

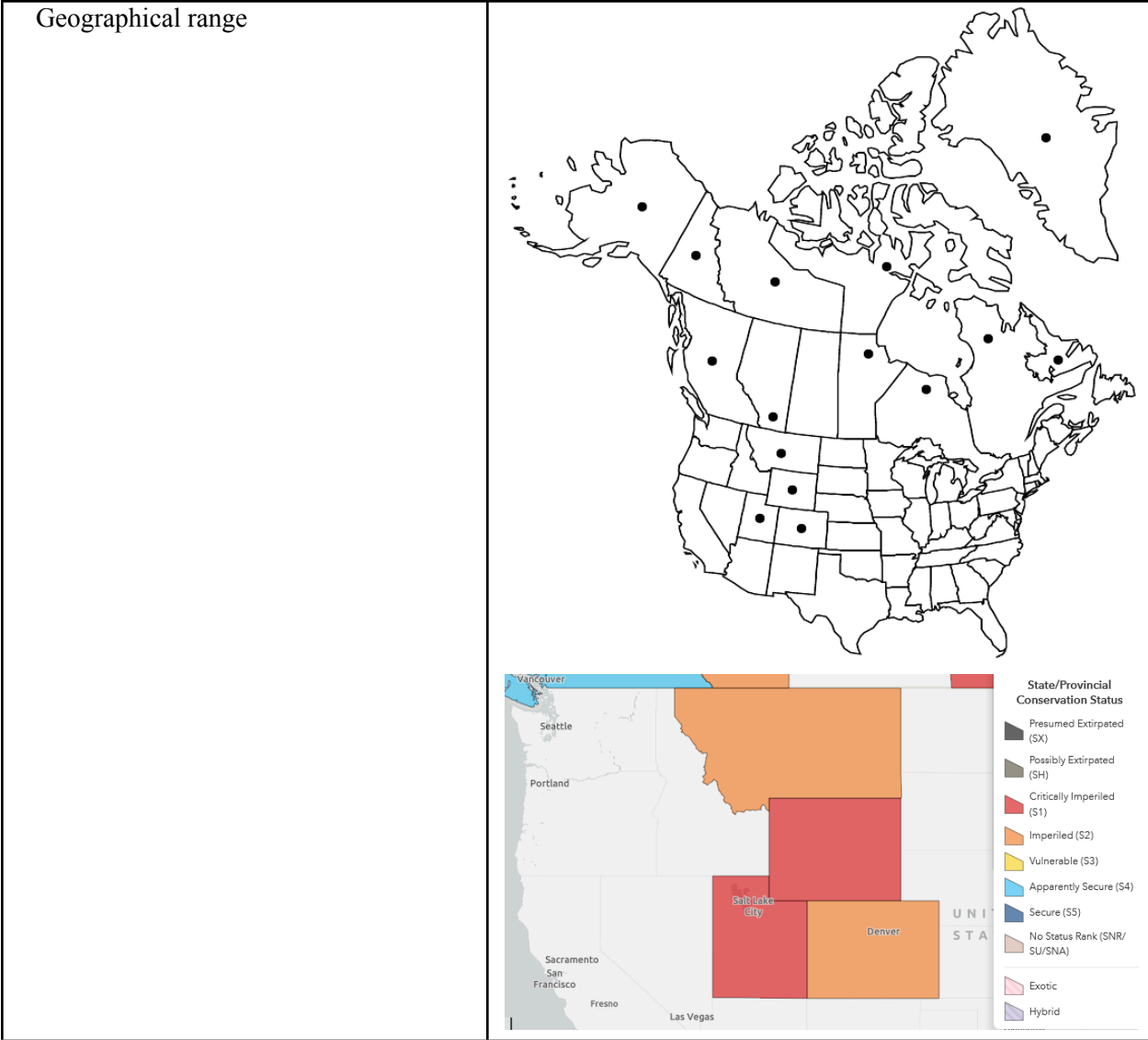


(10)

TAXONOMY	
Plant Family	—
Scientific Name	Polygonaceae (9)
Common Name	Knotweed, smartweed, dock, sorrel, or buckwheat family (9)
Species Scientific Name	—
Scientific Name	<i>Koenigia islandica</i> L. (1)(11)
Varieties	n/a

Sub-species	n/a
Cultivar	n/a
Common Synonym(s)	<i>Macounastrum islandicum</i> ; Island knotweed, island purslane, iceland purslane; Dvergsyre (Norwegian) (10)(11)(8)
Common Name(s)	Island Koenigia (9)
Species Code (as per USDA Plants database)	KOIS (11)

GENERAL INFORMATION



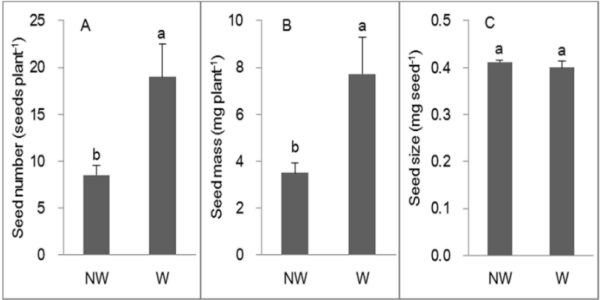
	Circumpolar, extending south in North America to scattered alpine summits in the Rocky Mountains as far south as Colorado. (7)(9)(12)																																																																																																		
Ecological distribution	<p>Inhabits arctic tundra and alpine meadows with permanently moist gravel, especially around persistent snow patches near streams, ponds, and lakes. Its northern circumpolar distribution extends into several temperate mountain ranges. Found in cold, wet bogs, often underlain by permafrost. May be found growing on wet gravel or sand or between wet mosses. At higher elevation, it can be found in a variety of different snow-bed communities, often associated with hygrophilous mosses. Its distribution is limited by its sensitivity to high temperatures. Wyoming populations are in alpine fens, late snowmelt basins, margins of alpine lakes and ponds, and in wet gravelly soils along alpine rivulets. (1)(4)(10)</p>																																																																																																		
Climate and elevation range	<p>Found anywhere from ~10m to ~3600 m above sea level depending on the variety, alpine or arctic.</p> <p>Prefers areas where heavier snow accumulation melt did not occur until early July, around 0°C at night to 15°-20°C during the day. Spring snowmelt provides a large initial water supply. Small, shallow root systems impede growth on windward slopes or ridgetops.</p> <p>Grows well at 27°C while controlled heat treatment at 40°C for 2 hours did no damage to the plants. Raising the temperature for 6 hours to 45°C about one-third of the plants died.</p> <p>Plants in the field are normally exposed to direct sunlight for many hours on clear days.</p> <p>Table 1. Environmental characteristics of the sites of the <i>Koenigia islandica</i> populations.</p> <table border="1" data-bbox="737 1499 1414 1818"> <thead> <tr> <th>Population name</th> <th>Svalbard</th> <th>Iqaluit</th> <th>Dovre</th> <th>Yukon</th> <th>Jasper</th> <th>Colorado</th> </tr> </thead> <tbody> <tr> <td>Country</td> <td>Norway</td> <td>Canada</td> <td>Norway</td> <td>Canada</td> <td>Canada</td> <td>USA</td> </tr> <tr> <td>Latitude</td> <td>78°14'N</td> <td>63°44'N</td> <td>62°18'N</td> <td>61°10'N</td> <td>52°49'N</td> <td>~40°N</td> </tr> <tr> <td>Longitude</td> <td>15°35'E</td> <td>68°34'W</td> <td>9°36'E</td> <td>138°25'W</td> <td>118°08'W</td> <td>~105°42'W</td> </tr> <tr> <td>Population category</td> <td>(high) arctic</td> <td>arctic</td> <td>high latitude</td> <td>high latitude</td> <td>alpine</td> <td>alpine</td> </tr> <tr> <td>Elevation (m a.s.l.)</td> <td>10</td> <td>15</td> <td>900</td> <td>783</td> <td>2300</td> <td>~3650</td> </tr> <tr> <td>Max. photop. (h)</td> <td>24</td> <td>20.83</td> <td>19.91</td> <td>19.35</td> <td>16.9</td> <td>15</td> </tr> <tr> <td>Mean annual temperature (°C)</td> <td>-6.7^a</td> <td>-9.8^b</td> <td>-0.1^c</td> <td>-3.8^d</td> <td>-^e</td> <td>-3.71^f</td> </tr> <tr> <td>Mean summer temp. (Jun-Aug, °C)</td> <td>4.2^a</td> <td>6.03^b</td> <td>9.1^c</td> <td>11.4^d</td> <td>7.53^e</td> <td>6.63^f</td> </tr> <tr> <td>Extreme maximum summer temp. (°C)</td> <td>21.3^a</td> <td>25.8^b</td> <td>26.8^c</td> <td>31.7^d</td> <td>29^e</td> <td>19^f</td> </tr> <tr> <td>Mean January temp.</td> <td>-15.3^a</td> <td>-26.6^b</td> <td>-8.8^c</td> <td>-22^d</td> <td>-</td> <td>-13.15^f</td> </tr> <tr> <td>Extreme minimum winter temp. (°C)</td> <td>-46.3^a</td> <td>-45.6^b</td> <td>-32.4^c</td> <td>-55^d</td> <td>-</td> <td>-37^f</td> </tr> <tr> <td>Mean annual precipitation (mm)</td> <td>190^a</td> <td>412.1^b</td> <td>435^c</td> <td>279.7^d</td> <td>-</td> <td>930^f</td> </tr> <tr> <td>Days without snow cover</td> <td>127^a</td> <td>117.7^b</td> <td>161.6^c</td> <td>188.2^d</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>(1)(3)(4)</p>	Population name	Svalbard	Iqaluit	Dovre	Yukon	Jasper	Colorado	Country	Norway	Canada	Norway	Canada	Canada	USA	Latitude	78°14'N	63°44'N	62°18'N	61°10'N	52°49'N	~40°N	Longitude	15°35'E	68°34'W	9°36'E	138°25'W	118°08'W	~105°42'W	Population category	(high) arctic	arctic	high latitude	high latitude	alpine	alpine	Elevation (m a.s.l.)	10	15	900	783	2300	~3650	Max. photop. (h)	24	20.83	19.91	19.35	16.9	15	Mean annual temperature (°C)	-6.7 ^a	-9.8 ^b	-0.1 ^c	-3.8 ^d	- ^e	-3.71 ^f	Mean summer temp. (Jun-Aug, °C)	4.2 ^a	6.03 ^b	9.1 ^c	11.4 ^d	7.53 ^e	6.63 ^f	Extreme maximum summer temp. (°C)	21.3 ^a	25.8 ^b	26.8 ^c	31.7 ^d	29 ^e	19 ^f	Mean January temp.	-15.3 ^a	-26.6 ^b	-8.8 ^c	-22 ^d	-	-13.15 ^f	Extreme minimum winter temp. (°C)	-46.3 ^a	-45.6 ^b	-32.4 ^c	-55 ^d	-	-37 ^f	Mean annual precipitation (mm)	190 ^a	412.1 ^b	435 ^c	279.7 ^d	-	930 ^f	Days without snow cover	127 ^a	117.7 ^b	161.6 ^c	188.2 ^d	-	-
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Local habitat and abundance	<i>Polygonum douglasii</i> ; <i>Polygonum confertiflorum</i> ; <i>Deschampsia caespitosa</i> ; <i>Caltha leptosepala</i> ; <i>Carex spp.</i> ; <i>Bryum arcticum</i> ; <i>Drepanocladus uncinatus</i> ; (1)
Plant strategy type / successional stage	<p>Due to accumulated seed banks, it is an opportunist that easily occupies patches with open, fine-grained substrates where and whenever they appear. It is indifferent as to soil pH.</p> <p>The early production of flowers after only one or several leaves have been produced. This allows plants to produce seeds in a very short growing season. Plants continue to produce both new leaves and flowers as the season continues. This mixed rather than deterministic pattern of growth allows plants to increase both photosynthetic and reproductive capacity and to take advantage of the short growing window.</p> <p>Alpine annuals put their photosynthate into aboveground parts to increase photosynthetic capacity and to reproduce sooner. Growing in areas with a good initial water supply permits this plant to mature with a small investment in roots. (1)(8)</p>
Plant characteristics	<p>Annual, tap-rooted herb which are 1-3 cm tall with delicate, shallow root systems. One to 15 flowers are produced in a small cluster surrounded by the first four leaves. Under favorable conditions, plants will branch and produce several flower clusters. As the season progresses, the same number of flowers are produced in each leaf axil, but leaves are progressively smaller, and finally are no larger than the seeds. This plant is self compatible and has mostly cleistogamous, self-pollinating flowers.</p> <p>Its success is attributed to its conservative seedbanking strategy, tininess and rapid development, low temperature optima for growth and reproduction, and daylength indifference to flowering.</p> <p>Plants are 1-8 cm tall. Stems are often reddish, branched or simple, rooting adventitiously from proximal nodes. Leaves are opposite, fused at base with a 0.5-1 mm sheath surrounding the stem, with an up to 1 mm long and pale brown continuation of the sheath above the petioles. Leaves 0.5–2 mm, the lower ones with a short petiole</p>

	0.2–0.5 mm, blade 1–3 × 0.5–1.5 mm, obovate, oblong or elliptic. Flowers are radially symmetric, bisexual, with a perianth of 3 tepals. Tepals 0.6–0.9 × 0.4–0.6 mm, oblong, yellowish green, white or pink. Stamens 3 + 3 staminodia (reduced, non-functional). Gynoecium of 3 fused carpels with one seed. Fruit is an trigonous achene 1-1.8 × 0.7-0.8 mm, dull and among the smallest of terrestrial flowering plants and one of few annual species in arctic and alpine floras. Sexual reproduction by seed; no vegetative reproduction; self-pollinated. Fruits are spread by surface water and birds. (1)(5)(6)(7)(8)
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PROPAGATION DETAILS

Ecotype	n/a
Propagation Goal	seeds
Propagation Method	seeds
Product Type	seeds
Stock Type	n/a
Time to Grow	The time from germination to seed ranged from 45 to 50 days. (1)
Target Specifications	n/a
Propagule Collection Instructions	Plants grew significantly larger and produced more seeds at daytime temperatures of 15°C in growth experiments. (1)
Propagule Processing/Propagule Characteristics	Plants grown at 15° C produced more seeds at each harvest than did those grown at 25° C. Light strongly promoted germination in seeds, whereas stratification did not decrease their light requirement.

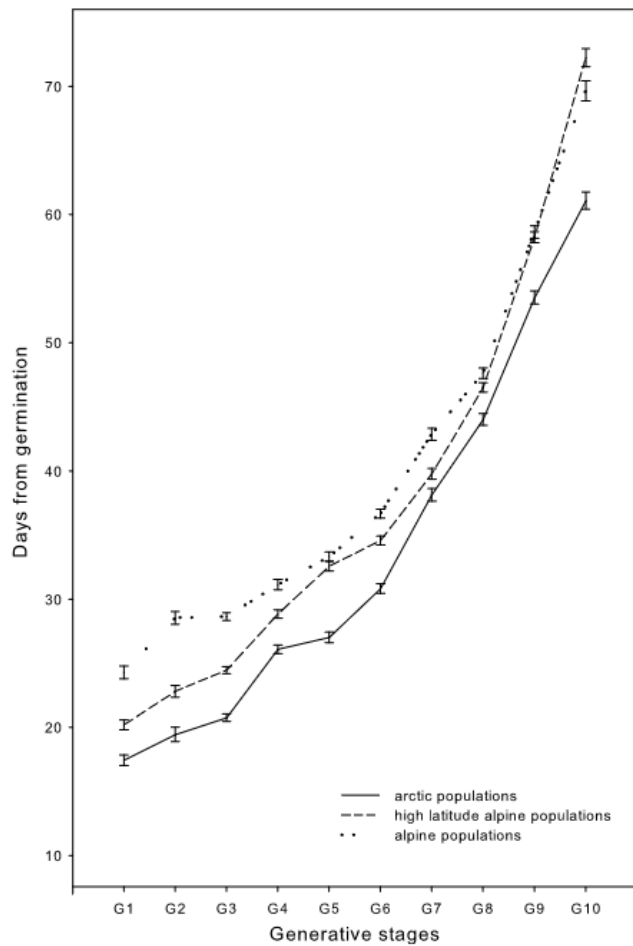
	<p>The 100 seed weight of seeds was found to be 43 mg.</p>  <p>Fig. 5. Differences of seed number per plant (A), seed mass per plant (B) and seed size (C). Different letters mean difference at 0.05 level. NW: no-warming; W: warming.</p>
<p>Pre-Planting Propagule Treatments</p>	<p>(1)(2)(5)(6)</p> <p>After collection, the seeds may be dried at room temperature and stored for 2-3 months at 18°C until further use. A study had used seeds that had been previously stored for 23 years at -22°C before being propagated through a full generation.</p> <p>Seeds germinated equally well in light and dark. Stratification is not fully necessary, although it increases germination percentages. Seeds germinated without any stratification, but about twice as many germinated after 2 mo of cold stratification (stratification at 3° C in the dark, 40% of the seeds germinated).</p> <p>Unabraded seeds germinated poorly at temperatures up to 18° C, with an optimum at 24° C (89% in 10 days). Scarified seeds germinated rapidly, and reached 100% germination in 3 days at 21° C. The seeds had no light requirement for germination, nor did fluctuating temperatures improve germination. (1)(5)(6)</p>
<p>Growing Area Preparation / Annual Practices for Perennial Crops</p>	<p>Plant’s photosynthetic temperature optimum 27° C.</p> <p>Scarified seeds were sown directly in 12 cm plastic pots in a peat-based standard potting compost at 7-8 seeds per pot, and placed at 21° C in natural daylight compartments of a phytotron. (1)(6)</p>
<p>Establishment Phase Details</p>	<p>Field-collected seeds in one study were germinated in “SG-30 Enconair” germination chambers under long day photoperiod (15:9) at 24° C day and 17° C night temperatures on wet filter paper in petri dishes. The resulting seedlings were transplanted to pots in a 1:8 mixture of sand and peat-based standard growing medium and grown in “Enconair GC-40” growth chambers. The seeds were harvested, dried at room temperature and</p>

stored for up to 2 years at -18°C until further use. (5)

Length of Establishment Phase

Table 2. Phenological stages of *Koenigia islandica* individuals.

Vegetative stages	Generative stages
0 – cotyledons only	0 – no buds/flowers
1 – 1st leaf	1 – 1st buds visible
2 – 1st pair of leaves	2 – buds just before opening
3 – 2nd pair of leaves	3 – 1–30% of flowers open
4 – 3rd pair of leaves	4 – 31–60% of flowers open
5 – 1st branch	5 – full flowering
6 – 2nd branch	6 – flowers wilted
7 – 1–30% of leaves dry	7 – 1st achenes visible
8 – 31–60% of leaves dry	8 – achenes mostly green
9 – 61–99% of leaves dry	9 – achenes mostly brown
10 – plants dead	10 – achenes fully ripe and dispersing



(3)

Active Growth Phase

Dry matter production was optimal at 12° C in both short day and long day conditions. (6)

Length of Active Growth Phase	Plants require at least a 5-6 week snow-free period to mature. Daylength had no significant effect on flowering. Plants are able to develop very fast and reached anthesis 30 d from germination. A separate batch of plants grown at 15° C receiving the full summer light integral, flowered after 24 days only and had ripe seeds 12 days later. (1)(6)
Hardening Phase	n/a
Length of Hardening Phase	n/a
Harvesting, Storage and Shipping	n/a
Length of Storage	n/a
Guidelines for Outplanting / Performance on Typical Sites	Seed into soil whose temperature at depths of 2-7 cm drop to near 0° C at night, while during the day, they usually reached 20° C at 2 cm and above 10° C at 7 cm. Remember that a particular site that is suitable in one year for growth of these species may be too dry in low snow years or may not melt out early enough in high snow years. With small seed banks and limited dispersal, this annual species must reproduce at a site nearly every year to persist. (1)
Other Comments	Small specimens of <i>Epilobium alpinum</i> may be mistaken for <i>K. islandica</i> , but the former has leaves with a more prominent midvein, and the flowers have a linear ovary. (9)
INFORMATION SOURCES	
References	See below
Other Sources Consulted	n/a
Protocol Author	Sean Flory
Date Protocol Created or Updated	05/26/25

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