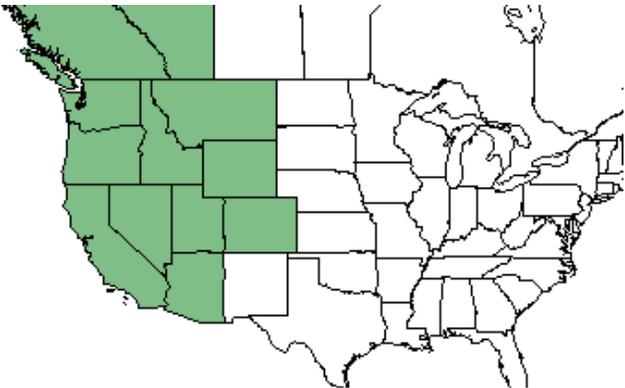


Plant Propagation Protocol for *Lewisia rediviva*

ESRM 412 – Native Plant Production

Protocol URL: <https://courses.washington.edu/esrm412/protocols/LERE7.pdf>

TAXONOMY	
Plant Family	
Scientific Name	Portulacaceae (Montiaceae)
Common Name	Purslane Family
Species Scientific Name	
Scientific Name	<i>Lewisia rediviva</i> Pursh ¹
Varieties	<i>Lewisia rediviva</i> Pursh var. <i>minor</i> (Rydb.) Munz ¹ <i>Lewisia rediviva</i> Pursh var. <i>rediviva</i> ¹
Sub-species	
Cultivar	
Common Synonym(s)	<i>Lewisia minor</i> Rydberg ¹ <i>Lewisia rediviva</i> Pursh subsp. <i>minor</i> (Rydb.) A.H. Holmgren ¹
Common Name(s)	Bitterroot ² , Oregon Bitterroot ³ , Rock Rose ⁴ , Redhead Louisa ⁵
Species Code (as per USDA Plants database)	LERE7 ¹
GENERAL INFORMATION	
Geographical range	<p>North American Distribution</p>  <p>Distribution in Washington State</p> 

Ecological distribution	Open gravelly and rocky areas from sagebrush plains to moderate elevations in the mountains. ² Along rocky ridges and in the thin soils of basalt flats. ⁴ Most common in intermontane grassland communities of Western states, but also found in dry shrub, woodland, and forest communities as well. ⁵
Climate and elevation range	Commonly found in dry western climates where the majority of precipitation is in cooler, winter months, and soil desiccation in summer is common. ⁵ Dry, open sites; foothills to subalpine. ⁶ Commonly found from 2500 to 6000 ft. ⁵ To 9800 ft (Mt. Grant in Mineral County, Nevada). ⁷
Local habitat and abundance	Located east of the Cascade crest in Washington. ² In the palouse prairies of eastern Washington, commonly associated with <i>Festuca idahoensis</i> , <i>Poa secunda</i> , <i>Pseudoroegneria spicata</i> , <i>Pascopyrum smithii</i> , <i>Senecio canus</i> , <i>Lomatium</i> spp., <i>Eriogonum ovalifolium</i> , et al. ⁵
Plant strategy type / successional stage	Primary successional species. Generally found in initial communities, or early in secondary successional communities. ⁵ Extremely tolerant of summer drought. Intolerant of summer precipitation. ⁶
Plant characteristics	Perennial forb ¹ with a thick, branched taproot (up to 12.8 cm long ⁵) and short, simple or branched stems, 1-3 cm tall. Numerous basal, succulent leaves, withering before flowering in late May to early July. Single oversized white to pink flowers followed by 6-20 rounded, shiny, dark brown seeds, 2mm wide. ⁸
PROPAGATION DETAILS	
Ecotype	
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	Container Seedling
Time to Grow	Flowering first occurs in the second year or later, with optimum flowering occurring within the third to fourth year. ⁷ Two years. Plants are not expected to flower until year 3 or 4. ⁹
Target Specifications	Height: 6 true leaves, 5 cm. ⁹ Root System: developed taproot in container. ⁹
Propagule Collection Instructions	Flowering typically occurs between late May and early July, with peak flowering occurring in mid-June. ⁷ Seeds ripen in 2-3 weeks, after which the disseminule, which contains the seeds, separates from the plant.

	<p>Seeds are thought to be wind-dispersed, as this capsule is quite light. The plant can produce up to 60 or 70 seeds per flower, but will often produce much less.⁷ Seeds are collected mid-summer when the disseminule breaks away from the stem. Seeds are shiny and black at maturity.⁹</p>
Propagule Processing/Propagule Characteristics	<p>Bitterroot seeds remain viable for many years.⁷ Seed storage is at least 5 years under cool, dry conditions.⁹</p>
Pre-Planting Propagule Treatments	<p>Seeds exhibit physiological dormancy.⁹ 5% of seeds will germinate without stratification. A cold-stratification period for up to 90 days, with temperatures just above freezing, can increase germination up to 100%.⁷ Spring planting of unstratified seed almost invariably results in failure.⁷ Seeds are imbibed with water, rolled in moistened paper towels, placed in an open zip-loc bag, and then held in a refrigerator at 1-3C for 60-90 days.⁹</p>
Growing Area Preparation / Annual Practices for Perennial Crops	<p>Sow thinly on the surface of 50:50 peat and gritty sand, covered with sharp grit.¹⁰ Sow seed directly into 6:1:1 milled sphagnum peat moss, perlite, and vermiculite with Osmocote controlled release fertilizer (13N:13P2O5:13K2O; 8 to 9 month release rate at 21C) and Micromax fertilizer (12%S, 0.1%B, 0.5%Cu, 12%Fe, 2.5%Mn, 0.05%Mo, 1%Zn) at the rate of 1 gram of Osmocote and 0.20 gram of Micromax per 172 ml container. Cover seeds with media.⁹</p>
Establishment Phase Details	<p>Seed can be planted outdoors in the fall without protection. Seedlings seem to be completely hardy.⁷ Seed should be sown in Autumn whenever possible. They can be left outside and can withstand temperatures as low as -5C, but freezing for long periods once the seed is wet can kill them.¹⁰ Seed sown after the new year normally takes a year to germinate, whereas fall-sown seed usually germinates that winter. Be wary of freeze-thaw cycles, which can lift the small root system and inhibit growth.¹⁰ An English grower suggests the removal of seed coats as the seed leaves thrust upward.⁷ Containers are filled and sown in fall, watered thoroughly, and left outdoors. Seedlings germinate in spring under fluctuating outdoor temperatures, generally between 1-10C.⁹</p>
Length of Establishment Phase	<p>6 weeks. Seedlings emerge 14 days after sowing. True</p>

	leaves appear 3 weeks after germination. ⁹
Active Growth Phase	Plants grow predominantly during cool spring and early summer temperatures. Seedlings are fertilized with 10-20-10 NPK liquid fertilizer during active growth, and allowed to dry down between waterings. ⁹
Length of Active Growth Phase	6 weeks in summer and 4 weeks in fall. ⁹
Hardening Phase	Plants are susceptible to overwatering during dormancy, and should remain dry during summer months. In late September, leaves reemerge and plants are regularly watered and fertilized with 10-20-10 liquid NPK at 200ppm for 6-8 weeks, until snowfall. ⁹
Length of Hardening Phase	8 weeks. ⁹
Harvesting, Storage and Shipping	Two to three years to harvest. Plants are harvested in July or August. ⁹
Length of Storage	Overwinter in outdoor nursery under insulating foam and snow. Can be stored for 5 months. ⁹
Guidelines for Outplanting / Performance on Typical Sites	<p>Cultivating bitterroot in Western Washington can in rare cases, be made possible, by absolutely perfect drainage. Generally speaking, bitterroot is “unadaptable to cultivation” in this area.⁷</p> <p>Temperature extremes have little or no effect, but summer moisture can be fatal.⁷</p> <p>General consensus is that crown rot is the most common cause of death, and that crowns should rest on scree, never soil. Root media should be deep with excellent drainage (aeration). Plant in steeply angled beds.⁷</p> <p>Fertilizer must be applied to plants in rock gardens or pots, particularly if the plants are not repotted frequently.⁷</p> <p>A fertilizer low in nitrogen should be used.¹⁰</p> <p>Light watering throughout the growing period, and perhaps a light feeding of dry manure in the fall will encourage the leaves to persist through flowering.⁷</p> <p>Growing bitterroot slowly, in good clay pots, for the first three years is critical. If they survive this they may live up to 20 years.¹⁰</p> <p>Plant in a raised bed of gritty soil, retained by surface stones, on a rather steep north or northwest-facing slope. A cool root-run and avoiding midday summer sun are keys to successful cultivation.¹¹</p> <p>Westside gardeners have successfully cultivated <i>Lewisia rediviva</i> in containers or the rock garden by providing sharp drainage, winter protection, and a “spell of baking-out dormancy” during summer.¹²</p>
Other Comments	Pursh published the original description of this plant

	from six specimens collected by Meriwether Lewis in Montana, 1806. A year later, the specimens were showing signs of life, and the roots and crowns were separated from the flowers and replanted. The flowers are all that remain of Lewis' original specimen. The specific epithet means 'restored to life', and was chosen by Pursh for the plant's apparent ability to survive being turned into a herbarium specimen. ^{7,10}
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PROPAGATION DETAILS

Ecotype	
Propagation Goal	Plants
Propagation Method	Vegetative
Product Type	Bareroot (field grown)
Stock Type	
Time to Grow	
Target Specifications	
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	A notch is cut in the rim of the caudex in the spring, which ideally leads to the development of a growing point at each notch. A year later, the caudex and root are cut lengthwise each growing point is planted out separately. ⁷
Pre-Planting Propagule Treatments	The Salish-Kootenai replant the root crown, cut from the harvested root, into the hole that the root was dug from. ⁷
Growing Area Preparation / Annual Practices for Perennial Crops	
Establishment Phase Details	
Length of Establishment Phase	
Active Growth Phase	
Length of Active Growth Phase	
Hardening Phase	
Length of Hardening Phase	
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	
Other Comments	

INFORMATION SOURCES

References	see below
Other Sources Consulted	
Protocol Author	Kelly Broadlick
Date Protocol Created or Updated	4/26/2015



Species

Bitterroot, *Lewisia rediviva*

Range

L. rediviva occurs in gravelly to dry soils, from sagebrush plains to lower elevations in the mountains; from southern B.C. to southeast Alberta, east of the Cascades in Washington and Oregon south to California; east to Idaho, Montana, Wyoming, Colorado, Utah, Nevada, and Arizona.(1)

Climate, elevation

L. rediviva grows in a wide range of climates and can be found from 60 to 3000 m (2)

Local occurrence

L. rediviva occurs all along the east side of the cascades (3)

Habitat preferences

Gravelly to dry, heavy soil, commonly on lithosol, from sagebrush plains to mid-elevations in the mountains (3)

Plant strategy type/successional stage

L. rediviva is a late successional strategy type and it takes up too 3 or 4 years to produce viable seeds. (2)

Associated species

Springbeauty, minerslettuce, purslane, talinopsis, pussypaws (2)

May be collected as:

Seed

Collection restrictions or guidelines

Seeds are collected in mid summer when the corolla turns papery and the disseminule breaks away from the stem. Seeds are shiny black at maturity.(1)

Seed germination

Seed dormancy is classified as physiological dormancy 60 to 90 day cold moist stratification. Germination occurs in early spring at temperatures slightly above freezing to 10c (1)

Seed life

Seed storage is at least 5 years under cool, dry conditions(1)

Recommended seed storage conditions

Cool dry conditions in a paper bag until planting time (2)

Propagation recommendations

Conetainers are filled and sown in late fall and irrigated thoroughly prior to winter stratification. Seedlings germinate in spring under fluctuating outdoor temperatures and are grown under full sun exposure. Plants are fertilized in the fall, pots are flushed with water, and irrigation frequency is gradually reduced in June through October. (1) The plant becomes dormant during the hot months and is prone to being overwatered during this period (2)

Soil or medium requirements

Growing media used is 6:1:1 milled spagnum peat, perlite, and vermiculite (1)

L. rediviva grows in a wide range of soils from shale, clay, sand, granite, serpentine, and talus (2)

Installation form

Seed

Recommended planting density

During the third or fourth year when the plants are dormant out-plant the plants in full sun in a well drained soil. Plant the plants 4-6 inches apart and don't add any water, wait for the rains to come. (2)

Care requirements after installed

Weed periodically as the plants need full sun. (2)

Normal rate of growth or spread; lifespan

Plant is mature within 3-4 years, the lifespan is not reported.

Sources cited

1. DeSanto, Jerry; Luna, Tara; Evans, Jeff; Wick, Dale. 2004. Propagation protocol for production of container *Lewisia rediviva* Pursh plants (116 ml containers); Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 17 May 2005). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.
2. USDA, NRCS. 2004. The PLANTS Database, Version 3.5 (<http://plants.usda.gov>). [National Plant Data Center](#), Baton Rouge, LA 70874-4490 USA.
3. Burke Museum of Natural History and Culture 5/15/05 (<http://www.washington.edu/burkemuseum/collections/herbarium/index.php>)

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