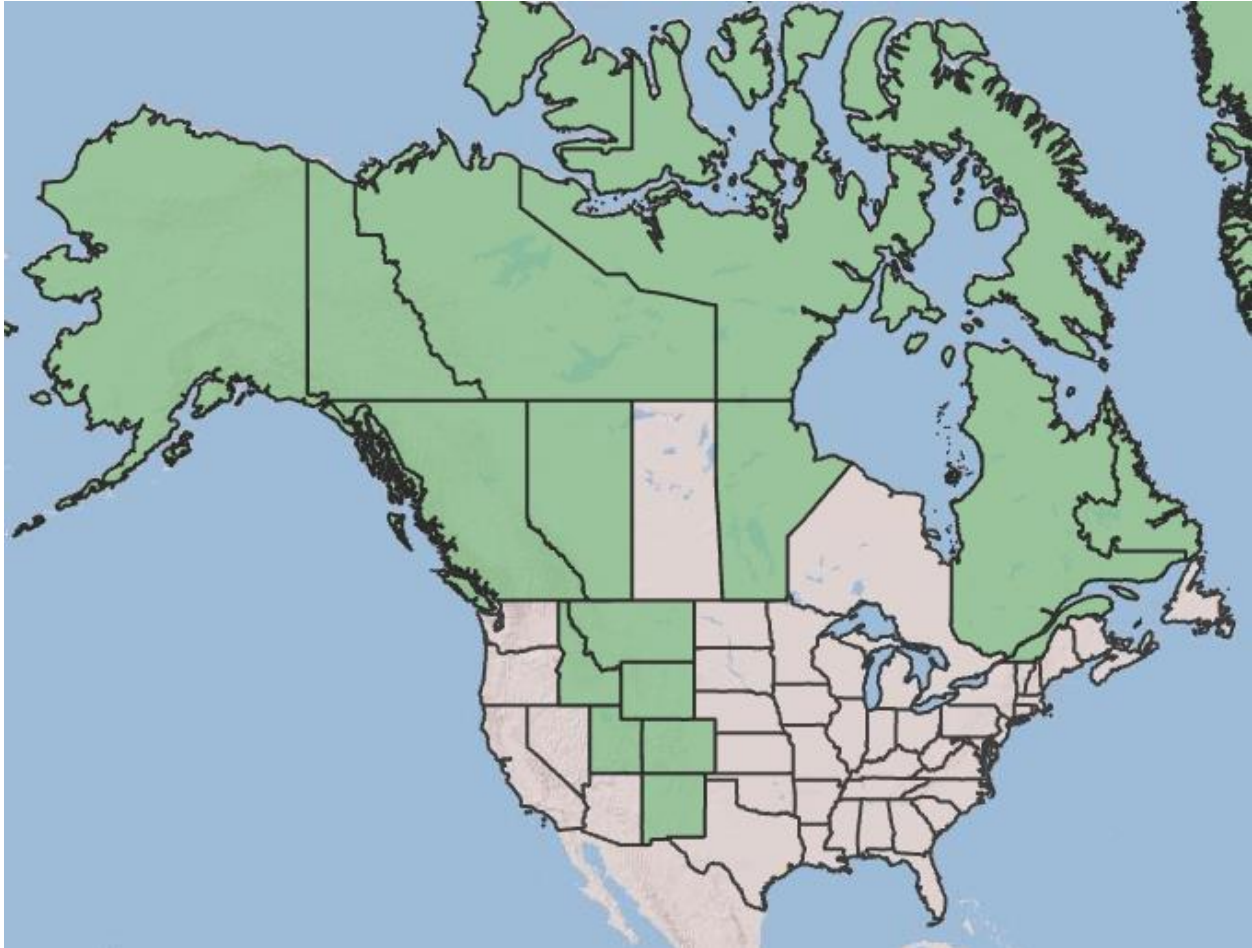


## Plant Propagation Protocol for *Campanula uniflora*

ESRM 412 – Native Plant Production


URL: <https://courses.washington.edu/esrm412/protocols/2024/CAUL2.pdf>



North American range of *Campanula uniflora*, shown in green. Image courtesy of USDA PLANTS Database.

TAXONOMY	
Plant Family	
Scientific Name	<i>Campanulaceae</i>
Common Name	Bellflower family, bluebell family [1] [3]
Species Scientific Name	
Scientific Name (A full scientific name consists of <i>Genus</i> , <i>epithet</i> , and authority- e.g., <i>Elymus glaucus</i> Buckley. Protocols are prepared for species, which may include multiple varieties, sub-species, and/or cultivars.)	<i>Campanula uniflora</i> L. [1]

Varieties (those varieties that are recognized in the USDA Plants database; report name and authority for each variety)	No reported varieties in the PLANTS database, nor recorded by U.S. Fish and Wildlife Service. [9]
Sub-species (those sub-species that are recognized in the USDA Plants database; report name and authority for each sub-species)	No reported subspecies in the PLANTS database, nor recorded by U.S. Fish and Wildlife Service. [9]
Cultivar	None found.
Common Synonym(s) (include full scientific names, including variety or subspecies information)	None found.
Common Name(s)	Arctic bellflower, arctic harebell, one-flowered harebell [1] [2] [5]
Species Code (as per USDA Plants database)	CAUN2 [1]
<b>GENERAL INFORMATION</b>	
Geographical range (distribution maps for North America and for the Pacific Northwest (generally available at county level for Washington/Oregon)	Found across the majority of Canada (excepting Saskatchewan and Ontario) as well as Alaska and into the United States in Idaho, Montana, Wyoming, Utah, Colorado, and New Mexico. [1] [2]
Ecological distribution (ecosystems it occurs in, etc)	Occurs primarily in alpine tundra, typically in serpentine or rocky soils high in the mountains. Can occur in moist or drier soils and in short grasslands such as meadows within mid-montane slopes. [1] [2] [3]
Climate and elevation range	Found in cool, low moisture climates at mid-montane elevations, ranging from 1,500 meters or higher in Alaska to 3,355-3965 across Canada. [2]
Local habitat and abundance (may include commonly associated species)	Generally found in alpine slopes with high levels of exposure, including ridges and cliffs. Prefers soil with a low level of loam or organic matter and high dominance of clay or silt. Frequently found near granite and basalt-derived sediments, as well as in previously riparian environments. Generally sparse, not forming clusters. [3]
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	Highly tolerant of stress from montane environments (cold temperatures, lower atmospheric oxygen, high wind, dry conditions) due to deep and strong rooting systems demonstrating a “receding” behavior of pulling into the ground while extending roots.

	<p>Perennial structure aids in energy conservation by not developing winter leaves. [3]  Commonly established within by <i>Pleospora herbarum</i>, which is a pathogenic fungus but not typically detrimental to <i>C. uniflora</i>'s fitness. [8]</p>
<p>Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc.)</p>	<p>Low-lying and perennial herbaceous subshrub reaching 5-10 cm tall. Extensive rooting system enables hardiness in harsh conditions, and aerial stems grow from root crown in multiple branches. Branches form erectly or decumbent. Leaves are primarily basal and annual, simple and 10-35 mm long, 2-8 mm wide. Leaves have a linear to lanceolate shape, attenuate base and acute to acuminate apex. Displays pinnate venation.  Bee pollinated.  Flowers are solitary and nodding, with 5-merous for green sepals and pale blue (with contrasting markings) petals. Non-spurred. Corolla is narrow and lobed. 5 stamens are free of the corolla with yellow anthers, ovary is inferior on 3 fused carpels. Fruits are black capsules with many seeds within, dehiscent. Plant largely glabrous. [3] [4] [7]</p>  <p>© Bruce Selyem</p> <p>Image courtesy of Montana Field Guide, 2008. [4]</p>

<b>PROPAGATION DETAILS: SEED</b> <b>University of Kentucky, 2002</b>	
Ecotype	Not specified.
Propagation Goal	Plants. [5]
Propagation Method	Grown from seed. [5]
Product Type	Plants were grown in containers (plugs). [5]
Stock Type	Not specified.
Time to Grow	Not specified.
Target Specifications	Not specified.
Propagule Collection Instructions	Not specified.
Propagule Processing/Propagule Characteristics	The protocol assumes that seed dormancy is equivalent to physiological dormancy, indicating that seeds kept in non-germinating-promoting conditions will remain in dormancy, increasing their longevity. [5]
Pre-Planting Propagule Treatments	Not specified.
Growing Area Preparation / Annual Practices for Perennial Crops	Not specified.
Establishment Phase Details	Not specified.
Length of Establishment Phase	Not specified.
Active Growth Phase	Not specified.
Length of Active Growth Phase	Not specified.
Hardening Phase	Not specified.
Length of Hardening Phase	Not specified.
Harvesting, Storage and Shipping	Not specified.
Length of Storage	Not specified.
Guidelines for Outplanting / Performance on Typical Sites	Not specified.
Other Comments	N/A
<b>PROPAGATION DETAILS: SEED</b> <b>Adapted from <i>Campanula scouleri</i> (USDA Dorena Genetic Resource Center, 2018)</b>	
Ecotype	Rogue River, Siskiyou National Forest, Oregon [6]
Propagation Goal	Plants. [6]
Propagation Method	From seed. [6]
Product Type	Plants are grown in containers (plugs).
Stock Type	262 mL (16 inch <sup>3</sup> ) containers. [6]
Time to Grow	14 weeks. [6]
Target Specifications	Plants expected to reach seedling stages with a firm root system in the plug. Given that <i>C. uniflora</i> relies heavily on its established root system, this should be a similar target. [6]
Propagule Collection Instructions	Not specified.

Propagule Processing/Propagule Characteristics	Not specified.
Pre-Planting Propagule Treatments	Seeds are deposited into medium plugs (Q-plugs) and sealed at cold (1-3 degrees C) for a 90-day cold stratification period, keeping moist throughout. In case of mold on the seeds or media, trays should be sprayed with 1% H <sub>2</sub> O <sub>2</sub> . [6]
Growing Area Preparation / Annual Practices for Perennial Crops	Seedlings are transplanted into main containers 3 weeks post-removal from stratification into a 40:20:20:20 peat/fir bark/perlite/pumice with fertilizer composite media with 1.5 g of Nutricote fertilizer per 262 mL of containers. [6]
Establishment Phase Details	Seedlings in containers are kept in greenhouse for growing over approximately two weeks, treated with 75-100 ppm calcium and magnesium for entire span of germination period. [6]
Length of Establishment Phase	2 weeks. [6]
Active Growth Phase	Plants are fast-growing, and continually dosed with soluble NPK fertilizers at 100-150 ppm weekly for entirety of the growing season. [6]
Length of Active Growth Phase	12 weeks. [6]
Hardening Phase	Plants are moved outdoors to induce hardening and acclimation to outdoor stressors such as wind and lower temperatures. [6] <i>C. scouleria</i> is generally lower in latitude than <i>C. uniflora</i> , and so the hardening phase may want to be extended in order to solidify the hardened tissues for alpine conditions versus low-montane elevations.
Length of Hardening	2 weeks [6] is advised for <i>C. scouleri</i> , but doubling it to 4 weeks may be better suited for <i>C. uniflora</i> as described above.
Harvesting, Storage and Shipping	Recommended to harvest in early October and outplanted quickly with little time spent in non-outdoor growing storage. Plants should be well-watered prior to packaging. [6]
Length of Storage	The protocol for <i>C. scouleri</i> indicates that long term storage is inoptimal for success in outplanting, but this runs counter to what should be inherent hardiness in <i>C. uniflora</i> due to its dense rooting system and low profile in the landscape. As such, it is likely that <i>C. uniflora</i> could be stored for at minimum 2-3 weeks, if not longer given sufficient watering and drainage.

Guidelines for Outplanting / Performance on Typical Sites	Plants should not be crowded close to one another, as in natural landscapes they are found sparsely and given ample room to establish a rhizosphere. Growth after outplanting should not be expected to be great, given the small size of the plant and the rapidness of the early growth phases. [10]
Other Comments	This species was chosen for adaptation of protocol due to its morphological similarity (isolated flowers, smaller size, typically found in rocky soils and harsh conditions) to <i>C. uniflora</i> , as well as its native range falling partially within the range of <i>C. uniflora</i> .
<b>INFORMATION SOURCES</b>	
References	See below.
Other Sources Consulted	N/A
Protocol Author	Rosemary Randall
Date Protocol Created or Updated	05/20/24

[1] United States Department of Agriculture Natural Resources Conservation Service. "Campanula Uniflora L." *USDA Plants Database*, plants.sc.egov.usda.gov/home/plantProfile?symbol=CAUN2. Accessed 22 May 2024.

[2] David L. Bleakly. "Campanula Uniflora (Arctic Harebell)." *New Mexico Rare Plants*, 1998, nmrareplants.unm.edu/node/394. Accessed 22 May 2024.

[3] Aiken, S.G., Dallwitz, M.J., Consaul, L.L., McJannet, C.L., Boles, R.L., Argus, G.W., Gillett, J.M., Scott, P.J., Elven, R., LeBlanc, M.C., Gillespie, L.J., Brysting, A.K., Solstad, H., and Harris, J.G. 2007. *Flora of the Canadian Arctic Archipelago: Descriptions, Illustrations, Identification, and Information Retrieval*. NRC Research Press, National Research Council of Canada, Ottawa. <http://nature.ca/aaflora/data>, accessed on 22 May 2024.

[4] Arctic Harebell — *Campanula uniflora*. *Montana Field Guide*. Montana Natural Heritage Program. Retrieved on May 22, 2024, from <https://FieldGuide.mt.gov/speciesDetail.aspx?elcode=PDCAM020Y0>

[5] Baskin, Jerry M.; Baskin, Carol C.. 2002. Propagation protocol for production of Container (plug) *Campanula uniflora* L. plants University of Kentucky Lexington, Kentucky. In: Native Plant Network. URL: <https://NativePlantNetwork.org> (accessed 2024/05/22). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources.

[6] Riley, Lee E.. 2018. Propagation protocol for production of Container (plug) *Campanula scouleri* Plants 262 ml (16 in3) container; USDA FS - Dorena Genetic Resource Center Cottage Grove, Oregon. In: Native Plant Network. URL: <https://NativePlantNetwork.org> (accessed

2024/05/22). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources.

[7] The University of Texas at Austin. "Campanula Uniflora." *Lady Bird Johnson Wildflower Center*, 5 Jan. 2023, [www.wildflower.org/plants/result.php?id\\_plant=CAUN2](http://www.wildflower.org/plants/result.php?id_plant=CAUN2).

[8] Wikipedia Authors. "Arctic Harebell." *Encyclopedia of Life*, [eol.org/pages/577809/articles](http://eol.org/pages/577809/articles). Accessed 22 May 2024.

[9] United States Fish and Wildlife Service. "Arctic Bellflower." *Explore the Taxonomic Tree*, [www.fws.gov/taxonomic-tree/13367](http://www.fws.gov/taxonomic-tree/13367). Accessed 22 May 2024.

[10] The University of Texas at Austin. "Campanula Uniflora (Gallery)." *Lady Bird Johnson Wildflower Center*, [www.wildflower.org/gallery/species.php?id\\_plant=CAUN2](http://www.wildflower.org/gallery/species.php?id_plant=CAUN2). Accessed 22 May 2024.