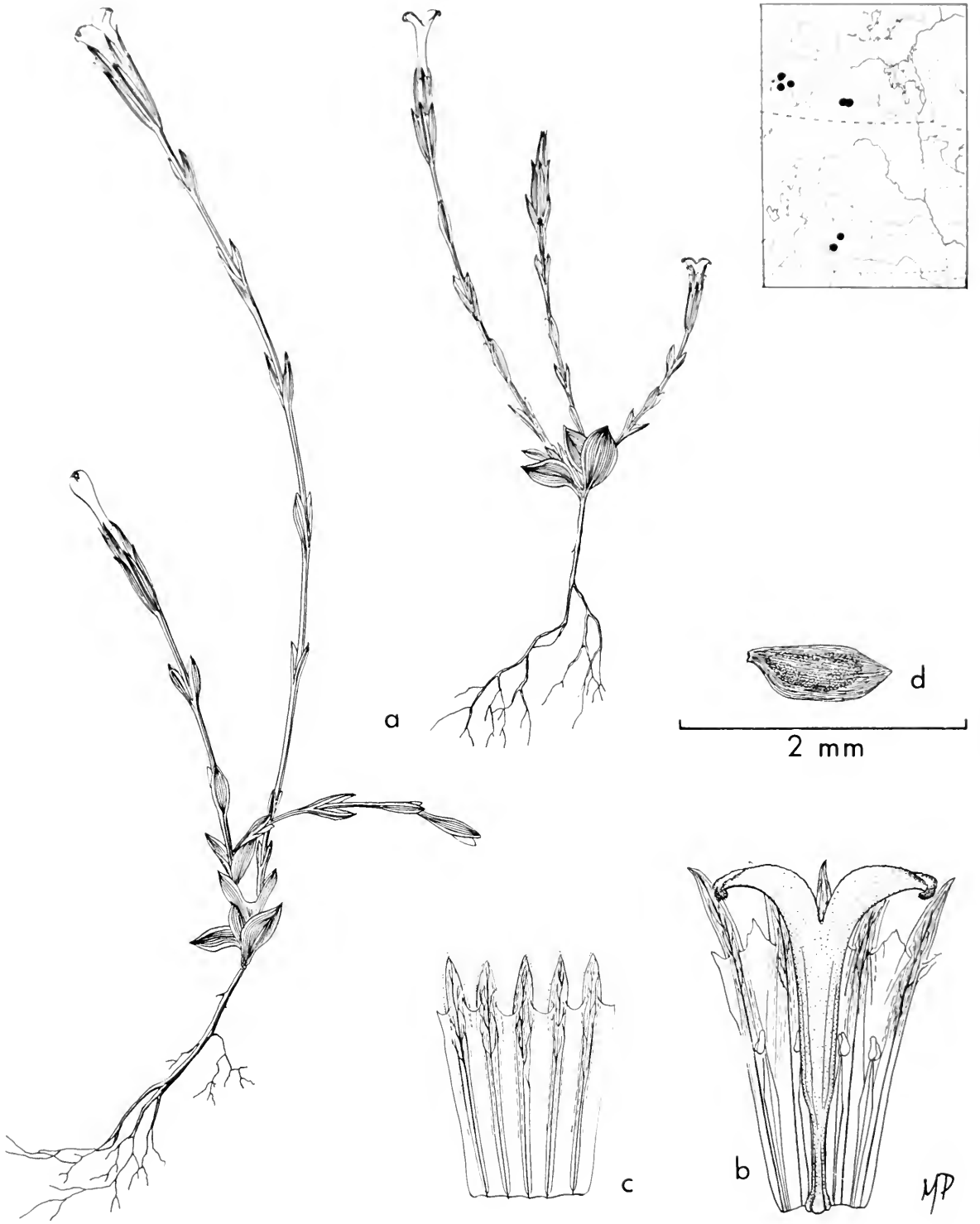
*Chondrophylla humilis* (Stev.) Cockerell in Am. Nat. 40: 871. 1906.

Common Name: Lowly Gentian.

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Figure 10. *Gentiana prostrata* Haenke. a, plant,  $\times 1$ . b, dwarf plant,  $\times 1$ . c, corolla,  $\times 2.25$ . d, calyx,  $\times 2.25$ . e, seed.





Annual, 1-8.5 cm tall, branched from the base with few to numerous ascending to straight branches, occasionally unbranched, the nodes frequently purple. Leaves pale green, linear-oblong, connate, scarcely recurving, the apices mucronate, the margins white, entire, the lower leaves spatulate and forming a rosette. Flowers solitary and terminal, erect. Calyx 4-5-parted, tubular, 4-8 mm long, the lobes less than a quarter as long as the tube, acute, the keels not prominent. Corolla tubular, to 10 mm long, the tube greenish or purplish, the lobes acuminate, the plicae white, obtuse, rarely toothed. Stamens inserted in the lower third of the corolla tube, the filaments flattened, the anthers oblong, 0.75 mm long, free. Pistil sessile, rarely short stipitate, the ovary lanceolate, 2.5-3.0 mm long, the style short or absent. Capsule 1.5 cm long, clavate, included in the marcescent corolla, the frequently purplish valves strongly recurving. Seeds ellipsoid, minutely striate, without wings.

South-central Saskatchewan, southwestern Alberta and Colorado. Occurring also in Asia. In moist sandy mud flats or saline meadows, bogs or mountain meadows. Flowering from mid-June to August; fruiting in August.

The name *G. aquatica* L. follows the treatment of Grossheim (1952). He has decided that *G. humilis* Stev., a name that has been applied to the American plant, is synonymous with *G. aquatica*. *G. humilis* Stev., of course, is a later homonym and therefore cannot be used.

A white-flowered form and a blue-flowered form were described respectively as *G. humilis* [var.] *albescens* Cockerell and *G. humilis* [var.] *caerulea* Cockerell (1889). Both are from Colorado. White-flowered forms may be referred to *Gentiana aquatica* f. *albescens* (Cockerell) comb. nov. (*Gentian humilis albescens* Cockerell in West. Am. Sci. 6: 11. 1889).

## 12. *Gentiana douglasiana* Bong.

### Figure 12

*G. douglasiana* Bong. in Mém. Acad. Imp. Sci. St. Pétersb. 2: 156. t. 6. 1833.  
(Type: *Douglas s.n.*, K; photo, DAO)

Common Names: Douglas's or Swamp Gentian.

Annual, erect, 0.5-2.7 dm tall, branched from the base or above, or simple, the stem angled and frequently deeply purplish. Roots fibrous. Leaves sessile, the basal ovate, elliptic to oblong-obovate, acute, forming a rosette, the median ovate, 4.0-(5.9)-8.0 mm long, 3.0-(4.7)-7.0 mm wide. Flowers each subtended by an ovate bract, solitary or in simple cymes with or without axillary flowers. Calyx 5-parted, campanulate, 6.5 mm long, without an intercalycular membrane, the lobes less than half as long as the tube, acute, keels absent. Corolla tubular-campanulate, about 12 mm long, the tube greenish, the purple lobes white within, oblong, about 3.5 mm long, the bifid plicae lanceolate, acute. Stamens inserted at the middle of the tube, anthers oblong, 1.4 mm long, free. Pistil sessile with prominent basal glands, the ovary oblong, stigmas sessile. Capsule obovate-

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Figure 11. *Gentiana aquatica* L. a, plants,  $\times 1.5$ . b, corolla with capsule,  $\times 4$ . c, calyx,  $\times 4$ . d, seed.

oblong to oblong, 12 mm long, 3 mm wide, the valves slightly parting at the tip, the seeds smooth, elongate, tapering at each end, light tan.

Sphagnum bogs along the west coast from Alaska to Washington, flowering from late May until September; fruiting in September and October.

This species superficially resembles those of *Gentianella* because the intracalycular membrane of the calyx is absent; however, this calyx character is of secondary importance despite Kusnezow's emphasis on it in his monograph. The well-developed interlobal corolla plicae and presence of the glands at the base of the ovary rather than at the base of the corolla suffice to place the species in *Gentiana*. Kusnezow placed *G. douglasiana* in the section *Chondrophylla* although it seems difficult to associate it closely with the other species in this section.

This species is endemic to the west coast and is not likely to be confused with any other.

### 13. *Gentiana nivalis* L.

#### Figure 13

*G. nivalis* L. Sp. Pl. 1: 332. 1753.

*Hippion nivale* (L.) Schmidt, in Roem. Archiv. f. Bot. 1: 3. f. 6. 1796.

*Ericoila nivale* (L.) Borckh. l.c. 27. 1796.

Common Name: Snowy Gentian.

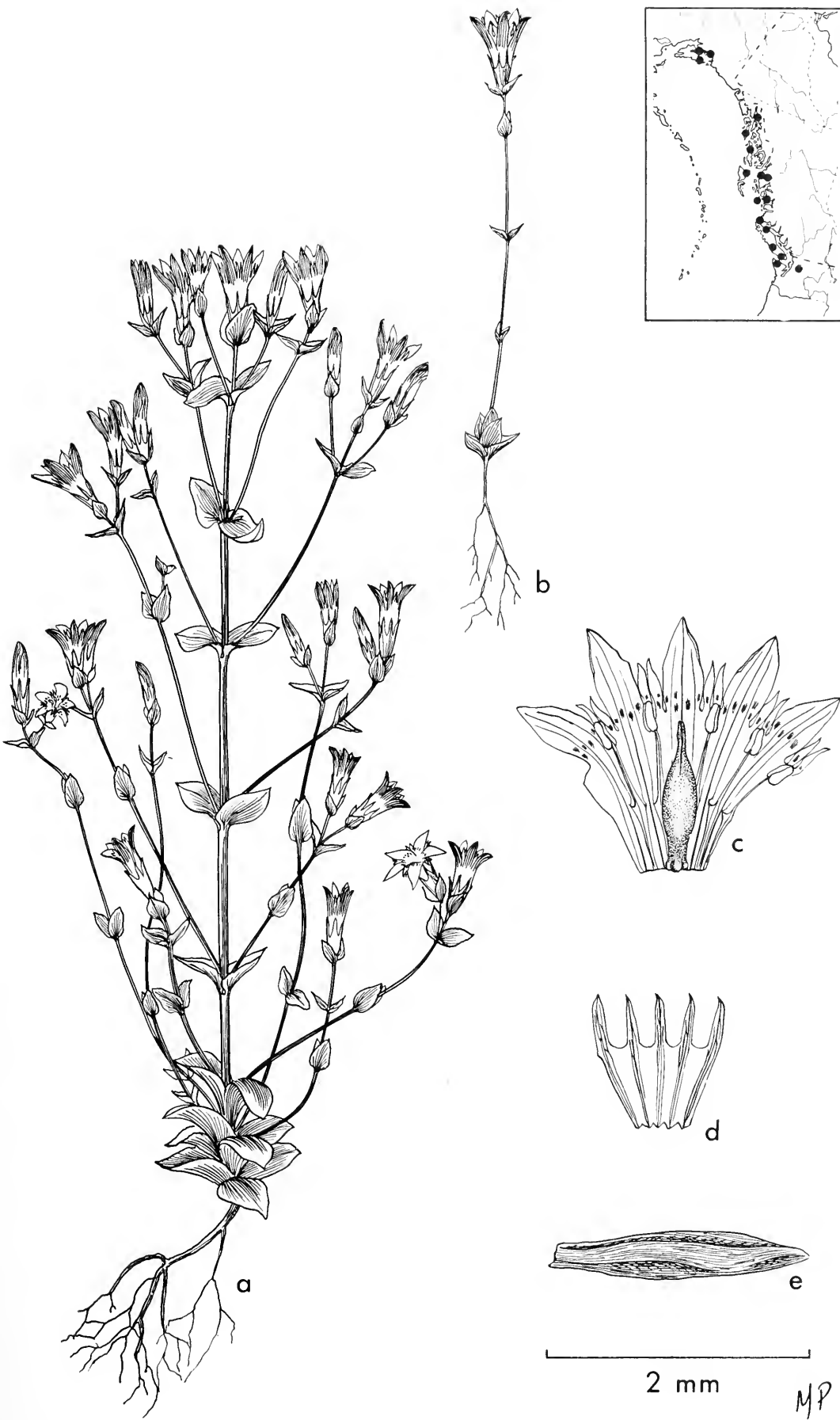
Annual, erect, 3-16 cm tall, fastigiately branched chiefly from the base, occasionally above, rarely simple, the stem angled and frequently purpled. Root a poorly developed taproot with few branches. Leaves sessile, the basal elliptic-obovate, obtuse, often forming rosettes, the cauline ovate, 3-9 mm long, 2-4 mm wide. Flowers terminal and axillary, 1.7-2.5 cm long. Calyx 4-5-parted, cylindrical, purple-keeled, the lobes lanceolate, about a quarter as long as the tube, acute. Corolla tubular becoming salverform when the lobes expand, green below becoming blue above, the ovate lobes blue, the plicae usually bifid, short triangular, acute. Stamens inserted in the middle of the tube, anthers oblong, attached at the middle, free, filaments not winged. Pistil sessile, the ovary cylindrical, stigmas flabelliform, style 1-1.5 mm long. Capsule cylindrical, 1-1.5 cm long, the valves parting in the upper part, seeds numerous, tapered to the ends, without wings, 0.5 mm long, shiny, dark brown, alveolate appearing faceted.

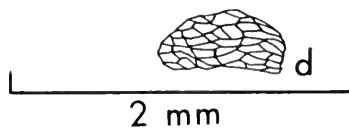
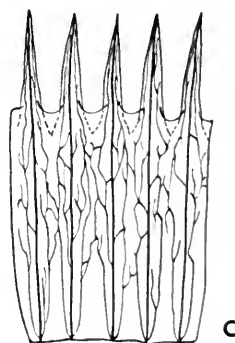
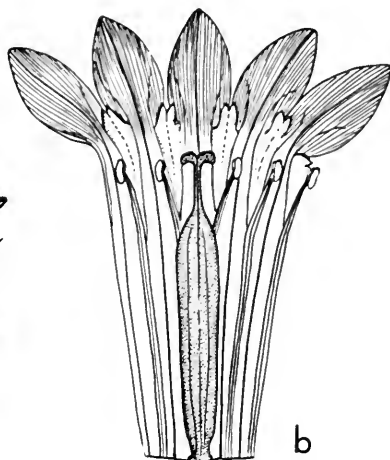
Meadows and slopes of Labrador from Kangalaksiorvik Fjord to Saglek, Hebron, Cape Mugford and Okkak. In Greenland from Nugssuaq to Igaliko and Prince Christian Sound. Also in Iceland, in Norway and in the mountains of central to south Europe and Asia Minor. Flowering from early July to August; fruiting in August.

Although found on the west coast of Greenland halfway along Davis Strait and also on the northern coast of Labrador, this species has not been

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Figure 12. *Gentiana douglasiana* Bong. a, plant,  $\times$  1. b, dwarf plant,  $\times$  1. c, corolla,  $\times$  3. d, calyx,  $\times$  3. e, seed.





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found on Baffin Island. This distribution pattern is probably real rather than due to a collection gap and emphasizes a different postglacial history for Baffin Island than for northern Labrador.

A white-flowered form, *G. nivalis* L. f. *albiflora* (Lange) stat. nov. (*G. nivalis* var. *albiflora* Lange in Meddel. Groenl. 3: 265. 1887), occurs in Greenland.

*Lomatogonium* A. Br. Fl. 13: 221. 1830.

Flowers 5-4 (rarely 7-6)-merous. Sepals nearly free or united at the base into a very short tube. Corolla rotate, each petal bearing two basal epipetalous glands each with or without an evascular fimbriate corona. Stamens alternate, with the corolla lobes inserted and united at the base to the petal margins, introrsely dehiscent. Ovary unilocular, the ovules borne at the sutures (parietal placentae). Stigmas two, decurrent along the carpel sutures. Capsule 2-valved, septicidally dehiscent from the apex.

Annual, possibly biennial, herbs of arctic, temperate and high alpine regions.

Type species: *L. rotatum* (L.) Fries, Summa Veg. Scand. Sect. Post. 554. 1849.

One species in North America.

1. *Lomatogonium rotatum* (L.) Fries

Figure 14

*L. rotatum* (L.) Fries, Summa Veg. Scand. Sect. Post. 554. 1849.

*Swertia rotata* L. Sp. Pl. 1: 226. 1753.

*Gentiana rotata* (L.) Froel. Gent. 105. 1796.

*Pleurogyne rotata* (L.) Griseb. Sp. Gen. 309. 1839.

*P. fontana* A. Nels. in Proc. Biol. Soc. Wash. 17: 177. 1904.

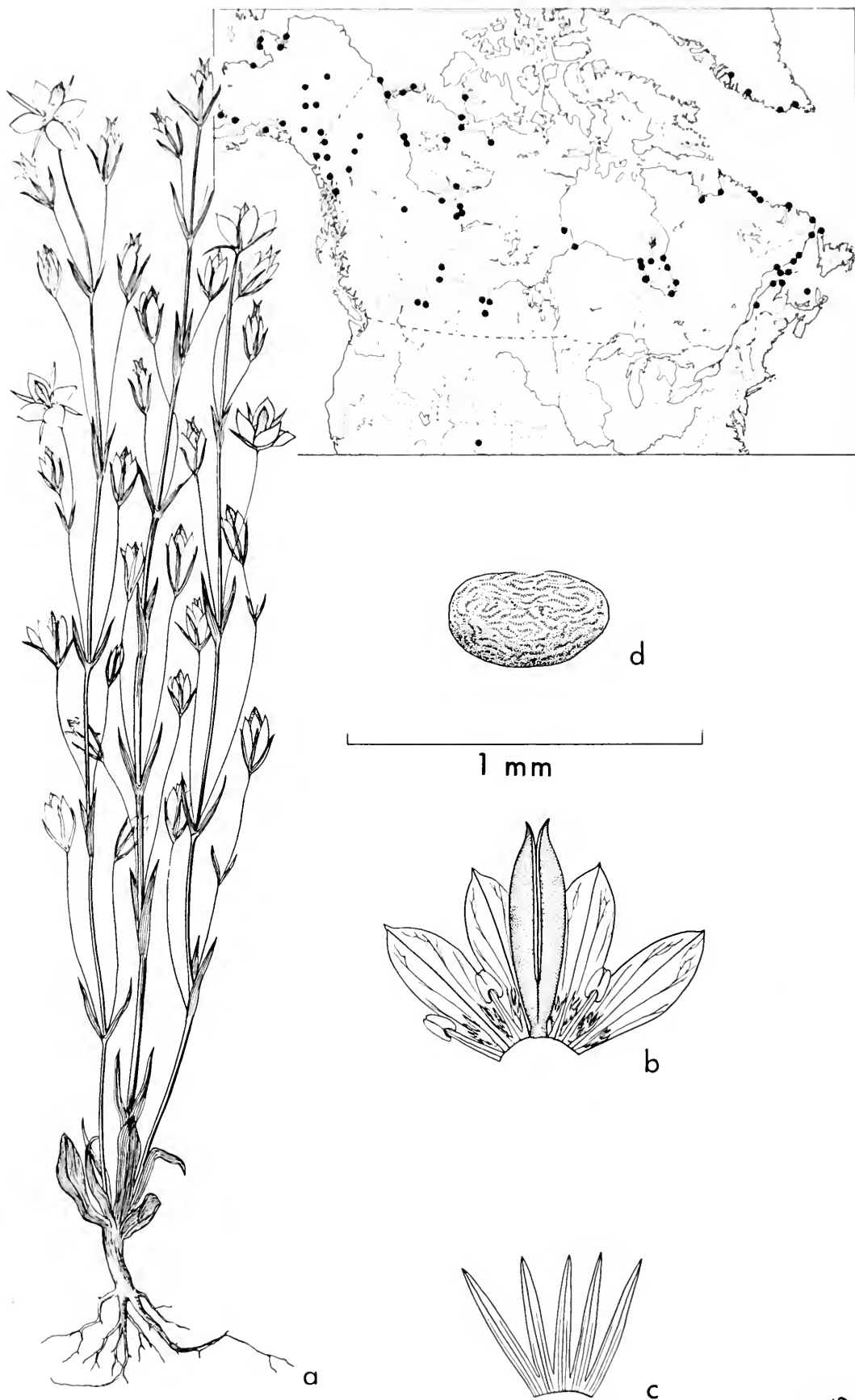
*L. rotatum* f. *ovalifolium* Fern. in Rhod. 21: 197. 1919.

Common Name: Marsh Felwort.

Annual with slender, poorly developed taproots, the stem erect, frequently branching, 0.5-3.0 dm tall. Basal leaves elliptic to spatulate, somewhat crowded, early withering; median leaves ovate to linear-lanceolate, obtuse, 0.5-2.0 cm long, 0.1-0.3 cm wide. Flowers in terminal cymes with or without axillary flowers below, or solitary. Sepals essentially free, linear-lanceolate, acute, 5-15 mm long, 0.5-1.5 mm wide with a prominent midvein. Corolla rotate, 0.8-2.0 cm wide, the tube very short, the pale blue or white purple-veined lobes ovate, acute to somewhat apiculate, each lobe bearing several fimbriae at the base. Stamens 0.5 cm long, the filaments flattened, the versatile anthers 2 mm long, 1 mm wide. Pistil oblong, sessile, to 1.0 cm long, the stigmas sutural. Capsule to 1.5 cm long, exserted from the marcescent and closed corolla, the valves strongly recurving at the tip, the seeds light to dark brown, longer than wide, 0.5-0.75 mm long.

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Figure 13. *Gentiana nivalis* L. a, plant,  $\times 1$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed.



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Circumboreal in distribution. In America extending from Alaska to Labrador, Quebec and Greenland then southward in Saskatchewan and Alberta and disjunct to Colorado. Flowering from late July throughout August; fruiting from late August to early September.

Grisebach (1839) described two varieties of *Lomatogonium rotatum* (under *Pleurogyne*), namely  $\beta$  *tenuifolia* and  $\gamma$  *americana*, based on leaf shape and branching. Fernald (1919), on the basis of these variations, reduced them to forms and at the same time described a third form, f. *ovalifolium* Fern. A white-flowered form, f. *albiflorum* Polunin, has been described from Greenland (Polunin 1943).

Because of concentrated collecting in Alaska and the Yukon, the map (Figure 14) gives a somewhat false picture of population density. But certainly *L. rotatum* has spread rapidly across the continent since deglaciation. The Colorado locality shown on the map represents the limit of an ancient preglacial distribution, and may be considered a refugium where this species remained during the glacial epoch. This sort of extension of range to Wyoming or Colorado is seen in a large number of Canadian plant species.

Grossheim (1952) considered *Pleurogyne stelleriana* (C. & S.) G. Don (= *Gentiana stelleriana* Cham. & Schlecht.) to be synonymous with *L. rotatum*, but as *G. stelleriana* was described from Asia, not North America, this synonymy has not been included.

### *Swertia* L. Sp. Pl. 1: 226. 1753.

Flowers 5-merous. Calyx deeply divided, the sepals nearly distinct. Corolla rotate, the thin lobes bearing one or two fringed foveae on the ventral surface. Stamens 5, inserted on the corolla tube alternate with the lobes, the extrorse anthers versatile. Ovary unilocular, bicarpellate, the style short or absent, the placentae parietal, sutural. Capsule 2-valved, somewhat flattened.

Biennial or perennial, usually small herbs of Europe, Africa, Asia, and America.

Type species: *Swertia perennis* L.

#### 1. *Swertia perennis* L.

Figure 15

*S. perennis* L. Sp. Pl. 1: 226. 1753.

*S. obtusa* Ledeb. in Acad. Imp. Sci. St. Pétersb. Mém. 5: 526. 1814.

*S. perennis* var. *obtusa* (Ledeb.) Ledeb. ex Griseb. Gen. Sp. Gen. 331. 1839.

Common Names: Felwort or *Swertia*.

Perennial from a fibrous-rooted rhizome, the stem erect to ascending, 1.5-6.0 dm tall. Basal leaves oblong-elliptic, short- to long-petiolate, 4-15 cm long, 1.5-3.5 cm wide; median leaves ovate-oblong, sessile or petiolate, diminishing in size upwards. Flowers in a terminal dichasium with or without axillary flowers or floral branches. Sepals essentially free, nar-

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Figure 14. *Lomatogonium rotatum* (L.) Fries. a, plant,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed.

rowly lanceolate, acute, 10 mm long, 2.5 mm wide at the base, green with hyaline entire margins and three prominent veins. Corolla rotate, 3.5 cm wide, the tube very short, the white or blue, purple-speckled or -veined lobes lanceolate, acute, each lobe bearing two circular fimbriate foveae 1 mm wide at the base. Stamens 6 mm long, the filaments flattened and slightly tapered, the anthers 2.5 mm long, 1 mm wide. Pistil ovate, sessile, 0.5 cm long, the reniform stigmas sessile. Capsule 1.3 cm long, slightly exserted from the marcescent, now tubular, corolla, the dehiscence apical, the dark-brown seeds flattened or angular and irregularly broadly winged all around.

The Aleutian Islands and coastal southern Alaska, also in Montana, Wyoming and Colorado, apparently found in Canada only in the Queen Charlotte Islands and the Haines Road area in the northwest corner of British Columbia. Also extending into Siberia and Europe, where it has been variously split into varieties. In meadows at 10,000 to 12,000 feet in the United States proper but in marshy places, bogs, open woods and alpine tundra in Alaska. Flowering in August in the south and in July and August in the north; fruiting in August.

*Frasera* Walt. Fl. Car. 87-88. 1788.

Flowers 4-merous. Calyx deeply divided, the sepals almost free. Corolla rotate, the firm lobes bearing one fringed fovea on the ventral surface. Stamens 4, inserted on the corolla tube alternate with the lobes, the anthers versatile, extrorse. Ovary unilocular, bicarpellate, attenuate to a filiform style, the placentae parietal, sutural. Capsule 2-valved, compressed either parallel or contrary to the valves.

Biennial or perennial, usually coarse herbs of the eastern and western continental United States and southern Canada.

Type species: *Frasera caroliniensis* Walt.

1. *Frasera caroliniensis* Walt.

Figure 16

*F. caroliniensis* Walt. Fl. Car. 87. 1788.

*Swertia caroliniensis* (Walt.) O. Ktze. Rev. Gen. 2: 430-431. 1891.

*Frasera walteri* Michx. Fl. Bor.-Am. 1: 97. 1803.

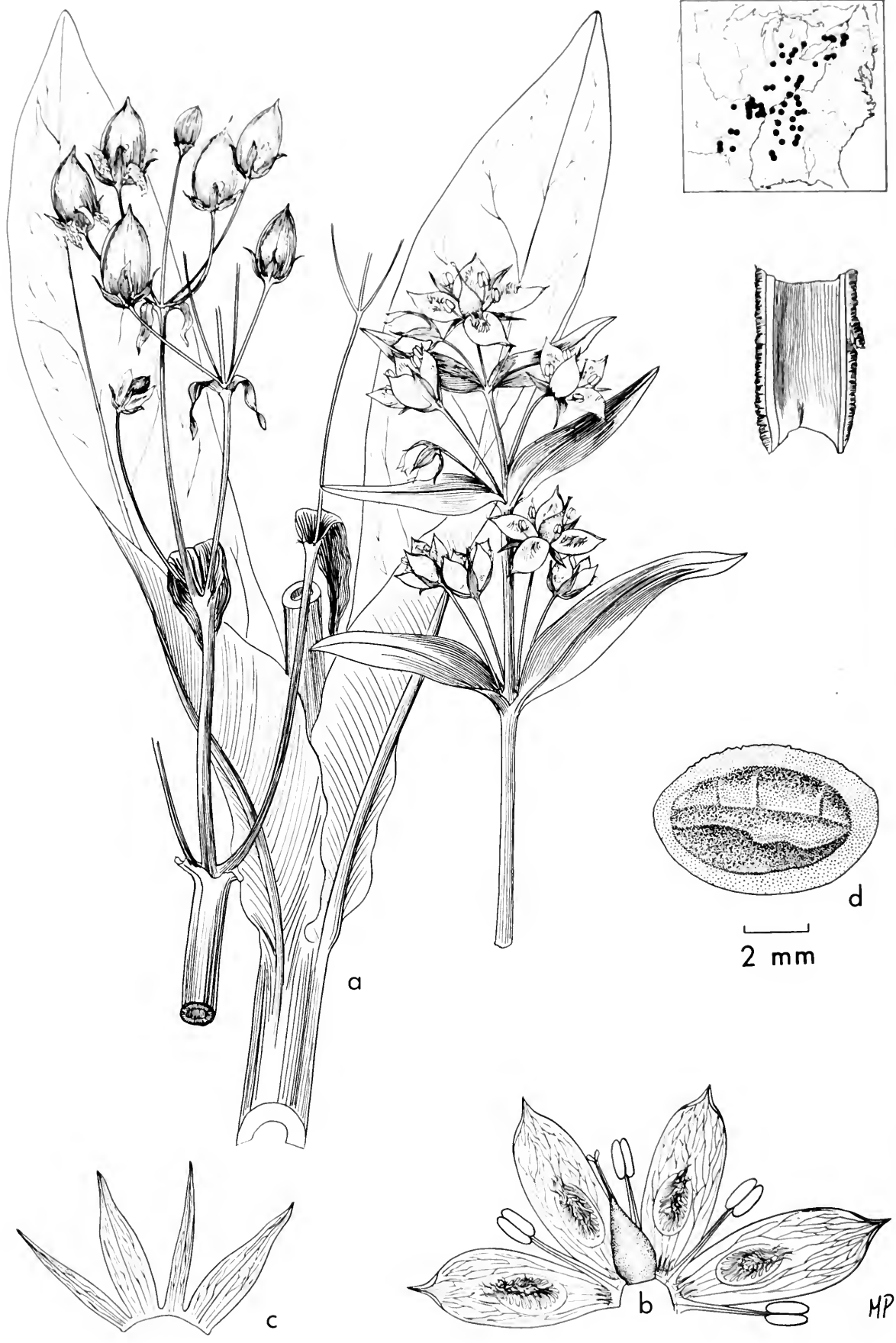
Common Name: American Columbo.

Perennial with a thick, woody taproot, 1-1.5 m high, unbranched, erect. Leaves in whorls of 3-5 (usually 4), entire, the basal obovate to oblanceolate, 20-35 cm long, 4-8 cm broad, narrowed to an obscure petiole, the cauline leaves sessile, oblong-lanceolate, 5-20 cm long, 1-5 cm broad. Flowers in a terminal, compound, open panicate cyme, the peduncles clustered, 4-12 cm long. Calyx lobes nearly distinct, lanceolate, mucronate, 20 mm long, 2 mm wide; corolla rotate, the tube short, the lobes ovate, 10-20 mm long, 4 mm broad, light greenish yellow with brown-purple speckles, the fovea single, circular with evident fimbriae. Stamens 8 mm

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Figure 15. *Swertia perennis* L. a, plant,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ .





long, the filaments slender, the anthers 3 mm long, 1 mm wide. Pistil ovate, 1.3 cm long, tapered into a slender style 2-3 mm long, the stigmas small. Capsule 2 cm long, 1 cm wide, flattened parallel to the woody valves, slightly exserted from the marcescent corolla, dehiscence apical, the seeds dark brown, oblong, 0.6-1.0 cm long, 0.4-0.5 cm broad, flattened, the surface pitted, conspicuously winged all around.

Ontario and Michigan south to Mississippi and Alabama. Sandy open woods, roadsides and fields. Flowering from May to July; fruiting from July to September, the dead stalks frequently persisting throughout the winter.

The genus *Frasera* was monographed by Card in 1931. A monograph of *Swertia* written by St. John (1941) quickly followed. He made *Frasera* synonymous with *Swertia*. Post (1950) made an anatomical study of the genus *Frasera* and of *Swertia perennis* L. In a letter to me, Dr. Post expressed the view that he favored the retention of the two genera on the basis of chromosome series relationships. He did not, however, consider the number of foveae to be of great enough significance to separate the genera. In this treatment this character is used for convenience because we have only one species of each genus in Canada.

*Halenia* Borckh. in Roem. Archiv. f. Bot. 1: 25. 1796,  
nom. conserv. Intern. Code Bot. Nom. 128. 1952.

Calyx 4-parted, tubular, often with squamellae at the base of each of the free foliaceous lobes. Corolla marcescent, campanulate, the lobes dextrorsely convolute, spurred, or foveate but without marginal squamellae. Stamens 4, included, adnate to the corolla tube, the anthers 2-celled, versatile. Ovary bicarpellate, unilocular, the placentae parietal, the stigmas 2, terminal. Capsule 2-valved, septicidally dehiscent from the apex. Seeds somewhat elongate, slightly flattened, granular or reticulate.

Annual, biennial or perennial herbs of temperate and high alpine regions of the world.

Type species: *H. sibirica* Borckh. = *H. corniculata* (L.) Druce

### 1. *Halenia deflexa* (Sm.) Griseb.

Figure 17

*H. deflexa* (Sm.) Griseb. in Hook. Fl. Bor.-Am. 2: 67. 1838; Gen. & Sp. Gent. 324. 1839.

Common Name: Spurred Gentian.

Winter annual, 0.3-1.9 dm tall, stem simple or branched above, quadrangular; leaves 3-5-nerved, the basal oblong-spatulate, 1-2 cm long, petiolate, the cauline oblong-lanceolate to ovate, acuminate, 1-5 cm long, 0.5-2 cm wide. Flowers in a terminal or axillary loose umbelliform or aggregate cyme. Calyx tubular, 0.4-0.8 cm long, the lobes ovate-lanceolate, acuminate. Corolla tubular, green, rarely purple, 0.8-1.4 cm long, the

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Figure 16. *Frasera caroliniensis* Walt. a, plant with stem section,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed.

lobes lanceolate to ovate, acute, about equal in length to the tube, the spurs 0.3-0.5 cm long, slender, cylindrical, obtuse, curved-spreading, deflexed at apex, glandular, frequently lacking in lower flowers or late-blooming flowers. Stamens inserted at the sinuses of the corolla lobes, not winged, the anthers about 1.0 mm long, free. Pistil sessile, the ovary lanceolate and slightly curved at the apex, 1.5 cm long, style absent, the stigmas oblong. Capsule sessile, exerted strongly beyond the marcescent corolla, the tip recurved, the valves dehiscing from the tip. Seeds oblong-ovoid, light brown, smooth to granular.

Labrador and Newfoundland west to British Columbia, south to Colorado and also in central Mexico (fide Allen, 1933). A species of cool damp woods and glades.

Key to the Subspecies

- Plants 1-9 dm tall, the internodes elongate; inflorescence open, the flowers with evident pedicels; corolla green, rarely purple. . 1a. *H. deflexa* ssp. *deflexa*  
Plants 0.3-1.5 dm tall, the internodes short; inflorescence congested, the flowers sessile or short-pedicellate; corolla purple, rarely green (frequently the entire plant purple) . . . . . 1b. *H. deflexa* ssp. *brentoniana*

1a. *Halenia deflexa* ssp. *deflexa*

- Swertia deflexa* Sm. in Rees. Cycl. 34: n. 8. 1819.  
*H. heterantha* Griseb. in Hook. Fl. Bor.-Am. 2: 68. 1838. (Type: *Brenton*, K)  
*Tetragonanthus deflexus* (Sm.) O. Ktze. Rev. Gen. Pl. 2: 431. 1891.  
*H. deflexa* var. *heterantha* (Griseb.) Fern. in Rhod. 1: 37. 1899.  
*T. heteranthus* (Griseb.) Heller, Muhlenbergia 1: 2. 1900.  
*H. deflexa* f. *heterantha* (Griseb.) Fern. in Rhod. 40: 340. 1938.

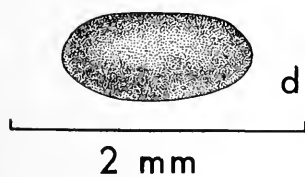
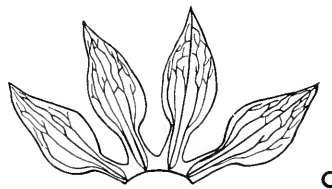
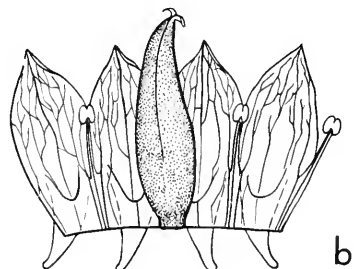
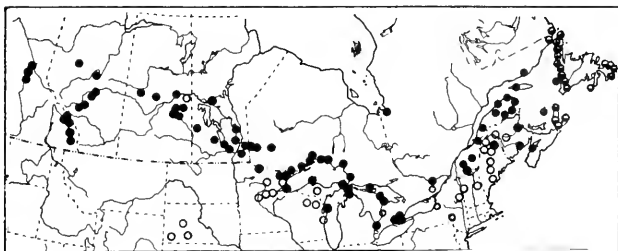
*Halenia deflexa* is evidently a winter annual. Rosettes found in April in cedar woods near the village of Kinburn, Ontario, 20 miles from Ottawa, when transferred to flats for observation, produced flowering plants which died off after forming seed at the end of the season.

The range of *H. deflexa* has been significantly extended since Allen (1933) monographed the genus. *H. deflexa* has an unusual distribution suggesting the possibility of Pleistocene survival in more than one refugium with subsequent migration routes later overlapping. The eastern portion of the range may have been derived from a northern Appalachian refugium with later extension of range through the Great Lakes to the west; the western portion may have arisen from a refugium in the southern Rockies with subsequent spread around the margin of the plains.

Occasionally a form is found which lacks spurs. Grisebach (1839) described this as *H. heterantha*. Allen placed it in the synonymy of *H. deflexa*, a wise decision since late-flowering plants and the lower portions of otherwise normal plants often lack spurs.

Figure 17. *Halenia deflexa* (Sm.) Griseb. a, ssp. *deflexa*, plant,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed. e, ssp. *brentoniana*, plant,  $\times 0.5$ . f, ssp. *brentoniana*, flower,  $\times 1$ . Map: *Halenia deflexa* ssp. *deflexa*, solid dots; literature records, open circles; ssp. *brentoniana*, half solid circles.





1b. *H. deflexa* ssp. *brentoniana* (Griseb.) stat. nov.

*H. deflexa* var. *Brentoniana* (Griseb.) Gray, Syn. Fl. N. Am. ed. 2. 2: 127. 1886.

*H. Brentoniana* Griseb. in Hook. Fl. Bor.-Am. 2: 68. 1838, et Gen. & Sp. Gent. 325. 1839. (Type: *Morrison*, K)

Plants 0.3-1.5 dm tall, erect, simple or branched, the internodes much shorter than ssp. *deflexa*; stem leaves similar; inflorescence a simple cyme or less often aggregate; corolla purple, the spurs as in the typical subspecies.

Labrador, Newfoundland, St. Pierre and Miquelon, to Nova Scotia, merging with the typical subspecies.

### *Gentianella* Moench, Meth. Pl. 482. 1794.

Calyx 4-5-parted, tubular or rarely spathose, without an inner continuous membranaceous rim. Corolla 4-5-lobed, marcescent, tubular, funnelform, campanulate to rotate, the lobes sinistrally or quincuncially convolute in the bud, without interlobal plicae. Stamens 4 or 5, included, inserted on the corolla tube, free, versatile. Ovary unilocular, the placentae parietal, ovules borne at the sutures or over the entire inner surface. Nectary glands at the base of the corolla tube, never foveate. Stigmas two, terminal. Capsule 2-valved, septicidally dehiscent from the apex. Seeds globose to slightly flattened, variously surfaced.

Annual, biennial or perennial herbs, rarely shrubs, of temperate regions and high alpine tropical regions.

Types species: *Gentianella campestris* (L.) Börner, Fl. für die Deut. Volk, 543. 1912 (= *Gentiana tetrandra* Moench. Meth. Pl. 482. 1794, based on *G. campestris* L. Sp. Pl. ed. 1. 231. 1753).

### Key to the Subgenera

- A. Flowers 4-merous; seeds oblong or angular, papillose; ovules borne over the entire inner surface of the ovary; sinuses of the corolla lobes with a thin inner membrane extending across the base and bearing minute processes. ....Subgenus I. *Eublephis*
- AA. Flowers 4- or 5-merous; seeds globose or slightly flattened, smooth; ovules borne in two rows along the margin of each suture; sinuses of the corolla lobes without an inner membrane.
  - B. Pedicels conspicuously shorter than the subtending internode; corolla orifice naked, or bearing scattered vascular minutely papillose fimbriae, or the fimbriae united to form a single scale extending across the base of each corolla lobe .....Subgenus II. *Gentianella*
  - BB. Pedicels conspicuously longer than the subtending internode; corolla orifice bearing two fimbriate scales at the base of each corolla lobe, the fimbriae shortly digitate, evascular, smooth....Subgenus III. *Comostoma*

Subgenus I. *Eublephis* (Raf.) Gillett

*Gentiana* L. subgenus *Eublephis* Raf. Med. Fl. 1: 208. 1828.

Key to the Species

Base of the calyx and the calyx keels smooth or wrinkled, the keels glossy purple; upper leaves obtuse, tending to be elliptic or spatulate ..... 1. *G. detonsa*

Base of the calyx near the junction with the peduncle and usually at least one pair of calyx keels covered by whitish or hyaline papillae (under magnification), occasionally present also on the margins of the lobes; keels green or purple; upper leaves acute..... 2. *G. crinita*

1. *Gentianella detonsa* (Rottb.) G. Don

*G. detonsa* (Rottb.) G. Don, Gen. Syst. 4: 179. 1838.

*Gentiana detonsa* Rottb. Kiob. Selsk. Skr. (Acta Hafn.) 10: 435. 1770. (Type: collector unknown, C!)

Annual or biennial, 0.5-9.0 dm tall, simple or branched. Basal leaves elliptic to spatulate, obtuse or acute, 0.5-3.5(-6.0) cm long, frequently forming a rosette; cauline leaves linear to elliptic or spatulate, usually rounded, 1.5-6.5 cm long, 0.1-0.7 cm wide. Flowers solitary and terminal, the pedicels 1-30 cm long, those of the branches shorter. Calyx narrowly to broadly funnelform, the tube 9-14 mm long, the inner lobes triangular, acute, the outer lobes longer, the keels smooth and reticulate, generally purple-tinged. Corolla pale to dark blue, narrowly funnelform, 2-5 cm long, the lobes oblong or expanded above, 9-15 mm long, the tips erose to denticulate, the margins with few to several cilia, 0.5-1.5 mm long. Stamens with marginal wings 1.5 mm long, the anthers 2.5 mm long, interstaminal glands oblong, crescent-shaped to round. Pistil short-stipitate, the ovary fusiform, about 12 mm long, stigmas various. Capsule as long as the corolla tube, dehiscent in the upper part. Seeds ovoid to oblong, the surface with rounded to collapsed papillae.

Circumboreal distribution extending from North America to Europe through Greenland and Iceland and to Asia through Siberia; in North America across the arctic and southward on the east to Quebec and Newfoundland and on the west through Alaska and the Rocky Mountains to the Sierra Madre of Mexico. There are several distinct subspecies. The above description is abbreviated from that in Gillett, 1957.

Key to the Subspecies

- A. Seeds oblong with smoothly rounded ends, the whitened papillae elongate and inflated or collapsed and scale-like, restricted to the ends, occasionally absent; calyx tube attenuate to the pedicel, not abruptly constricted; corolla narrowly funnelform. Arctic coast and west of the Mackenzie Mountains.
- B. Plants 0.5-1.8 dm high, simple or with branches arising from the base; basal rosette poorly developed or reduced to a single pair of leaves. Circumboreal above the northern limit of trees. .... 1a. *G. detonsa* ssp. *detonsa*

- BB. Plants 2-6 cm high, simple or with branches arising from the axils of cauline leaves, rarely from the base; basal rosette well developed, the leaves dense, rarely reduced. Yukon and Alaska, along the Yukon River and tributaries...1b. *G. detonsa* ssp. *yukonensis*
- AA. Seeds irregularly angled, the rounded, inflated, light-brown papillae distributed over most of the surface; calyx tube abruptly constricted to the pedicel; corolla broad, 8-15 mm wide, the tube rather broadly funnellform or goblet-shaped, with the orifice distinctly expanded.
- C. Plants usually short, 5-12 (-20) cm high, profusely branched from the densely spatulate-leaved base, corolla somewhat truncate. East coast of James Bay, Anticosti and Newfoundland .....1c. *G. detonsa* ssp. *nesophila*
- CC. Plants generally tall, 30-60 cm high, branched above, occasionally simple in small plants, the branches frequently sinuous and purpled; corolla more elongate. Extremely variable complex from the Mackenzie Valley east to Hudson Bay .....1d. *G. detonsa* ssp. *raupii*

1a. *Gentianella detonsa* ssp. *detonsa*

Figure 18

*Gentiana ciliata* Gunn. Fl. Norv. 2: 88. t. 2. f. 3-5, 1772.

*Anthopogon detonsa* (Rottb.) Raf. Fl. Tellur. 3: 25. 1837.

*Gentiana richardsonii* Porsild, in Nat. Mus. Can. Bull. No. 121: 274-275. 1951. (Type: Porsild 2653, CAN!)

(For more complete synonymy see Gillett, 1957)

Common Name: Shaved Gentian.

The subspecies *detonsa* occurs in Finland, Norway and Iceland, on the coast of Greenland, in America and Asia. There is a distribution gap between Greenland and Coppermine in Mackenzie District. It is then found again at the mouth of the Mackenzie River and in Kotzebue Sound. In moist meadows, along sandy sea beaches; flowering from mid-July to early August; fruiting in August.

1b. *Gentianella detonsa* ssp. *yukonensis* J.M. Gillett

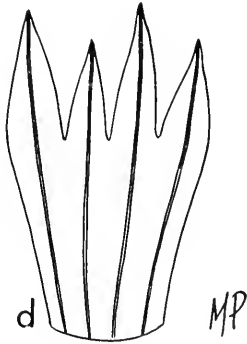
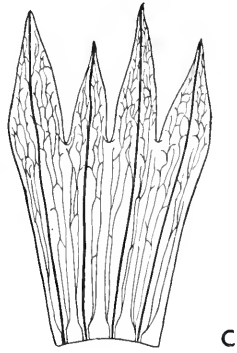
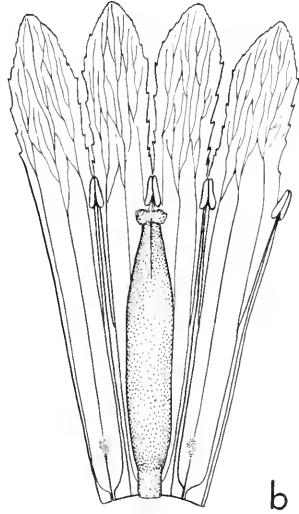
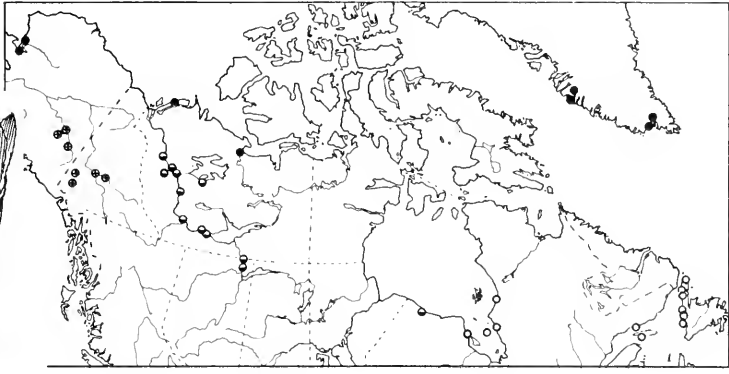
Figure 18

*G. detonsa* ssp. *yukonensis* Gillett in Ann. Mo. Bot. Gard. 44: 215. 1957.

(Type: Cody & Webster 5587, DAO)

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Figure 18. *Gentianella detonsa* (Rottb.) G. Don. a, ssp. *detonsa*, plant,  $\times$  0.5. b, corolla,  $\times$  1.5. c, interior of calyx,  $\times$  1.5. d, exterior of calyx,  $\times$  1.5. e, ssp. *yukonensis*, plant,  $\times$  0.5. Map: *G. detonsa* ssp. *detonsa*, solid dots; ssp. *nesophila*, open circles; ssp. *raupii*, half solid circles; ssp. *yukonensis*, encircled crosses.



Common Name: Yukon Fringed Gentian.

This subspecies is similar in floral characters to the typical subspecies. Vegetatively it is larger and stouter with a prominent rosette of basal leaves. It is restricted to sandy and gravelly places in the valley of the Yukon River and its tributaries.

1c. *Gentianella detonsa* ssp. *nesophila* (Th. Holm) J. M. Gillett  
Figure 19

*G. detonsa* ssp. *nesophila* (Holm) Gillett in Ann. Mo. Bot. Gard. 44: 216. 1957.

*Gentiana nesophila* Th. Holm in Ott. Nat. 15: 11. 1901. (Type: Macoun, CAN!)

Common Name: Island-loving Gentian.

From northwestern Newfoundland to the Mingan Islands and Anticosti and again on the east coast of James Bay. Probably it had a more continuous distribution at one time and the James Bay station represents a relict colony. On sandy and gravelly soil from sea level to about 20 meters. Flowering from late July until early September; fruiting from August until October.

1d. *Gentianella detonsa* ssp. *raupii* (Porsild) J. M. Gillett  
Figure 20

*G. detonsa* ssp. *raupii* (Porsild) Gillett in Ann. Mo. Bot. Gard. 44: 217. 1957.

*Gentiana raupii* Porsild, in Sargentia 4: 60. 1943. (Type: Porsild 6571, CAN!)

Common Name: Raup's Gentian.

This subspecies occupies the valley of the Mackenzie River but the southern and eastern margins of its range are unknown. Some specimens from Hudson Bay have been included. Other collections from the southern Hudson Bay region approach subspecies *nesophila*.

On sandy river shores, clay banks and salt plains at low elevation. Flowering from late June to early August; fruiting in August.

2. *Gentianella crinita* (Froel.) G. Don

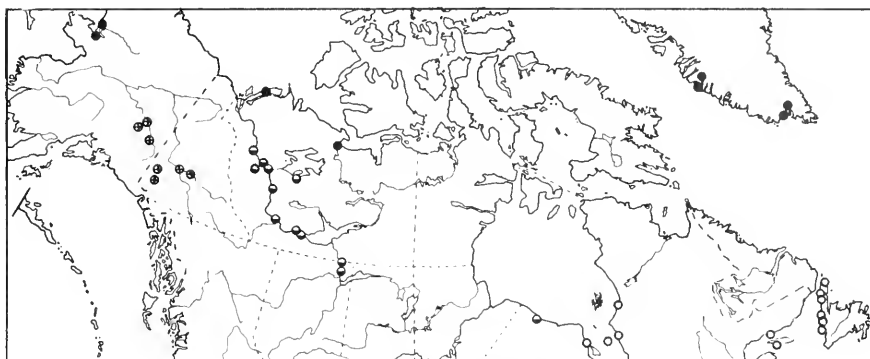
*G. crinita* (Froel.) G. Don, Gen. Syst. 4: 179. 1838.

*Gentiana crinita* Froel. Gent. Diss. 112. 1796, ex char.

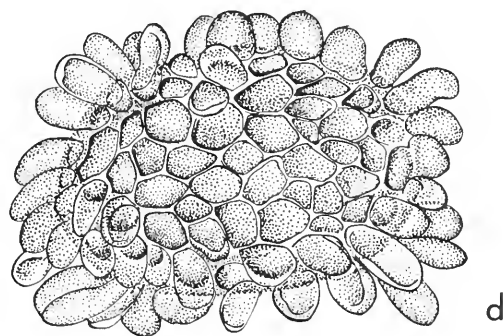
Annual or winter annual, 1-6 dm tall, branched or simple. Basal leaves lingulate to spatulate, obtuse to acute, 0.8-1.6 (rarely -3.3) cm long, soon

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Figure 19. *Gentianella detonsa* (Rottb.) G. Don ssp. *nesophila* (Holm) Gillett. a, plant,  $\times 0.5$ . b, corolla,  $\times 1.5$ . c, calyx,  $\times 1.5$ . d, seed. Map: *G. detonsa* ssp. *detonsa*, solid dots; ssp. *nesophila*, open circles; ssp. *raupii*, half solid circles; ssp. *yukonensis*, encircled crosses.

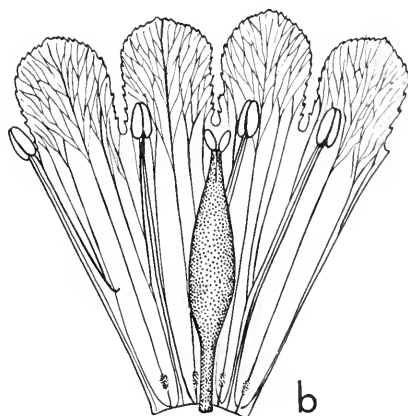


a

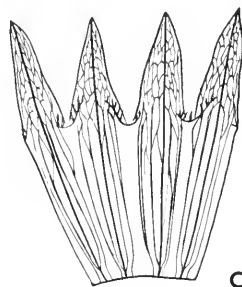


d

1 mm

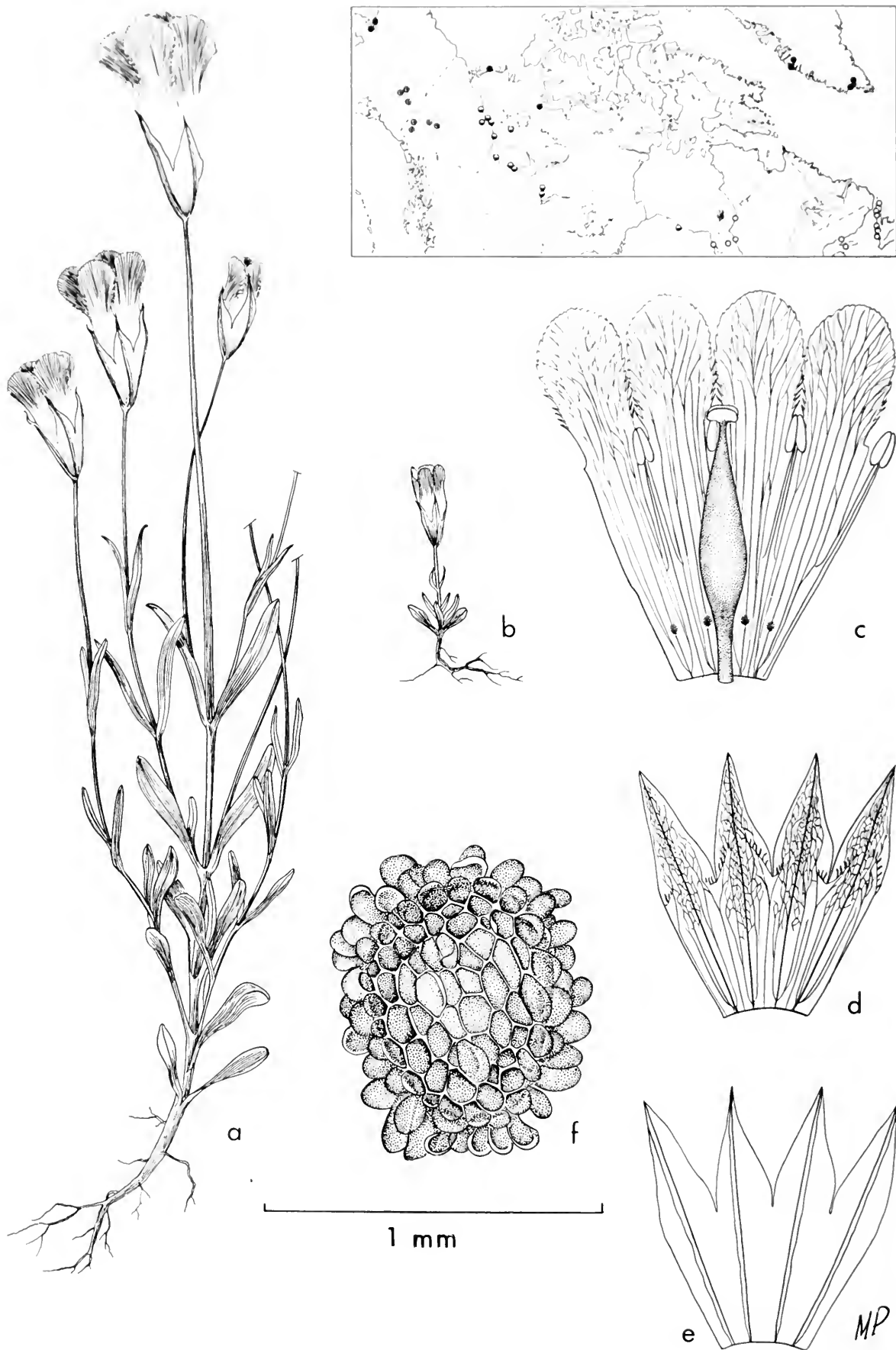


b



c

MP





withering and deciduous; cauline leaves linear to lanceolate-ovate and ovate, usually acute, 1.0-8.0 cm long, 0.1-2.0 cm wide. Flowers solitary to very numerous, the terminal pedicels 2-22 cm long, those of the branches shorter. Calyx narrowly to broadly funnelform, the tube 8-15 mm long, the inner lobes ovate-triangular, acute, the outer lobes lanceolate, conduplicate, keels weakly to very strongly papillose, dark green to purpletinged. Corolla pale to deep blue or white, narrowly to broadly funnelform, 25-60 mm long, the lobes oblong to obovate-oblong, the tips denticulate to short ciliate, the marginal fimbriae to 5 mm long. Stamens with marginal wings 1.3-3.0 mm wide, anthers 2-5 mm long, interstaminal glands oval to rounded. Pistil short-stipitate, the ovary fusiform, 12-25 mm long, stigmas various. Capsule as long as the corolla. Seeds oblong and angular, the surface with rounded to elongate inflated brown papillae.

Extending from the Appalachian Mountains and the Gulf of St. Lawrence in the east to the Great Lakes region, westward across the plains to the Rocky Mountains in Alberta, resolving into several intergrading subspecies.

Habitats various according to the subspecies but mainly alkaline situations. Flowering and fruiting roughly from June to September at usually low altitudes.

Key to the Subspecies

- A. Flowers 30-60 mm long; corolla lobes with lateral fringes in the upper half to 2-5 mm long, the tips frequently short-ciliate also; calyx keels 0.1-0.8 mm broad at the base.
  - B. Median leaves ovate to lanceolate-ovate, rounded at the base to subcordate, linear to elliptic only in the small phase<sup>1</sup>.....2a. *G. crinita* ssp. *crinita*
  - BB. Median leaves linear to linear-lanceolate....2b. *G. crinita* ssp. *procera*
- AA. Flowers 10-40 mm long; corolla lobes with short lateral fringes, the tips dentate or erose, rarely ciliate. Calyx keels not prominent or absent.
  - C. Flowers 30-35 mm long; corolla lobes orbicular, style 1.0-1.5 mm long, stigmas flabelliform.....2c. *G. crinita* ssp. *victorinii*
  - CC. Flowers 25-40 mm long; corolla lobes usually oblong, somewhat truncate, stigmas reniform, sessile.....2d. *G. crinita* ssp. *macounii*

2a. *Gentianella crinita* ssp. *crinita*

Figure 21

*Gentiana fimbriata* Andr. Bot. Rep. 509. 1808, ex ic.  
*Denckea crinita* (Froel.) Raf. in Med. Repos. II. 5: 352. 1808.

<sup>1</sup> Diminutive plants surrounding normal plants are produced from seed of the current year.

Figure 20. *Gentianella detonsa* (Rottb.) G. Don ssp. *raupii* (Porsild) Gillett. a, plant, × 0.5. b, dwarf plant, × 0.5. c, corolla, × 1.5. d, interior of calyx, × 1.5. e, exterior of calyx, × 1.5. f, seed. Map: *G. detonsa* ssp. *detonsa*, solid dots; ssp. *nesophila*, open circles; ssp. *raupii*, half solid circles; ssp. *yukonensis*, encircled crosses.

*Anthopogon incarnatum* Raf. New Fl. N. Am. 4: 90. 1836, ex char.

*A. brevifolium* Raf. l.c. 91. 1836, ex char.

Common Name: Fringed Gentian.

Centered in the Appalachians from western North Carolina to Massachusetts and Maine, northwest to eastern Ontario and western Quebec, west to the Great Lakes region as far as Manitoba. In the lakes region forming a cline with ssp. *procera*. Further west gradually merging with the western population of ssp. *macounii*. In a variety of habitats like roadsides, clearings in woods, swampy ground, gravel or sandy places. In general preferring calcareous habitats, and when it is found in a habitat that is not evidently calcareous, one can be certain that limestones are not far distant. Flowering throughout August to early October; fruiting from about mid-September to late October.

The white-flowered form may be called *G. crinita* (Froel.) G. Don f. *albina* (Fern.) comb. nov. (= *Gentiana crinita* Froel. f. *albina* Fern. in *Rhodora* 19: 152. 1917).

2b. *Gentianella crinita* ssp. *procera* (Holm) J. M. Gillett  
Figure 22

*G. crinita* ssp. *procera* (Holm) Gillett in Ann. Mo. Bot. Gard. 44: 226. 1957.

*Gentiana barbata* Froel.  $\beta$  *Browniana* Hook. ex Macnab in Edinb. New Phil. Jour. 19: 62. 1835. (Type: *Macnab s.n.*, BM; photo, MO!)

*Anthopogon virgatum* Raf. Fl. Tellur. 3: 25. 1837, ex char.

*Gentiana procera* Th. Holm in Ottawa Nat. 15: 111. 1901. (Type: *Dodge s.n.*, CAN!)

*Anthopogon procerus* (Th. Holm) Rydb. in Brittonia 1: 94. 1931.

*Gentianella procera* (Th. Holm) Hiit. in Mem. Soc. Faun. Fl. Fenn. no. 25: 77. 1950.

Common Names: Smaller or Slender Fringed Gentian.

From upper New York through the Great Lakes region to Minnesota, North Dakota and Manitoba. Clinal in nature, closely resembling ssp. *crinita* in the eastern part of the range but approaching ssp. *macounii* in the western portion.

2c. *Gentianella crinita* ssp. *victorinii* (Fern.) J. M. Gillett  
Figure 23

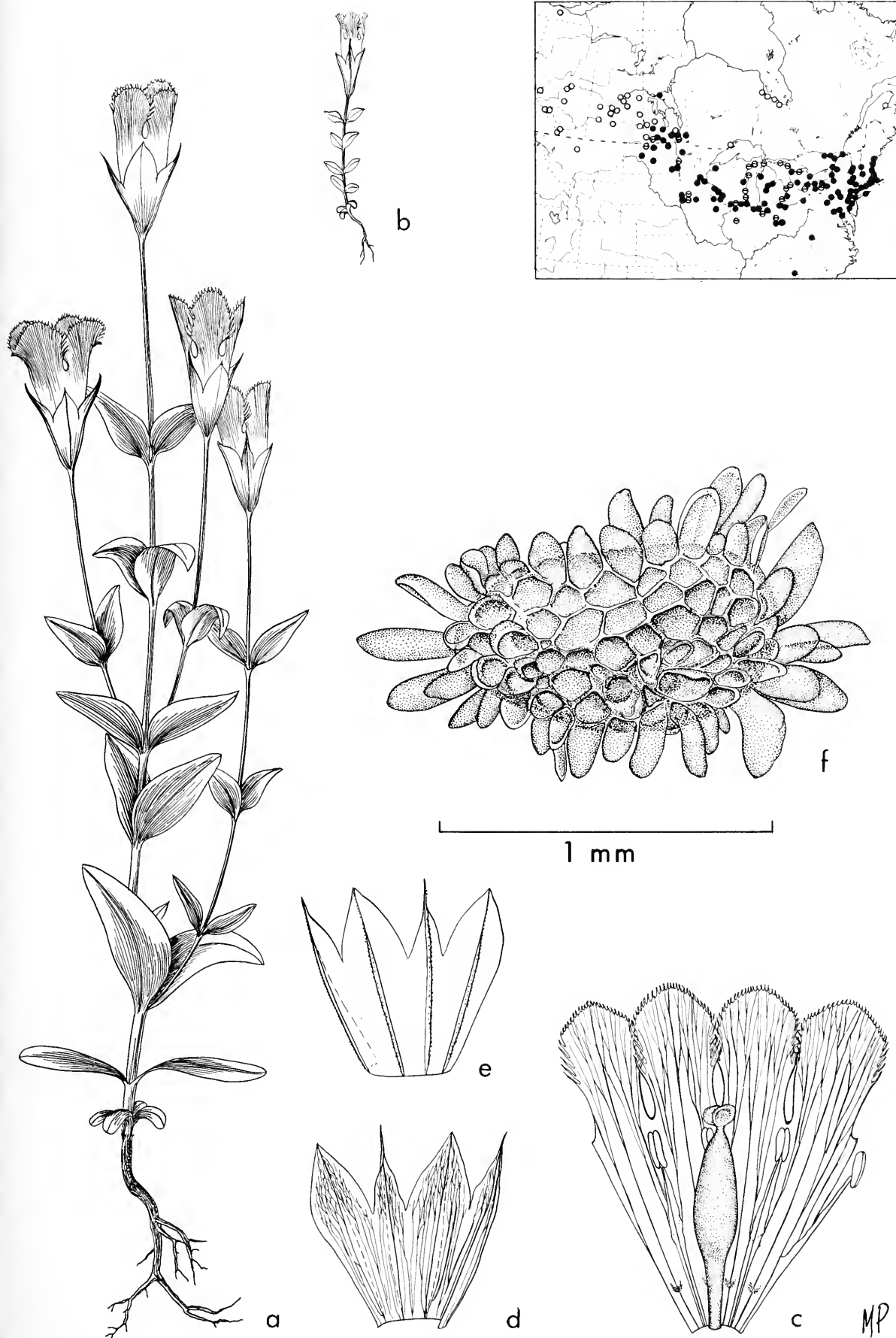
*G. crinita* ssp. *victorinii* (Fern.) Gillett in Ann. Mo. Bot. Gard. 44: 227. 1957.

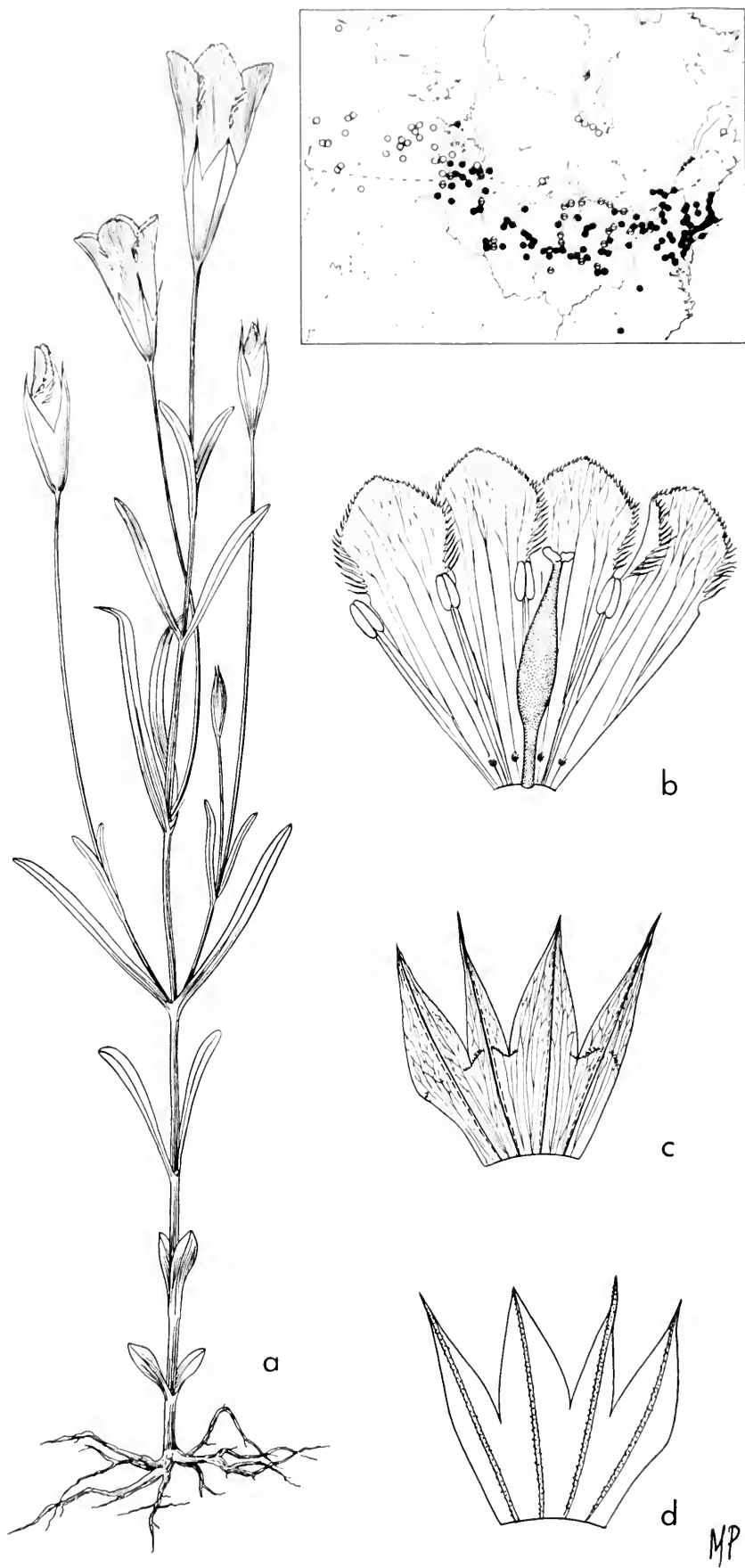
*Gentiana Victorinii* Fern. in Rhod. 25: 87. 1923. (Type: *Victorin 16073*, GH!)

Common Name: Victorin's Gentian.

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Figure 21. *Gentianella crinita* (Froel.) G. Don ssp. *crinita*. a, plant,  $\times 0.5$ . b, dwarf plant,  $\times 0.5$ . c, corolla,  $\times 1.5$ . d, interior of calyx,  $\times 1.5$ . e, exterior of calyx,  $\times 1.5$ . f, seed. Map: *G. crinita* ssp. *crinita*, solid dots; ssp. *macounii*, open circles; ssp. *procera*, barred circles; ssp. *victorinii*, crosses.





Quebec, restricted to the intercotidal zone of the St. Lawrence River from Deschambault to St. Jean Port Joli; flowering from late July through August until early September; fruiting from mid-August until mid-September.

This gentian occupies a unique habitat. It occurs in locations where the tidal action results in inundation of the shoreline but the water is still fresh. As a result a film of mud and debris is often deposited on the plants.

2d. *Gentianella crinita* ssp. *macounii* (Holm) J. M. Gillett  
Figure 24

*G. crinita* ssp. *macounii* (Holm) Gillett in Ann. Mo. Bot. Gard. 44: 228. 1957.  
*Gentiana macounii* Th. Holm, in Ott. Nat. 15: 110. 1901. (Type: *Macoun*, CAN!)  
*Gentiana detonsa* Rottb. var. *tonsa* Lunell, in Bull. Leeds Herb. 2: 7. 1908. (Type: *Lunell*, MIN!)  
*Gentiana gaspensis* Vict. in Contr. Lab. Bot. Univ. Montreal 20: 10. 1932. (Type: *Victoria*, Rolland & Jacques 33751, JBM!)  
(For further synonymy see Gillett, 1957, p. 228.)  
Common Name: Macoun's Fringed Gentian.

Through Alberta, Saskatchewan and Manitoba, southern James Bay, and in Gaspé, Quebec, southward in the Great Plains through North Dakota and Minnesota and transitional to *G. crinita* ssp. *procera* west of the Great Lakes. About the margins of sloughs and along river banks and meadows, occasionally in sandy swales and calcareous bogs. Flowering from late June to late August; fruiting during August and into September.  
Thieret (1961) collected an interesting specimen of *G. crinita* ssp. *macounii* from Kakisa Lake, Mackenzie District in 1960. This locality is very near Great Slave Lake and several hundred miles north of the main population. However, it is still distinct on morphological grounds from *G. detonsa* ssp. *raupii*, which grows at the west end of Great Slave, along the Mackenzie, and up the Athabasca to Fort Smith.

Subgenus II. *Gentianella*  
Key to the Species

- A. Corolla orifice naked, without faucal fimbriae.....Series Arctophilae
- B. Plants branched from the base or simple, the curved branches frequently bearing reduced flowers.
- C. Corolla lobes 4; outer calyx lobes broad and foliaceous; ovary narrowly ovoid to ellipsoid; flowers in loose simple cymes or axillary and solitary, occasionally in aggregate cymes, rarely subtended by a pair of bract-like leaves.  
Alaska and Canada south to Montana .....3. *G. propinqua*

Figure 22. *Gentianella crinita* (Froel.) G. Don ssp. *procera* (Holm) Gillett.  
a, plant, × 0.5. b, corolla, × 1. c, interior of calyx, × 1. d, exterior of calyx, × 1.  
Map: *G. crinita* ssp. *crinita*, solid dots; ssp. *macounii*, open circles; ssp. *procera*, barred circles; ssp. *victorinii*, crosses.

- CC. Corolla lobes 5; calyx lobes irregular but scarcely foliaceous; ovary generally broadly ovoid; flowers in compact terminal aggregate cymes or in a compact head due to reduction of the terminal internodes, subtended by the upper pair of bract-like leaves. Southwestern Greenland.....4. *G. aurea*
- BB. Plants branched above, the flowers of the branches about equal to those of the main stem, not reduced .....5. *G. quinquefolia*
- AA. Corolla orifice with dense or scattered fimbriae at the base of the lobes .....Series Amarellae
  - D. Calyx tube shorter than or equal to the acute to obtuse lobes; faucal fimbriae free at the base; terminal flowers about equal in length to the lateral ones.....6. *G. amarella*
  - DD. Calyx tube longer than the rounded, frequently auriculate lobes; faucal fimbriae united at the base; terminal flowers larger than the lateral ones. Only on Attu Island, Aleutian Chain.....7. *G. auriculata*

### 3. *Gentianella propinqua* (Richards.) J. M. Gillett

*G. propinqua* (Richards.) Gillett in Ann. Mo. Bot. Gard. 44: 236. 1957.

*Gentiana propinqua* Richards. in Frankl. Narr. 1st Jour. 734. 1823. (Type: Richardson s.n., K; photo, DAO!)

Annual, 2-35 cm tall, simple or branched from the base, the branches curved-ascending and bearing smaller flowers. Basal leaves frequently forming a rosette, elliptic to spatulate, obtuse, 5-35 mm long, 2-8 mm wide; median leaves ovate to lanceolate, acute to obtuse, 5-35 mm long, 2-10 mm wide. Flowers 4-merous, axillary or terminal, in simple or aggregate cymes, the terminal flower larger than the laterals. Calyx 5-12 mm long, the lobes ovate to lanceolate, acute. Corolla pale blue to white, tubular to narrowly funnelform, 12-20 mm long, the lobes ovate to ovate-lanceolate, a third to half as long as the tube, the orifice naked. Stamens with filament wings 0.25-0.5 mm wide, the anthers 0.7-1.5 mm long. Capsule longer than the marcescent corolla, up to 25 mm long. Seeds ovoid, 0.5-0.75 mm long, smooth, light tan to dark brown.

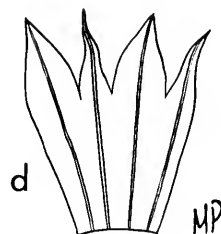
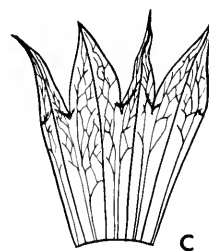
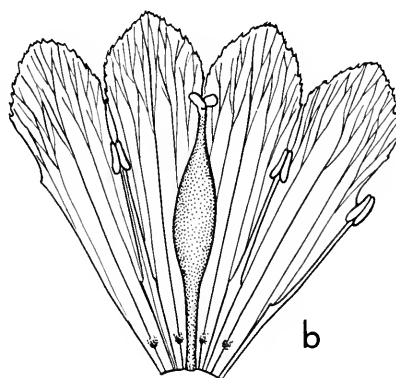
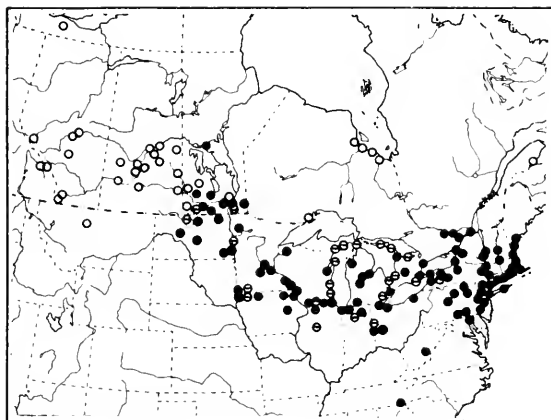
Mountains and valleys throughout Alaska and the Yukon south to west-central Alberta and east-central B.C. Sporadically to the shores of Hudson Bay with isolated stations in Montana, Gaspé County, Quebec, and the Straits of Belle Isle, Newfoundland. In a very wide variety of habitats, alpine meadows, rocky slopes, open sandy, clay, gravel or limestone areas, etc. Flowering from mid-June until early September; fruiting from August until late September.

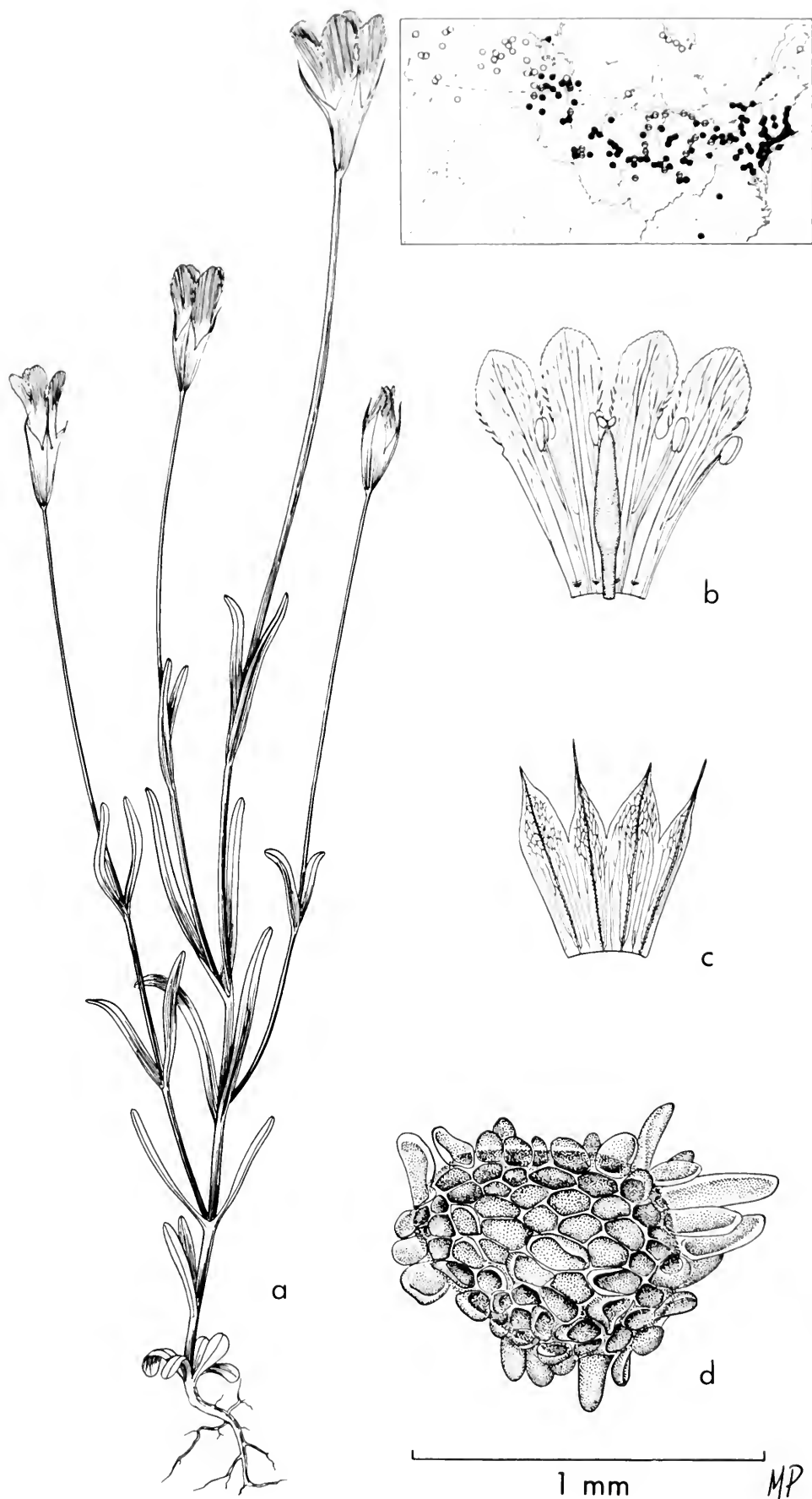
#### Key to the Subspecies

- Terminal flowers 15-20 mm long, conspicuously larger than the lateral ones; corolla lobes apiculate, blue. Alaska to Montana .....3a. *G. propinqua* ssp. *propinqua*

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Figure 23. *Gentianella crinita* (Froel.) G. Don ssp. *victorinii* (Fern.) Gillett. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, interior of calyx,  $\times 1$ . d, exterior of calyx,  $\times 1$ . Map: *G. crinita* ssp. *crinita*, solid dots; ssp. *macounii*, open circles; ssp. *procera*, barred circles; ssp. *victorinii*, crosses.







Terminal flowers about 10 mm long, about as long as the lateral flowers or slightly larger; corolla lobes obtuse and somewhat denticulate, pale violet to white. Aleutian Islands to southern Alaska .....  
.....3b. *G. propinqua* ssp. *aleutica*

3a. *Gentianella propinqua* ssp. *propinqua*  
Figure 25

*Gentiana rurikiana* Cham. & Schlecht. in *Linnaea* 1: 176. 1826, ex char.  
*G. arctophila* Griseb. in Hook. Fl. Bor.-Am. 2: 61. 1838. (Type: *Drummond*, K; photo, DAO)  
(For further synonymy see Gillett, 1957, p. 237.)  
Common Names: Four-parted Gentian, Small-flowered Gentian.

This species is easily recognized because the larger terminal flowers with apiculate corolla lobes are larger than the laterals. The ascending, curved basal branches bearing reduced flowers are also diagnostic.

A form, f. *acyanea*, lacking anthocyanin, was described by Gillett (1957) from British Columbia and Alaska.

3b. *Gentianella propinqua* ssp. *aleutica* (Cham. & Schlecht.) J. M. Gillett  
*G. propinqua* ssp. *aleutica* (C. & S.) Gillett in Ann. Mo. Bot. Gard. 44: 241. 1957.  
*Gentiana aleutica* C. & S. in *Linnaea* 1: 175. 1826, ex char.  
*Gentiana unalaschcensis* C. & S. 1. c. 1826, nom. nud.  
Common Name: Aleutian Four-parted Gentian.

Throughout the Aleutian Islands, Alaska and along the mainland as far as Juneau, on mountains in stony and mossy places, dry gullies and in grassy patches in gravel; flowering and fruiting throughout August.

4. *Gentianella aurea* (L.) H. Sm. ex Hyl.  
Figure 26

*G. aurea* (L.) H. Sm. ex Hyl. in Uppsala Univ. Arssk. 259. 1945.  
*Gentiana aurea* L. Syst. ed. 10. 1951, 1759. (Type: *Konig s.n.*, LINN; photo, A!)  
(For further synonymy see Gillett, 1957, p. 242.)  
Common Name: Golden Gentian.

Annual, 2-30 cm tall, simple or with curved-ascending basal branches frequently bearing reduced flowers. Basal leaves often rosette-forming, elliptic to spatulate, obtuse, 3-21 mm long, 1-10 mm wide; cauline leaves lanceolate to ovate, obtuse, the base rounded, 9-26 mm long, 4-13 mm wide; the upper leaves frequently enclosing the inflorescence. Flowers axillary and in dense terminal aggregate cymes. Calyx 3-8 mm long, two of the five lobes usually larger, two to three times as long as the tube.

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Figure 24. *Gentianella crinita* (Froel.) G. Don ssp. *macounii* (Holm) Gillett. a, plant, × 0.5. b, corolla, × 1. c, calyx, × 1. d, seed. Map: *G. crinita* ssp. *crinita*, solid dots; ssp. *macounii*, open circles; ssp. *procera*, barred circles; ssp. *victorinii*, crosses.

Corolla blue, tubular to narrowly funnelform, 6-11 mm long, without fimbriae in the throat, the lobes ovate, a third as long as the tube, the tips mucronate. Stamens included, the filament wings 0.25 mm wide at the base, the oblong anthers 0.75 mm long. Pistil short-stipitate, the stipe 0.5 mm long, the ovary cylindrical to ovoid, 6 mm long, the stigmas sessile. Capsule sometimes slightly longer than the marcescent corolla. Seeds ovoid, slightly flattened, 0.75 mm long, smooth, light brown.

In North America, this species is found only in Greenland. Elsewhere it extends from Norway to northern Russia, southward into the high mountains of southern Europe, the Caucasus, the Himalayan Mountains and in China. Flowering from mid-July until mid-August and fruiting in September.

5. *Gentianella quinquefolia* (L.) Small

*G. quinquefolia* (L.) Small, Fl. Southeast U.S. 929. 1903.

*Gentiana quinquefolia* L. Sp. Pl. 1: 230. 1753. (Type: *Kalm*, Sav. Cat. 328.31; photo, DAO)

Common Name: Ague Weed.

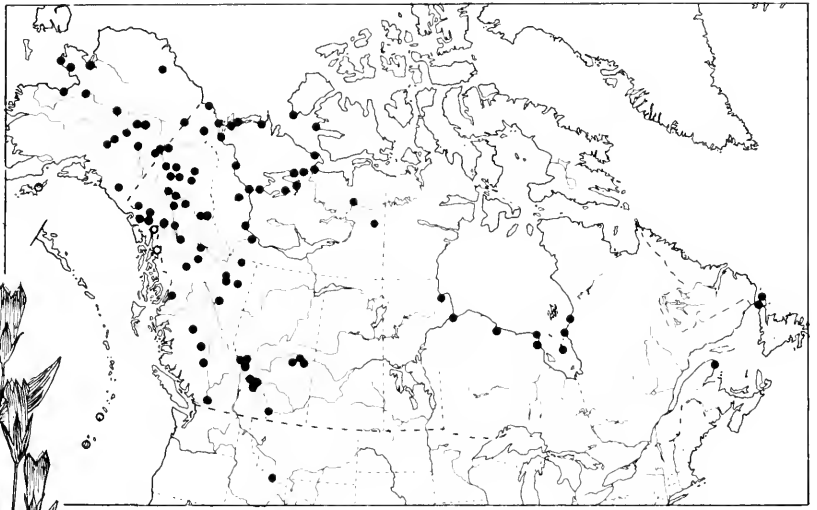
Annual, 2-8 cm tall, with profuse curved-ascending branches above. Basal leaves elliptic-spatulate, the apex rounded, 10-22 mm long, 4-10 mm wide, soon withering; cauline leaves broadly ovate, acute, the base cordate to rounded, frequently clasping, 15-60 mm long, 5-35 mm wide. Flowers in terminal umbelliform aggregate cymes, the pedicels 2-17 mm long. Calyx 4-10 mm long, the tube 1.5-3.5 mm long, the lobes as long as or longer than the tube. Corolla blue to white, narrowly funnelform, 15-20 mm long, without fimbriae in the throat, the lobes ovate, half as long as the tube, the tips apiculate. Stamens included, the filament wings incurved, the oblong anthers 1.75 mm long. Pistil stipitate, the stipe 2-3 mm long, the ovary cylindrical, 12 mm long, the stigmas sessile. Capsule as long as the marcescent corolla, dehiscent at the tip. Seeds rounded, 0.5 mm long, smooth, light brown.

Maine to New York and southern Ontario, southward in the Appalachians to North Carolina and Tennessee. Edge of woods in shade, roadsides, stream banks; flowering from early September until October, fruiting during late October.

Key to the Subspecies

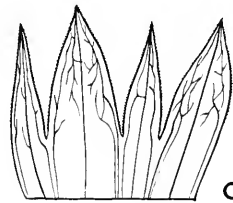
- Calyx 4-5 mm long, the lobes 2.0-2.5 mm long, narrowly triangular with hyaline margins and very prominent keels; corolla 16-18 mm long....  
.....*G. quinquefolia* ssp. *quinquefolia*
- Calyx 8-10 mm long, the lobes 5-6 mm long, elliptic-lanceolate to oblanceolate with thickened margins and broadly flattened, frequently nerve-like keels; corolla about 20 mm long .....*G. quinquefolia* ssp. *occidentalis*

Figure 25. *Gentianella propinqua* (Richards.) Gillett ssp. *propinqua*. a, plant,  $\times 0.5$  b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . d, seed. Map: *G. propinqua* ssp. *propinqua*, solid dots; ssp. *aleutica*, open circles.

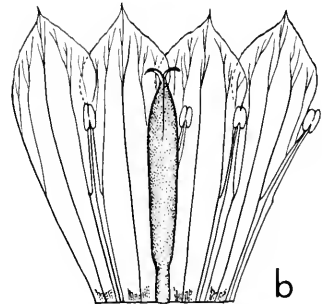


d

2 mm

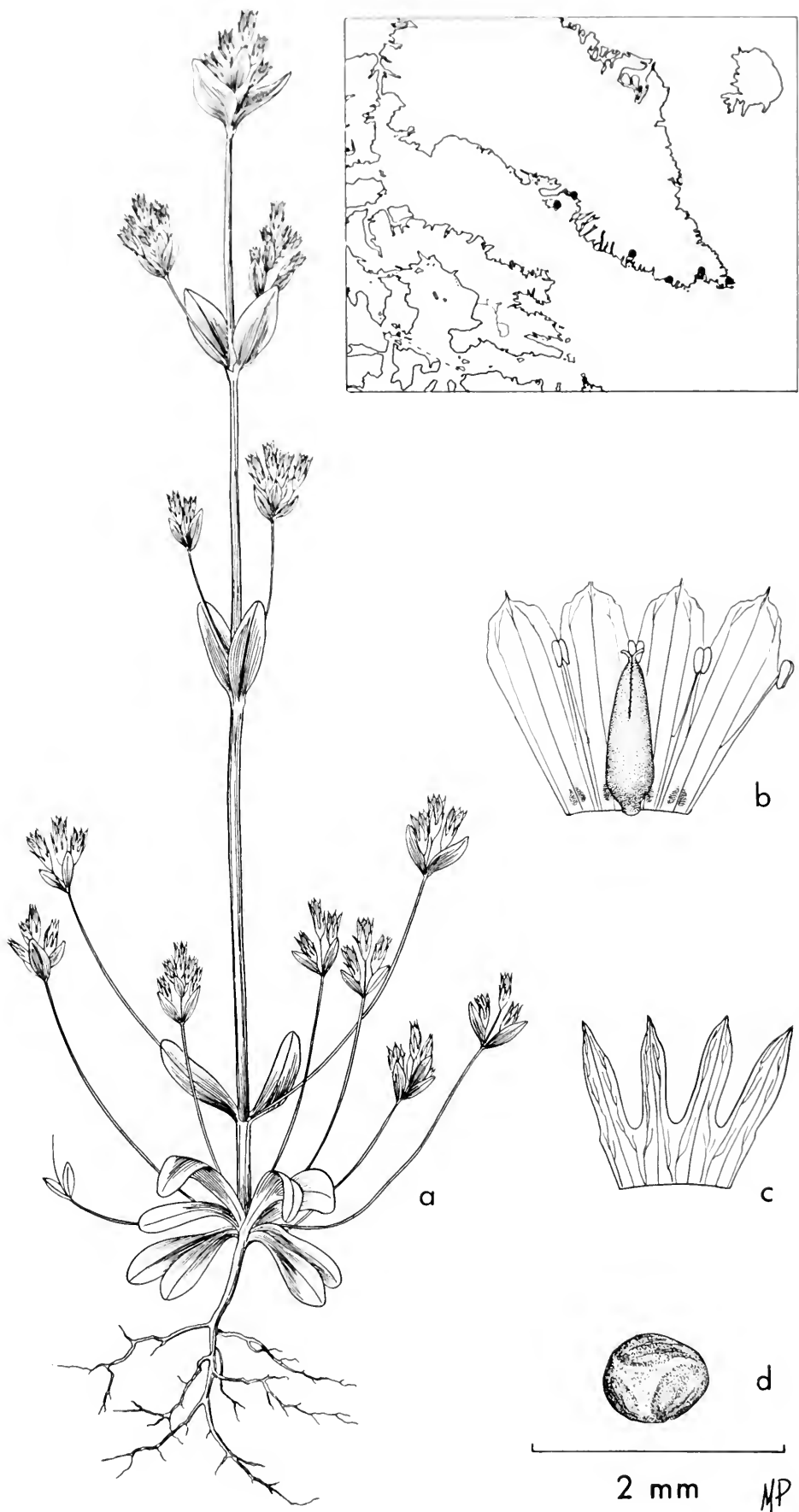


c



b

MP



5a. *Gentianella quinquefolia* ssp. *quinquefolia*

Figure 27

*Gentiana quinqueflora* Lam. Encyc. 2: 643. 1768, sphalm?

*Gentiana amarelloides* Michx. Fl. Bor. Am. 1: 175. 1805. (Type: *Michaux*, P; photo, DAO)

(For further synonymy see Gillett, 1957, p. 244.)

Maine to New York and southern Ontario (Middlesex County), southward in the Appalachians to North Carolina and Tennessee. Edge of woods in shady places, roadsides and stream banks. Flowering from early September until October; fruiting during late October.

5b. *Gentianella quinquefolia* ssp. *occidentalis* (A. Gray) J. M. Gillett

Figure 28

*G. quinquefolia* ssp. *occidentalis* (A. Gray) Gillett in Ann. Mo. Bot. Gard. 44: 245. 1957.

*Gentiana quinqueflora* Lam. var. *occidentalis* A. Gray. Man ed. 1. 359. 1848, based on Hook. Bot. Mag. 63: t. 3496. 1836.

*Gentiana quinquefolia* L. var. *occidentalis* (A. Gray) A. S. Hitchc. in Trans. Acad. Sci. St. Louis 5: 508. 1891.

(For further synonymy see Gillett, 1957, p. 245.)

Southern Ontario (Lambton County) and Ohio westward to Wisconsin, Iowa and Minnesota, south to Arkansas and Kentucky. Habitats similar to the typical subspecies but found also on prairie and in oak-juniper woods. Flowering and fruiting times similar to the ssp. *quinquefolia*.

Some material in the western counties of southern Ontario may be somewhat transitional in morphology.

6. *Gentianella amarella* (L.) Börner ssp. *acuta* (Michx.) J. M. Gillett

Figure 29

*G. amarella* ssp. *acuta* (Michx.) Gillett in Ann. Mo. Bot. Gard. 44: 253. 1957.

*Gentiana acuta* Michx. Fl. Bor.-Am. 1: 177. 1803. (Type: *Michaux*, P; photo, MO!)

(For further abundant synonymy see Gillett, 1957, pp. 253-4.)

Common Name: Northern Gentian.

Annual, 5-55 cm tall, simple or branched, the basal branches frequently bearing reduced flowers. Basal leaves elliptic, ligulate to spatulate, 10-30 mm long, 3-8 mm wide, early withering; median leaves ovate to ovate-lanceolate, the base rounded to subcordate and clasping, 10-60 mm long. Flowers numerous in simple or aggregate cymes or axillary, the pedicels 1-25 mm long. Calyx 5-7 mm long, usually 5-lobed, the lobes

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Figure 26. *Gentianella aurea* (L.) H. Sm. a, plant,  $\times 0.5$ . b, corolla,  $\times 5$ . c, calyx,  $\times 5$ . d, seed.

lanceolate to lanceolate-oblong, acute, unequal. Corolla mauve to blue or white, 10-15 mm long, the lobes ovate, fimbriate in the throat. Staminal filaments winged below, tapering upwards, the anthers oblong-oval, 1 mm long. Pistil sessile, the cylindrical ovary about 8 mm long, the stigmas sessile. Capsule as long as the corolla or exceeding it. Seeds variable, 0.5-0.8 mm long, ovoid, smooth, light brown.

Throughout western North America from Alaska to Mexico eastward to Ontario, Quebec, Newfoundland, Vermont and Maine. June to September, flowering and fruiting times varying with latitude. In a wide variety of habitats.

This subspecies has a broad range of variability and historically has been divided into a large number of species. There may be some doubt whether or not the North American population should be maintained as separate from the European. However, since the European population is geographically segregated and morphologically has larger flowers, ssp. *acuta* is maintained. The eastern Asiatic material, however, does not appear to differ appreciably.

The subspecies *heterosepala* complex, discussed by Gillett (1957), has been omitted from the map because it does not occur in Canada.

#### 7. *Gentianella auriculata* (Pall.) J. M. Gillett

No figure

*G. auriculata* (Pall.) Gillett in Ann. Mo. Bot. Gard. 44: 261. 1957.

*Gentiana auriculata* Pall. Fl. Ross. 1: 102 t. 92. f. 1. 1788, ex char. et ic.

*Dasystephana auriculata* (Pall.) Borckh. in Roem. Archiv. f. Bot. 1: 26. 1796.

*Hippion auriculatum* (Pall.) Schmidt in Roem. l.c. 11. 1796.

*Amarella auriculata* (Pall.) Greene, Leaf. Bot. Obs. & Crit. 1: 53. 1904.

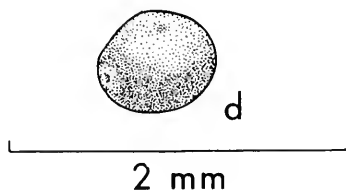
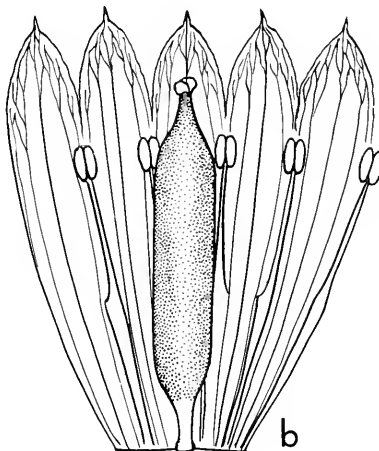
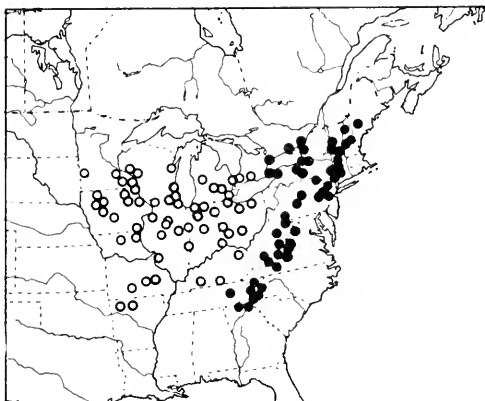
Common Name: Eared Gentian.

Annual, 2-25 cm tall, simple or branched above. Basal leaves forming loose rosettes, obovate, spatulate to elliptic, the cauline leaves elliptic-ovate to broadly ovate, 8-40 mm long, 3-15 mm wide, becoming smaller upwards. Flowers terminal or axillary, in simple or aggregate cymes, the terminal flower conspicuously larger than the lateral ones. Calyx 4-5-lobed, the tube ca. 6 mm long, the lobes strongly reticulately veined, broader than long, the base auriculate. Corolla blue, narrowly funnel-form to salverform, 18-28 mm long, the lobes ovate, the tube with a faucal corona of fimbriae united at the base. Stamens slightly exerted, the filaments inserted about the middle of the corolla, the anthers oblong, 1.6-1.8 mm long. Pistil sessile, the ovary cylindrical, 15 mm long, the stigma sessile, erect. Capsule slightly longer than the marcescent corolla, 25 mm long, dehiscing at the tip; seeds ovoid, 0.15 mm long, smooth, light brown.

On Attu Island, at the western extremity of the Aleutian Islands, Alaska. Also on the Commander Islands in the Bering Sea, in Kamtchatka and on the islands north of Japan. On gravelly slopes near sea level. Flowering through August into September; fruiting in September.

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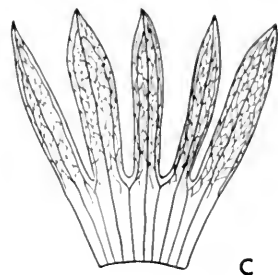
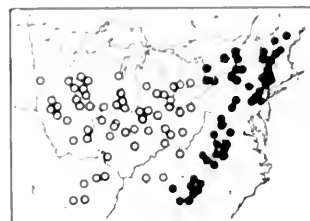
Figure 27. *Gentianella quinquefolia* (L.) Small ssp. *quinquefolia*. a, plant,  $\times 0.5$ , b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed. Map: *G. quinquefolia* ssp. *quinquefolia*, solid dots; ssp. *occidentalis*, open circles.



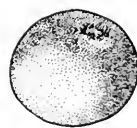
MP



a

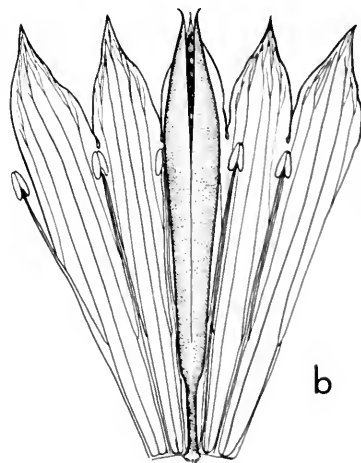


c



d

2 mm



b

MP



Attu Island represents the only record of this species for North America. It was first collected there by G. B. Van Schaack.

Subgenus III. *Comastoma*

8. *Gentianella tenella* (Rottb.) Börner

Figure 30

*G. tenella* (Rottb.) Börner, Fl. deut. Volk, 542. 1912.  
*Gentiana tenella* Rottb. in Kiob. Selsk. Skrift. (Acta Hafn.) 10: 436. 1770.  
(Type: collector unknown, C!)  
*Lomatogonium tenellum* (Rottb.) Löve and Löve in Acta Hort. Gotoborg.  
20: 117. 1956.  
*Comastoma tenella* (Rottb.) Toyok. in Bot. Mag. Tokyo. 74: 198. 1961.

Annual, 1-26 cm tall, simple or with curved ascending branches. Basal leaves two or in dense rosettes, elliptic to spatulate, frequently deciduous, median and upper leaves ovate to ovate-elliptic, 4-9 mm long, 1-3 mm wide, obtuse, the attenuate base somewhat clasping. Flowers solitary, terminal or axillary, the pedicels 2-10 cm long. Calyx 4-5-parted, the tube nearly obsolete, 5-10 mm long, the outer lobes broadly ovate to lanceolate, the inner lanceolate. Corolla tubular to somewhat salverform, blue to white, about 11 mm long, the lobes oblong-ovate, the orifice bearing at the base of the corolla lobe two evascular fimbriate scales. Stamens inserted near the upper third of the corolla tube, anthers oval, about 1 mm long, filaments taper-winged. Pistil sessile, the ovary fusiform, stigmas ovate-oblong, recurving in fruit. Capsule longer than the marcescent corolla, up to 12 mm long. Seeds ovoid, slightly flattened, 0.75 mm long, smooth, light brown.

In Greenland, northern continental Canada and Alaska; in the Rocky Mountains as far south as Arizona and New Mexico and in California. In a variety of habitats from sandy sea beaches, slopes, lake shores and meadows to alpine tundra at sea level in the north to high mountains in the south. Flowering from late July until late August or early September; fruiting from late August until September.

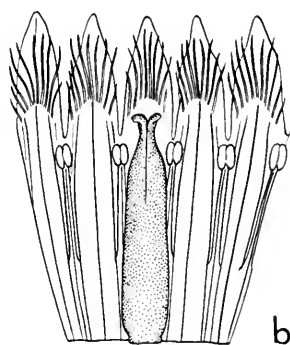
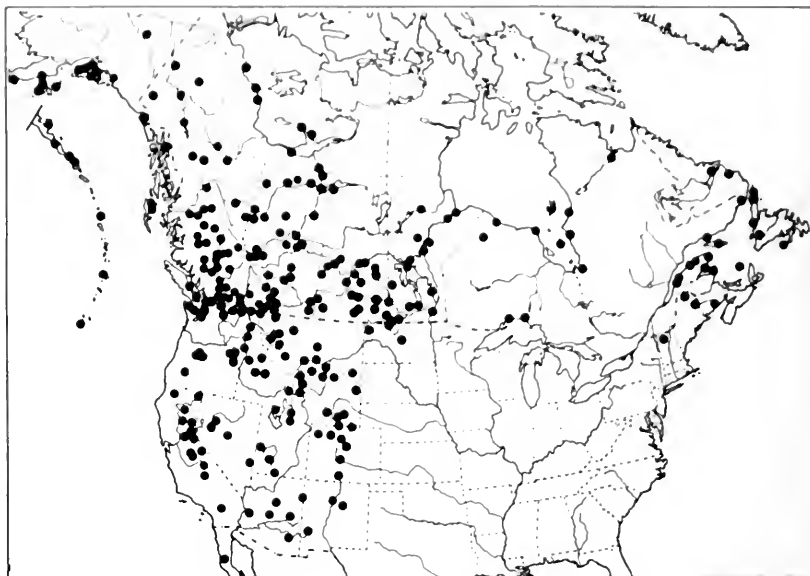
Collectors are apt to overlook this species because it can be mistaken for *Gentianella propinqua* or *G. amarella* ssp. *acuta*. The scattered distribution of *G. tenella* may be accounted for by the apparent similarity of these three species.

*G. tenella* also occurs in northern Europe and Asia. In the southern parts of these continents it is found in the mountains. With the exception of a small population from the Pribilof Islands, Alaska, described as ssp. *pribilofii* by Gillett (1957), all American material is ssp. *tenella*.

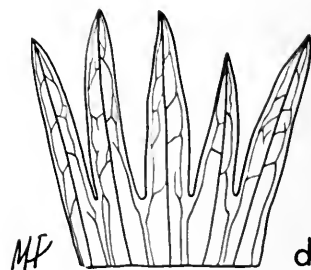
Key to the Subspecies

- Plants caespitose or branching above, or simple, the branches curved-ascending; calyx lobes lanceolate to ovate. Alaska to Greenland . . . . .  
.....8a. *G. tenella* ssp. *tenella*

Figure 28. *Gentianella quinquefolia* (L.) Small ssp. *occidentalis* (Gray) Gillett. a, plant,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed. Map: *G. quinquefolia* ssp. *quinquefolia*, solid dots; ssp. *occidentalis*, open circles.



2 mm



Plants with contracted internodes, densely leafy, the branches curved-ascending; one or two calyx lobes broadly ovate. Pribilof Islands, Alaska, only .....8b. *G. tenella* ssp. *pribilofii*

In this account *G. tenella* is being retained in the genus *Gentianella*, where it was provisionally placed in 1957. Löve (1961) maintained that the species should be placed in *Lomatogonium*, apparently on the basis of chromosome number. Subsequently, Toyokuni (1961) set up a new genus, *Comastoma*, to include this and related species. This problem cannot be resolved satisfactorily here.

*Sabatia* Adans. Fam. Pl. 2: 503. 1763.

Flowers 5-12(-14)-parted. Calyx tubular, campanulate to somewhat turbinate, the lobes minute to foliaceous. Corolla rotate, the short tube urceolate to cylindrical, the lobes wide-spreading, dextrorsely contorted in the bud. Stamens 5-12, inserted in the corolla throat, erect but curving strongly to one side after anthesis, the anthers basally attached, dehiscing by lateral longitudinal slits. Ovary bicarpellate, unilocular, the placentae slightly intruding into the locule. Stigmas 2, spirally twisted at anthesis and bent to one side, later becoming erect, style slender. Capsule 2-valved, septicidal. Seeds numerous, globose to slightly flattened.

Erect, glabrous, annual or perennial herbs, frequently stoloniferous and arising from a short caudex or elongate, branched rhizome. Chiefly eastern North American coastal plain but extending westward to the prairies of Oklahoma and Texas, south to central Mexico and eastward into the West Indies.

Type species: *Sabatia dodecandra* (L.) BSP. (= *Chironia dodecandra* L. Sp. Pl. 1: 190. 1753).

1. *Sabatia kennedyana* Fern.

Figure 31

*S. kennedyana* Fern. in Rhod. 18: 150. 1916. (Type: Williams s.n., GH!)

*S. kennedyana* f. *candida* Fern. in Rhod. 18: 151. 1916. (Type: Underwood s.n., GH)

*S. kennedyana* f. *encycla* Fern. in Rhod. 24: 180. 1922. (Type: Fernald & Long 24354, GH)

Common Name: Kennedy's *Sabatia*.

Perennial, arising from a slender, fragile rhizome, 30-65 cm high. Stems hollow below, single or several, branched in the upper third. Roots slender and fibrous, accompanied by decumbent stolons or rhizomes bearing at the tip a rosette of linear to oblanceolate leaves 2-15 cm long, 3-15 mm wide. Basal and lower cauline leaves similar to the rosette leaves, the cauline lanceolate to narrowly linear, acute to acuminate, 3-5 cm long, 4-10 mm wide. Flowers in complete or reduced cymules, the terminal flower short-pedicellate, the pedicels 1-5 cm long. Calyx crateriform or

Figure 29. *Gentianella amarella* (L.) Börner ssp. *acuta* (Michx.) Gillett. a, plant, × 0.5. b, corolla, × 3. c, detail of fringe. d, calyx, × 3. e, seed.

shallowly campanulate, 3-4 mm long, the lobes linear, 6-10 mm long. Corolla tube cylindrical, 2-3 times as long as the calyx tube, the lobes 7-12 in number, 18-24 mm long, 7-10 mm wide, obovate-spatulate, obtuse or rarely emarginate, pink or rarely white. Stamens with slender filaments, the anthers 3-6 mm long. Ovary half-exserted from the corolla tube, the style 2-6 mm long with slender stigmas. Capsule broadly cylindrical, 7-11 mm long, 4-7 mm in diameter.

Flowering from mid-June until early August; probably fruiting in August.

*Sabatia kennedyana* is the only one of the seventeen species of the North American genus *Sabatia*, revised by Wilbur (1955), that extends as far north as Canada. Wilbur gave the following habitat and distribution: "Sandy and peaty margins of ponds and streams in southern Nova Scotia, eastern Massachusetts, Rhode Island, southeastern North Carolina and northeastern South Carolina." This coastal plain species is closely related to *S. dodecandra* (L.) BSP. Wilbur did not cite specimens of *Sabatia angularis* (L.) Pursh from Ontario or plot them on his distribution map although Macoun (1884 and 1886) had reported it for southwestern Ontario (based on a report by Asa Gray). Wilbur's map indicates that it occurs in Ohio along the southern shore of Lake Erie. There is therefore a possibility that *S. angularis* occurs in southern Ontario, the counties of Lambton, Kent, Essex and perhaps Middlesex being likely locations.

### *Centaurium* Hill, Br. Herb. 62. 1756

Flowers 5-, rarely 4-parted. Calyx tubular, angular, with slender lobes. Corolla marcescent, usually salverform, constricted at the orifice, the lobes evident. Stamens 5-4, inserted in the upper part of the corolla tube, the filaments slender, free, the anthers usually contorted after dehiscence, frequently caducous. Ovary unilocular, or with intruding sutural placentae. Nectary glands on the slightly disc-like, broadened portion of the gynophore. Style filiform, often separated below, stigmas two or fused into a spherical or disc-like head. Capsule 2-valved, septicidal. Seeds numerous, alveolate.

Chiefly annuals, sometimes perennials of temperate and tropical regions of Europe, Asia, Africa and the Americas.

Type species: *Gentiana centaurium* L. Sp. 1: 229. 1753.

### Key to the Species<sup>2</sup>

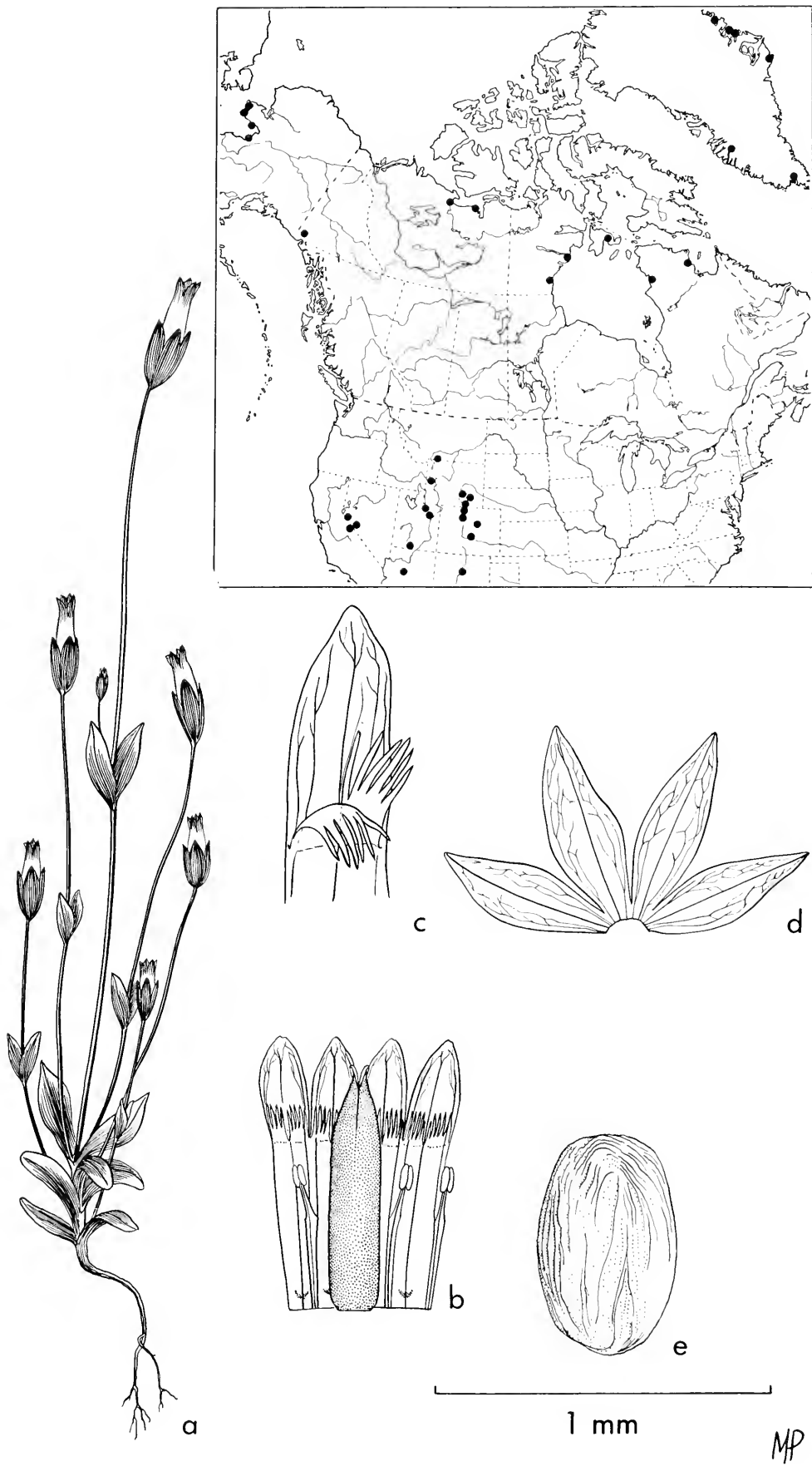
- A. Anthers 0.5-1.0 mm long, terminal flower with pedicels 15-30 mm long, calyx as long as or longer than the corolla tube .....1. *C. exaltatum*
- AA. Anthers 1.5-2.0 mm long, terminal flowers sessile or subsessile, calyx shorter than the corolla tube.

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<sup>2</sup> Since this manuscript was written, a specimen has been drawn to my attention from the Herbar P. Louis-Marie, Institut d'Oka, Quebec, labeled as follows: "Cap Tormentine, New Brunswick: commune dans les champs, Reine-Aimée Ste-Marie, Août, 1947." This specimen has been identified as *Centaurium pulchellum* (Sw.) Druce.

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Figure 30. *Gentianella tenella* (Rottb.) Börner. a, plant,  $\times 1$ . b, corolla,  $\times 3$ . c, detail of fringe. d, calyx,  $\times 3$ . e, seed.





- C. Branching dichotomous throughout, the lower branch internodes elongate; inflorescence a cymose panicle, the lanceolate acute corolla lobes 1.5-2.0 mm wide .....2. *C. muhlenbergii*
- CC. Branches axillary and mainly terminal; inflorescence an umbelliform aggregate dichasium, the oblong obtuse corolla lobes ca. 2.5-3.0 mm wide .....3. *C. erythraea*

# 1. *Centaureum exaltatum* (Griseb. ex Hook.) Wight

## Figure 32

*C. exaltatum* (Griseb. ex Hook.) Wight in Contr. U.S. Nat. Herb. 11: 449. 1906 (as *Centaurion*).

*Cicendia exaltata* Griseb. in Hook. Fl. Bor.-Am. 2: 69. 1838; Gen. et Sp. Gent. 159. 1839. (Type: Douglas, K)

*Erythraea douglasii* Gray, Bot Calif. 1: 480. 1876. (Type: Douglas, K)

*E. exaltata* (Griseb. ex Hook.) Coville, Contr. Nat. Herb. 4: 150. 1893.

Common Names: Great Basin or Desert Centaury.

Annual herb, 0.7-4.0 dm high, simple or strictly branched and with a slender taproot. Basal leaves similar to the lower cauline, frequently withering early, cauline leaves elliptic to oblong-lanceolate, 0.7-2.5 cm long, 0.2-0.5 cm wide, acute, diminishing in size upwards. Flowers in simple cymes and axillary on pedicels to 4.5 cm long. Calyx 4-5-parted, short-tubular, the lobes linear to linear-lanceolate, 4-5 times as long as the tube. Corolla pale pink to white, the tube 6-12 mm long, the lobes elliptic-obovate, 5 mm long, 1.5 mm wide with erose obtuse tips. Stamens inserted below the orifice of the corolla tube, the anthers 1.0 mm long. Pistil sessile, as long as the corolla tube, cylindrical, the stigmas flabelliform, the style to 2 mm long. Capsule to 1.5 cm long, the style caducous, the valves separating most of their length, the seeds ovoid, alveolate-reticulate, 0.25 mm long, dark brown.

Moist places around ponds or lake shores and on palouse prairie. Southern British Columbia through eastern Washington and Oregon to southern California, east to Idaho and south through Utah and Nevada to Arizona. Flowering in July and August; fruiting from mid-August into September.

This species attains its northernmost limit on the shores of Lake Osoyoos, B.C. This station is the only one for Canada and was recorded by Eastham (1947). There are several collections made by him on file in the herbarium of the University of British Columbia and a duplicate at Ottawa (DAO). During the summer of 1953, two further collections were made by J. A. Calder and D.B.O. Savile from the same locality.

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Figure 31. *Sabatia kennedyana* Fern. a, plant,  $\times 0.5$ . b, corolla,  $\times 1$ . c, calyx,  $\times 1$ . Map: According to Wilbur.

2. *Centaurium muhlenbergii* (Griseb.) W. F. Wight

No figure

*C. muhlenbergii* (Griseb.) W. F. Wight in Contrib. U.S. Nat. Herb. 11: 450. 1906.

*Erythraea Muehlenbergii* Griseb. Gen. & Sp. Gent. 146. 1839. (Type: Douglas, K)

*Centaurodes Muhlenbergii* (Griseb.) Kuntze Rev. Gen. Pl. 2: 426. 1891.

Common Name: Muhlenberg's Centaury.

Annual herb, 1-3 dm high, simple or dichotomously branched throughout. Basal leaves oblong-spatulate, 2.5-3.5 cm long, 1.0-1.5 cm wide, obtuse, the cauline ovate acute, smaller, 0.7-1.5 cm long, becoming lanceolate above. Flowers in open cymose panicles, the terminal (fork) flowers sessile. Calyx 5-parted, short-tubular, the lobes linear-lanceolate, at least twice as long as the tube but shorter than the corolla tube. Corolla pink to white, the tube 7-8 mm long, the lobes elliptic, 5-6 mm long, ca. 1.5 mm wide with erose tips. Stamens inserted at the orifice of the corolla tube, the anthers 1.5 mm long. Pistil sessile, nearly as long as the corolla tube, cylindrical, the stigmas flabelliform, as long as broad, the style 2 mm long. Capsule slightly longer than the immature ovary, seeds not seen (ca. 0.2 mm long—Munz).

Hitchcock (1959), in the latest floristic treatment of the region, gives the northern range of this species as "e. Wash. from Kittitas to Spokane cos." There is no doubt, however, that the several sheets from Stanley Park, Vancouver, are of this species.

When Grisebach described *E. Muehlenbergii*, he gave Beck's *E. Centaurium* in synonymy and cited the Muhlenberg collection from the Willdenow herbarium. Under "Patria" he then cited a Douglas collection from California which he had seen in the Hooker herbarium and quoted the Oswego, New York, record given by Beck.

Gray (1878), in his very fine treatment of the genus, showed that the New York plant cited was the introduced *Erythraea ramosissima* Pers. (= *C. pulchellum* (Sev.) Druce). He also chose the Douglas collection from California as lectotype and dropped the "e" used in the original spelling of the specific epithet. His change in spelling has been accepted generally, as here, although Munz and Keck (1959) retained the original *Muehlenbergii*.

I saw a photograph of the Willdenow herbarium specimen and believe it to be *C. pulchellum*.

3. *Centaurium erythraea* Rafn

Figure 33

*C. erythraea* Rafn, Danm. & Holst. Fl. 2: 75. 1800.

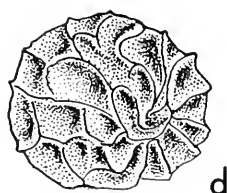
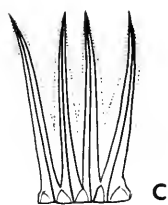
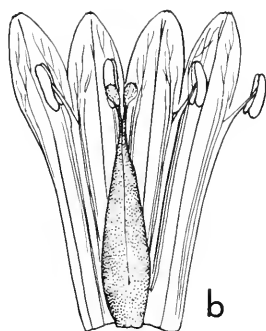
*Gentiana centaurium* Auct. non *G. centaurium* L. = *C. littorale* (D. Turner) Gilmour.

Common Names: Common, European or Pink Centaury.

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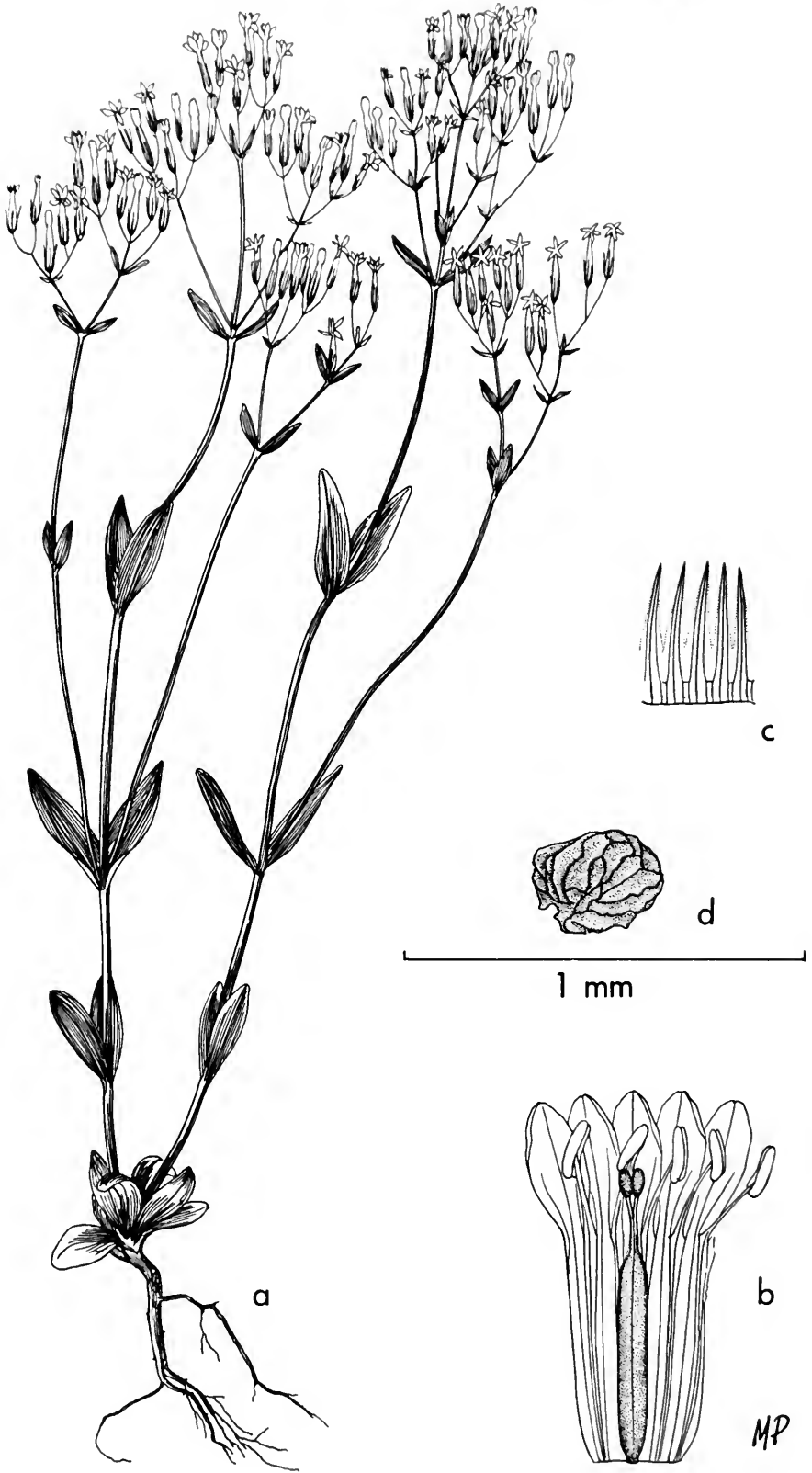
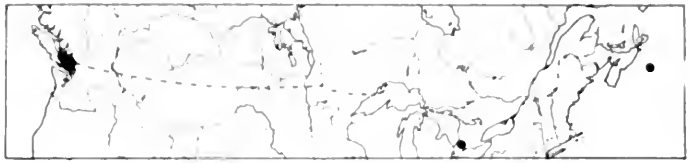
Figure 32. *Centaurium exaltatum* (Griseb. ex Hook.) Wight. a, plant,  $\times 0.5$ . b, corolla,  $\times 2$ . c, calyx,  $\times 2$ . d, seed.





1 mm

MP



Annual herb, 0.8-5.0 dm tall, strictly branched and with a slender taproot. Basal leaves frequently forming rosettes, oblong-obovate to spatulate, 1-2.5 cm long, 0.3-1.2 cm wide, the cauline leaves usually ovate-lanceolate, 1.0-2.5 cm long acute, diminishing in size upwards. Inflorescence a dense terminal umbelliform aggregate dichasium. Calyx 4-5-parted, tubular, the lobes linear to linear-lanceolate, 2-3 times as long as the tube. Corolla salverform when the lobes are expanded, pink, the tube 7-9 mm long, the lobes oblong, 4-7 mm long, 3 mm wide. Stamens inserted at the orifice of the corolla tube, filamentous, the anthers versatile, 2.5 mm long, spirally contorted after dehiscence. Pistil sessile, to 7 mm long, the capsule cylindrical, about 1.0 cm long, the valves and lower part of the style separating, the seeds irregularly angled, alveolate, 0.25 mm long, light tan.

A native of Europe occurring over most of that continent except the northernmost portion. Natural habitats in Europe include grassy places, fields, ditches, dry land and waste places. Flowering in Canada from late June until August; fruiting in late July to September.

*C. erythraea* has been introduced into Canada on Sable Island, Nova Scotia, where it was found by H. T. Güssow in 1911 and again by J. S. Erskine in 1952 and 1953. Pink centaury is also found from Victoria to Ladysmith, Vancouver Island, British Columbia, and on South Pender Island. The John Dearness herbarium (in DAO) contains a collection from Strathroy, Ontario, made by A. K. Reynolds in 1898. Undoubtedly it has been widely introduced into the United States but our records show it from Oregon and Washington only.

This species, in common with several others, is heterodistylous, i.e., it has long- and short-styled flowers, although both heterodistylous and normal flowers may occur on the same plant. Heterodistily is common in the Primulaceae.

The name *C. erythraea* Rafn is accepted in accordance with Dandy's "List of British Vascular Plants." Dr. Dandy has pointed out in correspondence that the type of *Gentiana centaurium* L. is the plant known in Europe as *C. littorale* (D. Turner) Gilmour. The name *C. minus* Moench he rejects under Article 65 of the Code as having been consistently misapplied to the common centaury.

In addition to the three species of *Centaurium* described above, there is also a single but ample collection by J. A. Calder and K. T. MacKay made in 1961. This collection (*Calder & MacKay 30753*) came from Cattle Point, Uplands Park, Victoria, B.C., where it was found in meadows near the shoreline. The plants are 15 cm or less high and the fork flowers are pedicellate. Pending comparison with authentically determined material, the collection has been tentatively identified as *C. curvistamineum* (Wittr.) Druce. This species is considered by Hitchcock (1959) to be synonymous with *C. muhlenbergii* but both Abrams (1951) and Munz and Keck (1959) recognized it as distinct. The latter authors gave the range of *C. curvistamineum* as extending to eastern Washington.

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Figure 33. *Centaurium erythraea* Rafn. a, plant,  $\times 0.5$ . b, corolla,  $\times 3$ , c, calyx,  $\times 3$ . d, seed.

*Bartonia* Mühl. ex Willd. Ges. Naturf. Fr. Berlin, Neue Schr. 3: 444.  
1801, nom. conserv. Int. Code Bot. Nom. 127. 1952.

Calyx of four essentially free sepals. Corolla deeply 4-lobed, marcescent, campanulate, each lobe with a single vascular strand, without glands. Stamens 4, alternate with the lobes, the filaments short, attached at the corolla sinuses, the anthers introrse, frequently caducous after anthesis. Ovary unilocular, 2-carpellate, placenta parietal, the ovules borne on the entire surface of the ovary wall. Capsule 2-valved, thin-walled, septicidal. Seeds very numerous, minute, ellipsoid, smooth to minutely reticulate.

Annual herbs with three species endemic to eastern North America.

Type species: *Bartonia tenella* Willd. l.c.=*B. virginica* (L.) BSP.  
Prel. Cat. N.Y 36. 1888, based on *Sagina virginica* L. Sp. Pl. 128. 1753.

### Key to the Species

- Corolla lobes oblong with an erose to entire, apiculate apex; capsule dehiscing below the usually elongate style; leaf scales essentially opposite, the numerous nodes progressively more crowded towards the base .....1. *B. virginica*
- Corolla lobes lanceolate to oblong, acute, inapiculate; capsule dehiscing by terminal separation of the short styles; leaf scales alternate, the few internodes only slightly shortened towards the base.....2. *B. paniculata*

#### 1. *Bartonia virginica* (L.) BSP.

##### Figure 34

*B. virginica* (L.) BSP. Prel. Cat. N.Y. Pl. 36. 1888.

*Sagina virginica* L. Sp. Pl. 1: 128. 1753. (Type: Clayton 649, BM; photo, DAO!)

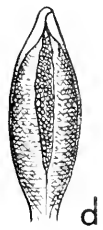
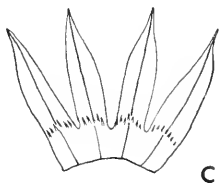
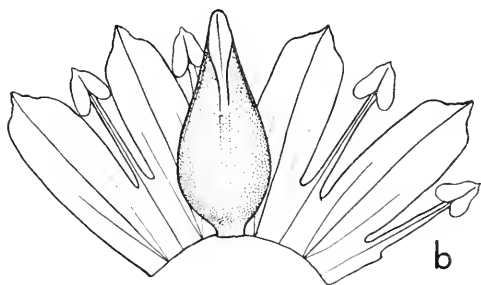
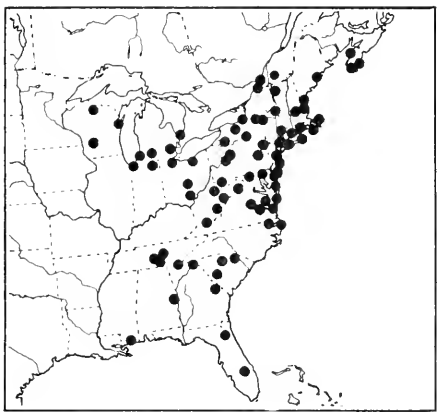
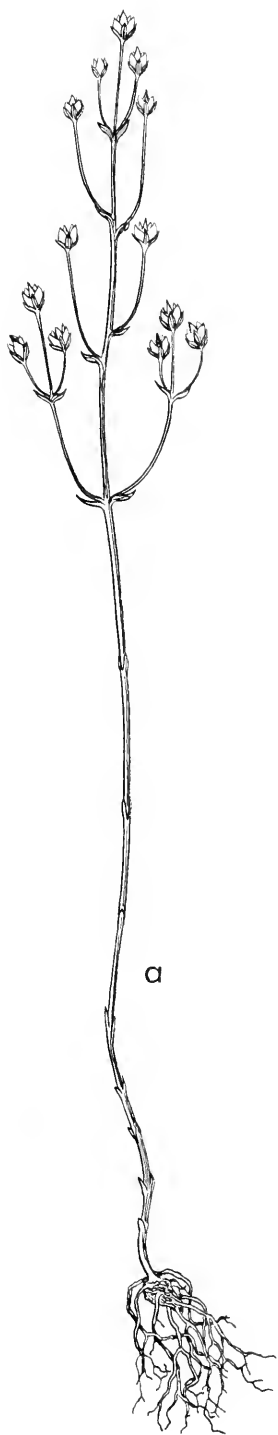
Common Names: Virginian *Bartonia*, Screwstem.

Annual, 0.4-4.5 dm tall, erect, simple or branched above, the stem stout, frequently twisted, the nodes numerous and becoming progressively closer together towards the purpled base. Leaves scale-like, subulate, opposite or subopposite, 0.9-4.7 mm long. Flowers in simple terminal cymes with axillary flowers or branches below. Calyx lobes almost distinct, subulate-lanceolate, 0.4-1.1 mm wide, 2.0-3.5 mm long. Corolla greenish yellow, the tube a third as long, the lobes oblong, mucronate, erose or entire, 0.75-1.2 mm wide with a prominent midvein. Stamens flattened, the oblong, mucronate anthers 0.6-1.2 mm long. Pistil ovate, 2.5-4.5 mm long, the style 1.0-2.0 mm long, the stigmas decurrent. Capsule ovate, 4.0-5.5 mm long, dehiscing below the persistent style. Seeds small and extremely numerous, light brown.

Nova Scotia and southern Quebec, Michigan and Wisconsin, south to Florida and Alabama. No Ontario records. Corema barrens, sphagnous

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Figure 34. *Bartonia virginica* (L.) BSP. a, plant,  $\times 0.5$ . b, corolla,  $\times 6$ . c, calyx,  $\times 6$ . d, capsule,  $\times 6$ . e, seed.



0.5mm MP

bogs, margins of swamps, peaty and sandy lake shores, openings in open brush and in dry thickets. Flowering from early July until late September; fruiting from early August until November.

2. *Bartonia paniculata* (Michx.) Muhl. ssp. *iodandra* (Robins.) J. M. Gillett  
Figure 35

*B. paniculata* ssp. *iodandra* (Robins.) Gillett in Rhod. 61: 54. 1959.

*B. iodandra* Robins. in Bot. Gaz. 26: 47. 1898. (Type: Robinson & Schrenk 5, GH!)

*B. paniculata* var. *iodandra* (Robins.) Fern. in Rhod. 23: 288. 1922.

*B. iodandra* var. *sabulonensis* Fern. in Proc. Bost. Soc. Nat. Hist. 36: 89. 1921. (Type: St. John 1307, GH!)

*B. paniculata* var. *sabulonensis* Fern. in Rhod. 23: 288. 1922.

*B. paniculata* var. *intermedia* Fern. in Rhod. 23: 287. 1922. (Type: Fernald & Long 22299, GH!)

Common Name: Screwstem.

Annual, 0.3-2.5 (av. 1.2) dm tall, the usually purple, angled stems occasionally stout. Leaf-scales 0.5-3.0 mm long, alternate, subulate. Flowers in simple cymes or solitary or with axillary flowers below. Calyx tube frequently well developed, slightly winged at the base, the sinuses rounded, the lobes 1.5-3.2 (av. 2.4) mm long, 0.5-1.1 (av. 0.8) mm wide, ovate to lanceolate. Corolla 3.0-6.2 (av. 4.4) mm long, white to somewhat erubescens, the tube shorter than or about as long as the lobes, the oblong lobes variable, 0.8-2.0 (av. 1.3) mm wide, acute to slightly mucronate with a nerve usually evident. Stamens 2.4-5.0 (av. 3.6) mm long, the frequently purple filaments broadened below, the usually purple anthers variable, with or without an apiculate tip. Pistil 3.0-5.5 (av. 3.9) mm long, the style 0.6-1.5 (av. 0.95) mm long. Capsule 4.0-6.0 (av. 5.0) mm long. Seeds averaging 0.15 by 0.10 mm, lightly brown with a testa of inflated cells, extremely numerous.

As pointed out by Gillett (1959), this subspecies intergrades rather freely with ssp. *paniculata*. Intermediate specimens between *B. paniculata* and *B. virginica* occur sporadically where the species ranges overlap.

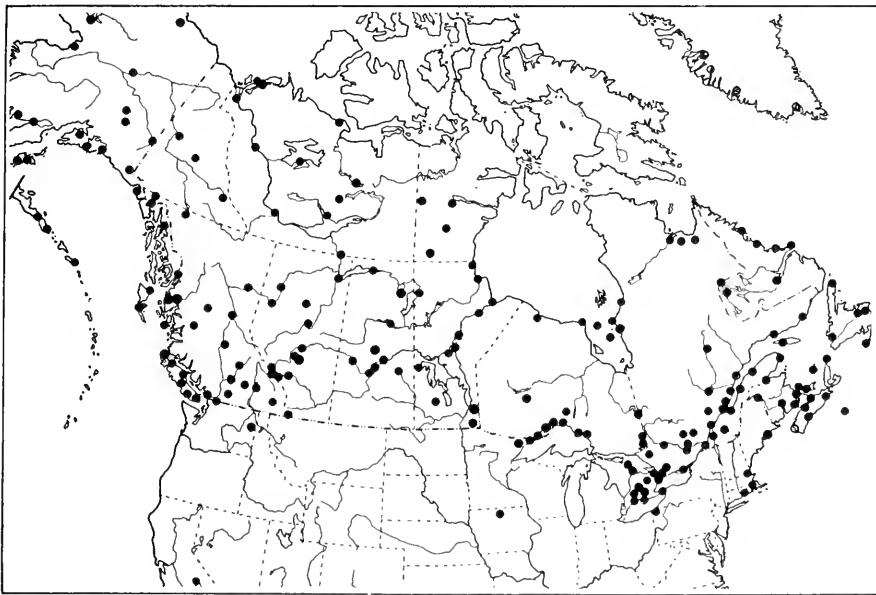
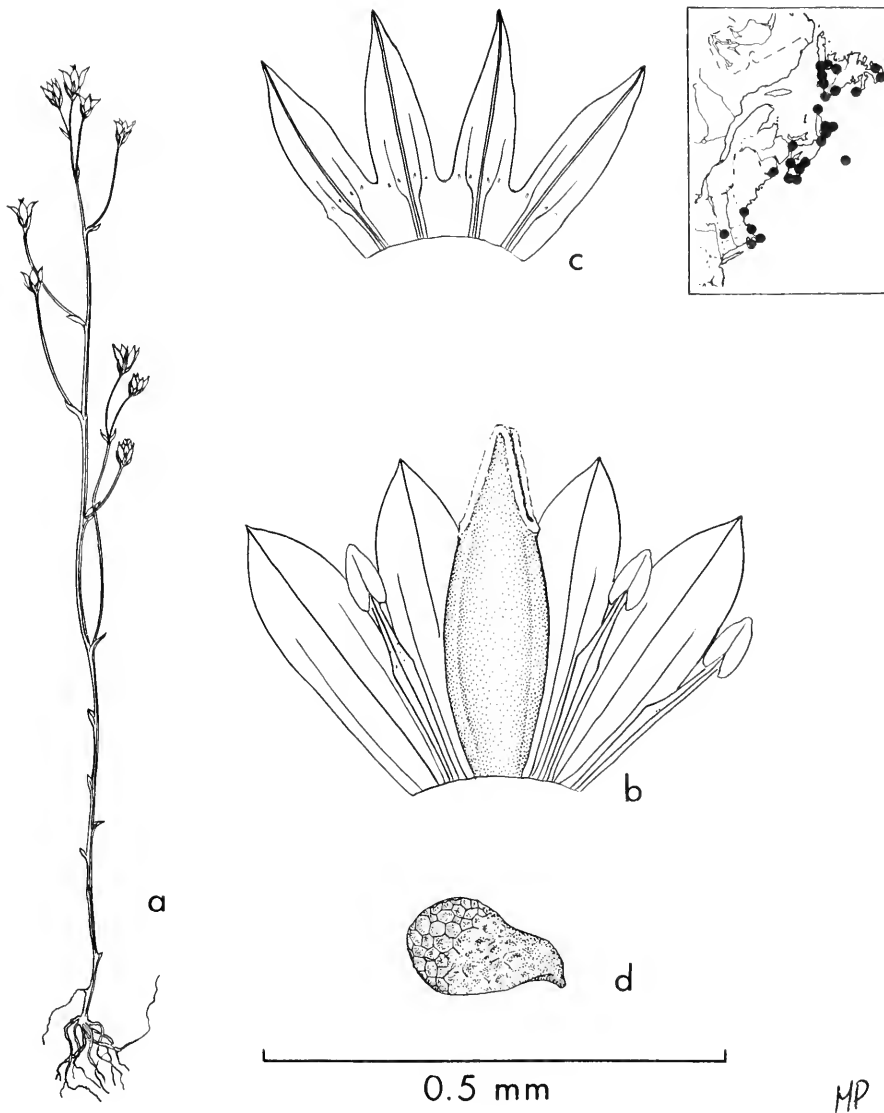
## MENYANTHACEAE Buckbean Family

Perennial rhizomatous aquatic or bog herbs with alternate or basal, entire or crenulate, simple or trifoliolate leaves. Plants heterodistylous, flowers bisexual, regular, 5-lobed or parted, borne in racemose scapes or in umbels on long filiform stems. Corolla rotate to funnelform, 5-lobed or cleft. Calyx deeply 5-parted. Stamens 5, alternate with the corolla lobes and borne on the corolla tube. Ovary falsely perigynous by adnation of the calyx and corolla to the lower third, 1-celled, falsely 2-celled by an intrusion of the placenta. Style long or wanting (heterostyly). Fruit a dehiscent or indehiscent capsule. Seeds usually smooth.

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Figure 35. *Bartonia paniculata* (Michx.) Muhl. ssp. *iodandra* (Robins.) Gillett. a, plant,  $\times 0.5$ . b, corolla,  $\times 6$ . c, calyx,  $\times 6$ . d, seed.

Map: *Menyanthes trifoliata* L. (see Figure 36).



Widely distributed, temperate and tropical zones. Five genera: *Fauria* extending from Washington and B.C. to Alaska and Japan; *Menyanthes* with one circumboreal species extending from Europe through Asia and in North America as far south as California; *Villarsia* with perhaps 10 species in Australia and South Africa; *Nymphoides* with 2 native species and one introduced in temperate North America, the remaining 18 chiefly in the tropical and subtropical regions of the world; and *Liparophyllum* with one species occurring in Tasmania and in the Alps of New Zealand.

### Key to the Genera

- A. Bog plants, not submerged; petioles and scapes erect.
  - B. Leaves distinctly trifoliate; corolla lobes bearded.....**Menyanthes**
  - BB. Leaves simple, 2-lobed; each corolla lobe bearing an erose to digitate crest on the midvein .....**Fauria**
- AA. Submerged aquatics with floating leaves and flowers.....**Nymphoides**

*Menyanthes* L. Sp. Pl. 1: 145. 1753.

Plants heterodistylous. Calyx 5-lobed, the tube adnate to the ovary, fleshy, the lobes free. Corolla tube short, the lobes free and spreading, each lobe covered throughout most of the length by a beard of evascular fimbriae concentrated about the three veins. Stamens 5, attached at the sinuses of the lobes, the filaments slender, free, the anthers basifixed, introrse, recurving slightly after dehiscence. Ovary unilocular, the placenta parietal, the ovules sutural. Style stout, the two stigmas distinct. Capsule loculicidal, splitting almost to the base, heavily walled, the seeds elliptical, flattened, shiny, smooth, light brown.

A monotypic genus of the cooler temperate zone, widely distributed.

#### 1. *Menyanthes trifoliata* L.

Figure 36

*M. trifoliata* L. Sp. Pl. 1: 145. 1753.

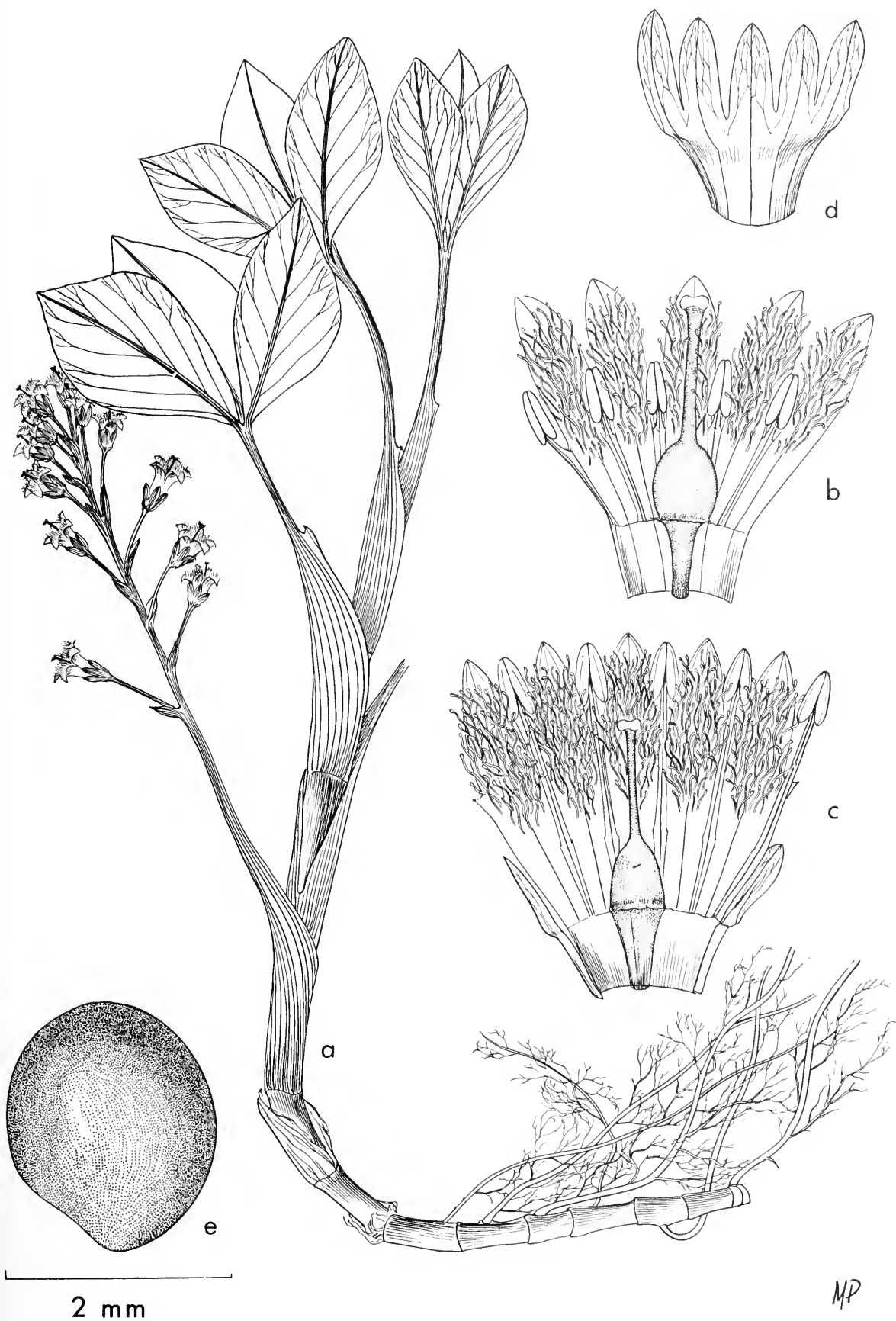
Common Name: Buckbean.

Perennial herb with stout creeping rootstalk covered by persistent leaf bases. Leaves trifoliolate, the leaflets oblong to obovate or elliptic, sessile, 2-6 cm long, entire or broadly crenate to undulate, borne on a stout petiole, 3-20 cm long with a strong basal sheath. Racemes of a few to 25 flowers borne on a scape-like peduncle. Calyx tube obconic, the lobes oblong-ovate, obtuse, 3-5 mm long. Corolla white or roseate, the tube as long as the calyx, the lobes spreading, about 0.8 cm long, acute, the surface bearing numerous thickened hairs or processes. Stamens erect, exserted, introrse, the filaments slender in one form, the other with short filaments, the anthers purple with divergent recurved thecae. Pistil ovate, the style short when filaments are elongate, long when anthers are

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Figure 36. *Menyanthes trifoliata* L. a, plant,  $\times 0.5$ . b, long-styled flower,  $\times 3$ . c, short-styled flower,  $\times 3$ . d, calyx,  $\times 3$ . e, seed. Map: see Figure 35.





nearly sessile, persistent. Capsule stout, ellipsoid, about 8-10 mm long. Seeds 2.5 mm long, 2 mm wide, slightly flattened, glossy, light brown.

Bogs and margins of sluggish streams, throughout the temperate zone. Flowering from mid-June to July; fruiting in July and August.

Dimorphic flowers occur in this species. Those with short styles and long, exerted stamens and those with long styles and short, included stamens, occur on separate plants. This, as pointed out in the discussion on *Centaureum* spp., is an adaptation that ensures cross-pollination.

The heterostyly of the flowers is somewhat disguised by the racemose type of inflorescence so that on herbarium specimens exerted styles or stamens are only evident in older, more mature flowers.

In 1960 a clone of long-styled plants was collected in a small lake on the Cassiar Mine road south of Watson Lake, Yukon. A clone of short-styled plants grew in another small pond a few hundred yards away.

*Menyanthes trifoliata* probably is rather exacting in its growth requirements. Cultivation attempts so far have not been very rewarding.

*Fauria* Franchet in Bull Soc. Philom. Paris. Ser. 7, 10: 140. 1886.

Flowers heterodistylous. Calyx 5-lobed, the tube adnate to the ovary, the lobes free. Corolla with a short tube, the lobes spreading, each lobe bearing an erose to irregularly toothed crest along the midvein. Stamens 5, attached at the sinuses of the corolla lobes, free, the anthers sagittate, introrse. Ovary unilocular, the placenta parietal, the ovules sutural only. Nectar copious, and with a rank odor. Style elongate, stigma bilobate. Capsule dehiscent at the apex into 4 teeth. Seeds ellipsoid, flattened, glossy, pale brown.

A coastal genus of the west coast of North America extending to Japan and the northern islands.

1. *Fauria crista-galli* (Menzies ex Hook.) Makino

Figure 37

*F. crista-galli* (Menzies ex Hook.) Makino in Bot. Mag. Tok. 18: 15. 1904.

*Menyanthes crista-galli* Hook. Bot. Misc. 1: 45. t. 24. 1830. (Type: *Menzies*, K; photo, DAO)

*Villarsia crista-galli* (Menzies ex Hook.) Griseb. in Hook. Fl. Bor. Am. 2: 70. 1838.

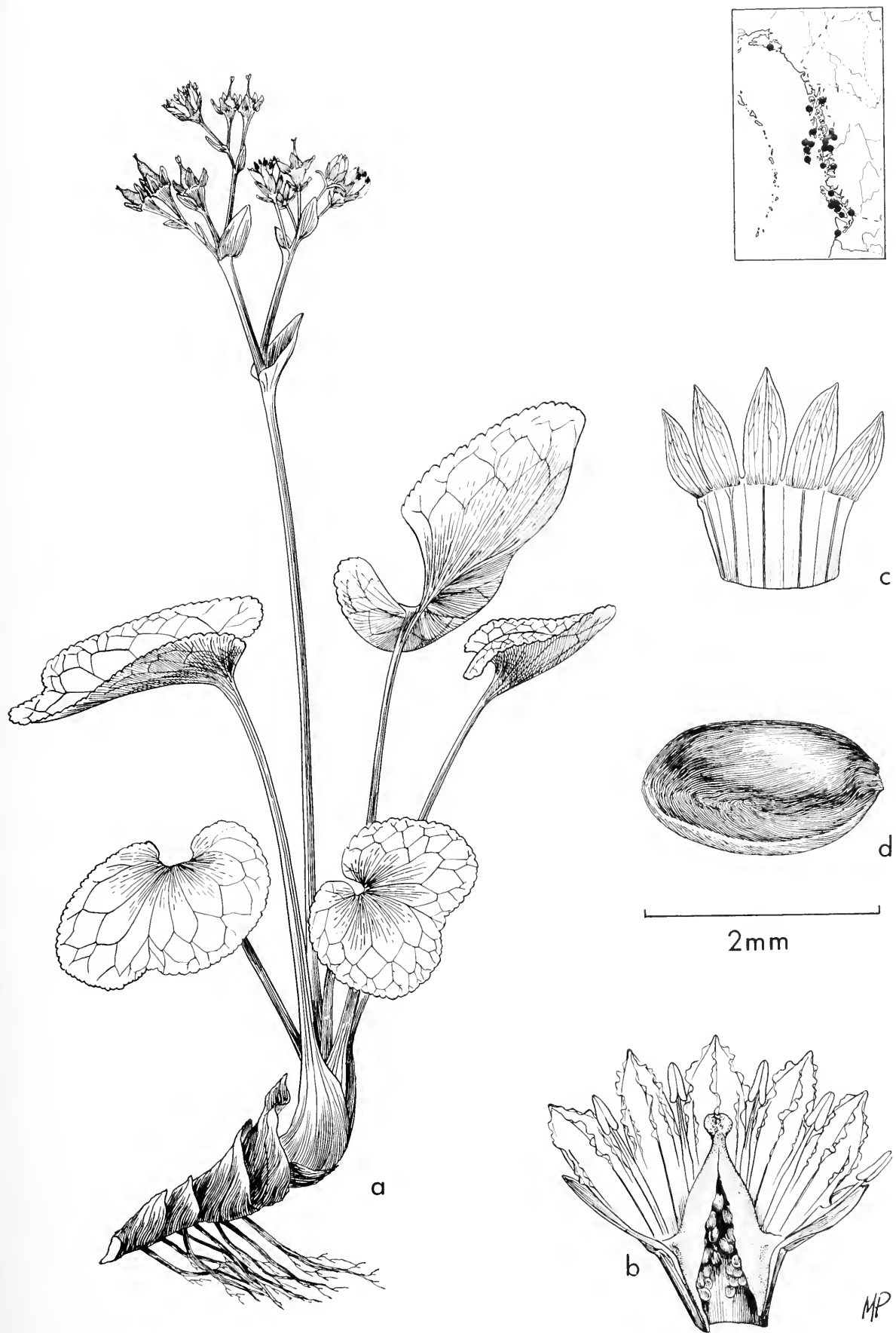
*Nephrophyllidium crista-galli* (Menzies ex Hook.) Gilg in Engl. Pfl. Fam. 4: 105. f. 47. 1895.

Common Name: Deer Cabbage.

Perennial herb with stout creeping rootstalk. Leaves all basal, reniform, sometimes emarginate, crenate, the blades 5-14 cm broad, the stout petioles to 3 dm long; flowers borne in simple to corymbiform cymes on scapes to 6 dm long; bracts linear-lanceolate to ovate, 5-15 mm long, the pedicels elongating during flowering. Calyx tube conic, the lobes lance-

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Figure 37. *Fauria crista-galli* (Menzies ex Hook.) Makino. a, plant,  $\times 0.5$ . b, corolla with capsule,  $\times 4$ . c, calyx,  $\times 4$ . d, seed.



olate, 3-4 mm long with a blunt callous tip. Corolla white, deliquescent, the lobes horizontally spreading, 5-6 mm long, oblong-ovate, bearing an erose to irregularly toothed crest on the midvein and with margins similar to the crest, without hairs on the surface. Stamens erect, introrse, the filaments short-tapered. Pistil ovate, the style stout, 2-3 mm long. Capsule slender, the lower half adnate to the calyx tube, the free portion narrowly ovoid to cylindrical.

Northern Washington, coastal B.C. to Alaska. Wet sphagnum bogs. Flowering from late June to mid-August; fruiting in August.

*Fauria crista-galli* has been grown in the greenhouse from seed collected by J. A. Calder at Prince Rupert, B.C., in 1954. A small rosette of leaves was produced during the first year but no flowers developed. The leaves died in the fall, when the plant entered a period of winter-dormancy. Vigorous growth was resumed after re-potting the following spring and flowers appeared during the second week of July. The central flower of each cyme opened first (as one would expect) and the two laterals followed in a day or so. During flowering the pedicels of the laterals elongated considerably. The odor of the flowers was rank and overpowering and the petals became deliquescent within a few days.

### *Nymphoides* Hill, Brit. Herb. 77. 1756.

Calyx 5-parted, tubular. Corolla deciduous, rotate, 5-parted, the lobes variously fimbriate, with epipetalous glands. Stamens 5, inserted on the corolla tube, the anthers introrse, free. Ovary unilocular, the placenta parietal, the ovules borne at the sutures. Glands 5, borne on the hypogynous disc. Stigmas 2, persistent, borne on a short style. Capsule unilocular, bursting irregularly, containing 2 to many smooth to muricate seeds.

Perennial aquatic herbs of tropical and temperate zones. Perhaps 20 species, two native in the United States and Canada and one cultivated European species.

Type species: *Nymphoides flava* Hill, Brit. Herb. 77. 1756 (= *N. peltata* (S. G. Gmel.) O. Ktze. Rev. Gen. 429. 1891, as *Nymphodes*).

#### 1. *Nymphoides cordata* (Ell.) Fern.

Figure 38

*N. cordata* (Ell.) Fern. Rhod. 40: 338. 1938.

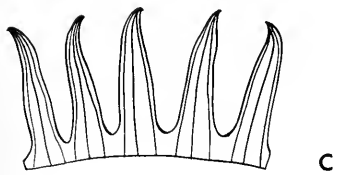
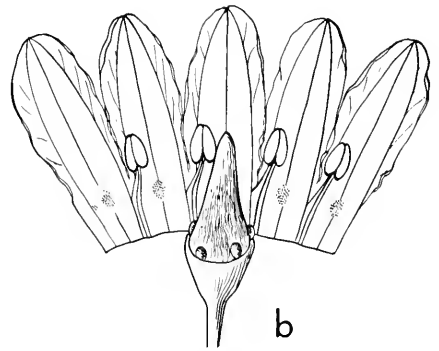
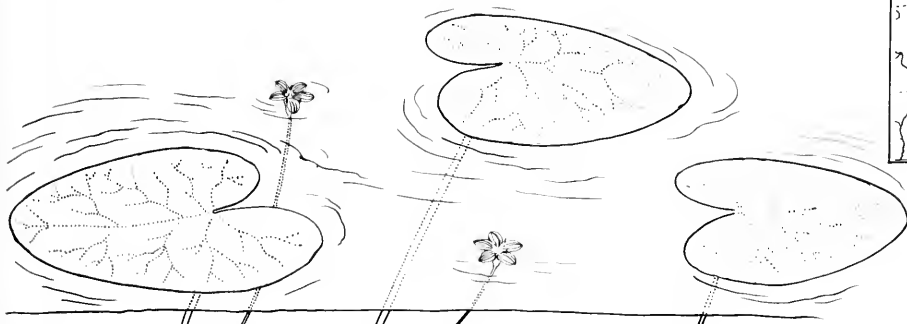
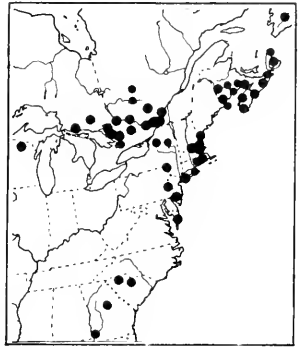
*Villarsia cordata* Ell. Sk. Bot. S.C. & Ga. 1: 230. 1816 or 17.

Common Name: Floating-heart.

Perennial aquatic rhizomatous herb. Leaves terminal on the rhizome in a compact cluster, each leaf with a straight or coiled petiole bearing a floating, cordate, green or frequently purple-mottled blade 2-5 cm long, 1.5-4 cm wide, the petioles frequently producing clusters of pendant tubers and an irregular umbel of delicate white flowers, the tubers eventually producing new leaves and roots and becoming detached. Flowers with

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Figure 38. *Nymphoides cordata* (Ell.) Fern. a, plant,  $\times 0.5$ . b, corolla,  $\times 4$ . c, calyx,  $\times 4$ .



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pedicels of various lengths borne in an umbelliform cluster. Calyx united at the base, the lobes lanceolate to ovate, acute, 3-3.5 mm long, with a single green midrib. Corolla white, campanulate, the lobes 4-5 mm long, elliptic-ovate, somewhat apiculate, the margins minutely lacerate. Stamens inserted at the sinuses, about a third as long as the corolla, the oblong introrse anthers 0.75 mm long. Intrastaminal glands prominent. Pistil sessile to subinferior, the ovary with a short rounded style, the stigmas not evident. Capsules and seeds not seen.

Nova Scotia, southwestern Quebec, throughout the Ottawa River system and in Muskoka, westward to Wisconsin, southward throughout the coastal plain of Florida. Preferring sand bottom in warm water with low wave-action. Flowering infrequently here from July through to September.

*Nymphoides peltata* (Gmel.) O. Ktze., the yellow floating heart, is a species of southern Europe and Asia Minor that has been introduced into North America and is cultivated in artificial ponds. In the United States it has escaped into rivers. We have records of cultivation in Canada at St. Vallier, Quebec; Sudbury and Turkey Point, Ontario; and Hope, B.C. The species can easily be confused with a monocotyledonous species, *Hydrocleis nymphoides*, the water poppy.

## GLOSSARY

The botanical terms used in this paper are defined below. Most of them are taken from Jackson (1949) but some special terms applicable to gentians are included.

*acuminate*: having a gradually diminishing apex.

*acute*: sharply pointed but not drawn out.

*adnate*: attached the whole length.

*aestivation*: the arrangement of floral parts in a bud.

*aggregate cyme*: a cymose inflorescence in which the cyme may have pairs of lateral members.

*alveolate*: marked as though honeycombed.

*anthesis*: the period of expansion of the flower, when fertilization takes place.

*apiculate*: furnished with a sharp, short point.

*attenuate*: narrowed, tapered.

*auriculate*: eared, auricled.

*autophyte*: a plant not dependent upon humus, as opposed to saprophyte.

*axillary*: growing at an angle, usually of a leaf.

*basifixed*: attached at the base.

*bearded*: in *Menyanthes*, the covering of hairlike processes on the petals.

*bifid*: twice-cleft.

*bisexual*: having both stamens and pistils, i.e., hermaphroditic (=perfect).

*bract*: modified leaves between the normal leaves and the flower or inflorescence.

*caducous*: dropping off early.

*callose*: hard and thick in texture.

*campanuliform*: applied to a corolla, bell-shaped.

*cespitose*: growing in tufts.

*cilia*: thin, hairlike processes (adj. *ciliate*).

*clavate*: club-shaped, thickened towards the apex.

*conduplicate*: folded together lengthwise.

*connate*: united.

*connivent*: coming into contact or converging.

*convolute*: one part rolled up in another.

*corymb*: a flat-topped or convex, open, indeterminate flower cluster.

*crateriform*: cup-shaped, hemispheric or shallow in contour.

*crenulate*: crenate (scalloped) but the toothings small.

*crest*: an elevated, usually irregularly toothed ridge.

*cyme*: a flower cluster of the determinate type.

*cymule*: a diminutive cyme or portion of one.

*decumbent*: reclining, but with the summit ascending.

*decurrent*: running down; of stigmas, extending down the sides of the ovary.

*deliquescent*: dissolving or melting away.

*dentate*: toothed.

*denticulate*: minutely toothed.

*dextrorse*: towards the right hand.

*dichasium*: an inflorescence in which two equal shoots arise below the terminal flower and each shoot again branches in the same manner.

*digitate*: finger-like.

*entire*: without toothings, the margin even.

*epipetalous*: borne upon the petals.

*erose*: as though bitten or gnawed.

*evascular*: without vascular traces.

*extorse*: directed outward, as the dehiscence of an anther.

*faceted*: having faces.

*fastigiate*: branches erect and close together.

*faucal*: of the corolla throat.  
*fimbria*: a fringe (adj. *fimbriate*, with the margin bordered by long slender processes).  
*flabelliform*: shaped like a fan.  
*foliaceous*: leaf-like.  
*fovea*: a depression or pit on the petal surface (adj. *foveate*).  
*free*: not adhering, the reverse of *adnate*.  
*fringe*: a line of hairlike appendages.  
*fusiform*: thick, but tapering towards each end.  
*gland*: a secreting structure on the surface of an organ.  
*gynophore*: the stipe of a pistil.  
*heterodistily*: dimorphism, bearing long- or short-styled flowers on separate plants.  
*hirsute*: hairy, with rough distinct hairs.  
*hypogynous*: free from but inserted beneath the pistil.  
*imbricate*: of the corolla, overlapping at the edge only.  
*induplicate-valvate*: in aestivation, with the edges applied to each other or not quite touching.  
*inflorescence*: a floral axis with its appendages. Now commonly restricted to a flower cluster, but sometimes applied also to a solitary flower.  
*insert*: the place where a body is attached to its support.  
*internode*: the portion of a stem between two nodes.  
*interstaminal glands*: basal corolla glands between and alternate with the stamens.  
*intracalycular membrane*: a thin membrane on the inner surface of the calyx (genus *Gentiana*).  
*introrse*: turned inwards.  
*involucre*: a ring of bracts surrounding several flowers.  
*involute*: having the edges rolled inwards.  
*keel*: a ridge on the exterior of a calyx lobe.  
*lacerate*: torn, or irregularly cleft.  
*lamellate*: bearing thin plates of tissue.  
*lanceolate*: narrow and tapering, with the greatest width at about one third from the base.  
*linear*: narrow, several times longer than wide, the sides usually parallel.  
*lingulate*: tongue-shaped.  
*locule*: the cavity of an ovary or anther.  
*loculicidal*: dehiscence of a capsule by the back or dorsal surface.  
*marcescent*: withering without falling off.  
*-merous*: denoting parts or numbers, as *dimerous*, etc.  
*mucronate*: having a short and straight point.  
*muricate*: rough, with short, hard, tubercular excrescences.  
*naked*: here, indicating the absence of a fringe.  
*nectary*: the organ in which nectar is secreted.  
*nerve*: a vein or slender rib.  
*node*: that part of a stem which normally has a leaf or whorl of leaves.  
*oblanceolate*: tapering towards the base more than towards the apex.  
*oblong*: much longer than broad, with parallel sides.  
*obovate*: reversed ovate.  
*obsolete*: wanting or rudimentary.  
*obtuse*: blunt or rounded at the end.  
*offshoot*: a lateral shoot (*offset*).  
*open*: expanded, not closed.  
*orbicular*: of a flat body, with a circular outline.  
*ovate*: shaped like a longitudinal section of hen's egg, the broader end basal.  
*panicle*: a loose flower cluster.  
*papilla*: here, a protuberance on the seed coat (adj. *papillose*).  
*parietal*: borne on the wall (e.g., ovules on the ovary wall).



*pedicel*: the support of a single flower (adj. *pedicellate*, borne on a pedicel).  
*peduncle*: the stalk of a flower generally or of a flower cluster.  
*perigynous*: the perianth adnate to the lower part of the pistil.  
*placenta*: the organ that bears the ovules in an ovary.  
*plica*: a fold, here used for the corolla tissue between the lobes.  
*poculiform*: goblet-shaped.  
*puberulus*: slightly hairy.  
*quincuncially*: of aestivation, in a quincunx, i.e., two parts exterior, two interior, and one having one margin exterior and the other interior as in a rose calyx.  
*raceme*: a indeterminate inflorescence, the flowers alternating along the central rachis.  
*reduced*: having failed to develop to expected form.  
*reniform*: kidney-shaped.  
*reticulate*: netted.  
*revolute*: rolled back from the margin or apex.  
*rhizome*: an underground stem.  
*rootstalk*: the primary, unbranched root in a young plant.  
*rotate*: circular and flat, of a corolla with a short tube.  
*sagittate*: arrow-shaped.  
*salverform*: salver-shaped, as the corolla of a primrose.  
*saprophyte*: a plant that lives upon dead organic matter.  
*scabrous*: rough.  
*scape*: a leafless floral axis arising from the ground level.  
*septicidal*: dehiscing through the lines of junction of a capsule.  
*sessile*: without a stalk.  
*simple*: here, not branched.  
*sinal membrane*: here, applied to a thin membrane that extends across the interior of the corolla sinus in the fringed gentians.  
*sinistrally*: turned to the left.  
*sinuate*: with a wavy margin, here also applied to the attitude of stems.  
*spathe*: here, a calyx that is split along one side.  
*spathose*: spathe-like.  
*spatulate*: oblong with the basal end attenuate.  
*spur*: a hollow extension of the corolla nectary.  
*squamellate*: bearing squamae or scales.  
*stipitate*: having a stipe or stalk.  
*stolon*: a runner that is disposed to root.  
*striate*: marked with longitudinal parallel lines.  
*strict*: close and upright, very straight.  
*subulate*: awl-shaped.  
*superior*: of an ovary, when all the floral envelopes are below it.  
*suture*: a junction or seam.  
*testa*: the outer coat of the seed.  
*trifoliolate*: with three leaflets.  
*truncate*: as though cut off at the end.  
*turbinate*: cone-shaped.  
*umbelliform*: umbrella-shaped.  
*undulate*: wavy.  
*urceolate*: pitcher-like.  
*vaginate*: sheathed.  
*vascular*: related to or furnished with vessels.  
*versatile*: turning freely on its support, as anthers on filaments.  
*whorl*: the arrangement of organs in a circle around an axis.  
*wing*: a membranaceous expansion.  
*winter-annual*: a plant that germinates in autumn, lives through the winter, flowers, fruits and dies the following year.

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