Plant Propagation Protocol for *Polemonium carneum*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/*[USDASpeciesCode.pdf]*

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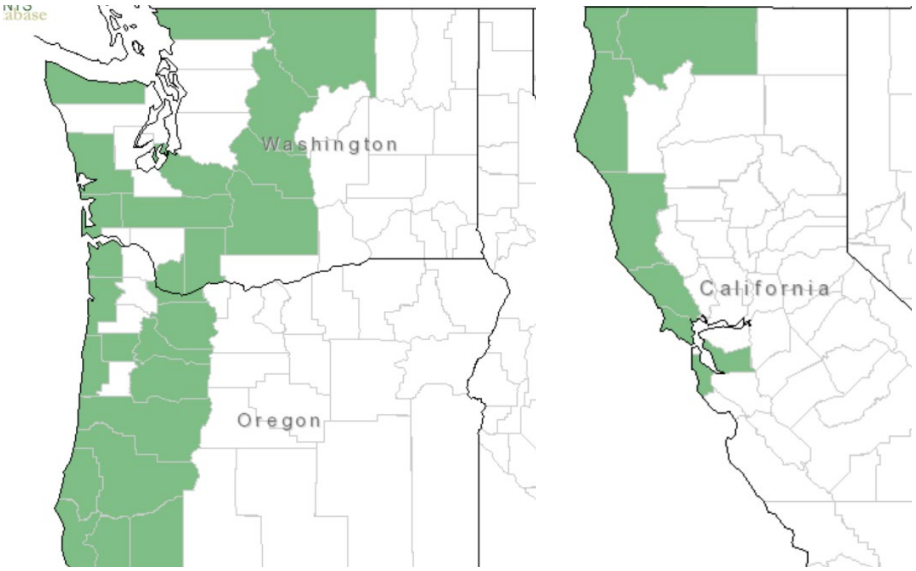

Distribution through WA, OR, CA[1]

TAXONOMY	
Plant Family	
Scientific Name	Polemoniaceae
Common Name	Phlox Family
Species Scientific Name	
Scientific Name	*Polemonium carneum* A. Gray[1]
Varieties	None
Sub-species	luteum A. Gray[1]

Cultivar	None
Common Synonym(s)	Polemonium carneum A. Gray ssp. luteum (A. Gray) Brand[1]
Common Name(s)	Royal Jacob's-ladder, great polemonium, salmon polemonium[7]
Species Code (as per USDA Plants database)	POCA4[1]
GENERAL INFORMATION	
Geographical range	Native to NW United States: W. of the Cascade Range in WA south to San Francisco Bay Area in CA.[1] See maps above for distribution through WA, OR, CA.
Ecological distribution	Woody thickets, moist open forests, meadows, edges of prairies, roadsides[5], coastal[10]
Climate and elevation range	Moist to dry, <1800 m. elevation[2] (sea level to mid elevations)[3] (50-600m in WA)[5]
Local habitat and abundance	Low water, full sun to part shade, rich moisture retentive soil, adaptable to heavy clay soils.[4] Damp, humus-like soil. Associated Species: *Pseudotsuga menziesii, Alnus rubra, Acer macrophyllum, Symphoricarpos albus, Carex spp. Marah oreganus, Rubus spp., Rosa spp., Polystichum munitum, Pteridium aquilinum, Iris tenax, Aquilegia Formosa, Eriophyllum lanatum, Campanula scouleri, Penstemon serrulatus.*[5]
Plant strategy type / successional stage	Hardiness zone 6a -5º to -10ºF[4]
Plant characteristics	Herbaceous perennial, rhizomatous, loosely clustered stems[7] Leaves: cauline, smaller upward, leaflets 7-21, lanceolate to ovate Inflorescence: cauline, 4-11 flowered Flower: calyx 8-10mm, acute; corolla rotate to bell-shaped, white to pale pink (rarely purple) Fruit: 4-8 mm, 3-6 mm wide Seed: dark brown to black[2]
PROPAGATION DETAILS * indicates reference to other species of Polemonium (species listed)	
Ecotype	No information available
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)[6]
Stock Type	*160-172 ml container[8,9] (range from viscosum and pulcherrimum species protocol)
Time to Grow	Weeks[6]

Target Specifications	Well-developed crowns, roots and rhizomes filling soil profile in container.[6]
Propagule Collection Instructions	*Seeds are collected in late June/early July when capsules turn brown and begin to dehisce. Seeds are black at maturity. Seeds are collected in paper bags and kept in a well ventilated drying shed prior to cleaning (P. pulcherrimum)[9] *Collect mature capsules in late August when they begin to split and turn tan in color. Seeds are black at maturity. Seeds are collected in paper bags and kept in a well ventilated drying shed prior to cleaning (P. viscosum)[8]
Propagule Processing/Propagule Characteristics	*Seeds are cleaned with a hammermill and 1/16" screen. Seed longevity is unknown. Seed dormancy is classified as physiological dormancy. Seeds/Kg: 704,000/kg % Purity: 100% % Germination: 75% (P. pulcherrimum)[9] *Seeds are hand cleaned at the nursery. Seed longevity is unknown. Seed dormancy is classified as physiological dormancy. Seeds/Kg: 2,300,000/kg % Purity: 100% % Germination: N/A (P. viscosum)[8]
Pre-Planting Propagule Treatments	Germination best facilitated by 80 days of cool (38 ºF)/moist stratification. [6]
Growing Area Preparation / Annual Practices for Perennial Crops	*Greenhouse and outdoor nursery growing facility. Sowing Method: Direct Seeding. Seeds are covered with media (P. pulcherrimum)[9], (P. viscosum)[8] *Growing media used is 6:1:1 milled sphagnum peat, 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 conetainer. Greenhouse temperatures are maintained at 21 to 25C during the day and 16 to 18C at night. Seedlings are hand watered and remain in greenhouse until mid May. Seedlings are then moved to outdoor nursery for the

	remainder of the growing season. Seedlings are irrigated with Rainbird automatic irrigation system in early morning until containers are thoroughly leached. Average growing season of nursery is from late April after snowmelt until October 15th (P. pulcherrimum)[9] *Growing medium used is 1:1:1 mix of sand:gravel:promix with the addition of lime. 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. Seedlings are irrigated with Rainbird automatic irrigation system in early morning until containers are thoroughly leached. Average growing season of nursery is from late April after snowmelt until October 15th (P. viscosum)[8]
Establishment Phase Details	*Seedlings emerge 8 days after sowing. Germination was uniform (P. pulcherrimum)[9] *Medium is kept slightly moist during germination. Seeds germinated over a 3 week period during spring under fluctuating temperatures. True leaves appeared 2 weeks after germination. This species produces a long and extensive taproot shortly after germination. After seedlings are established, it is important to allow them to dry down betweeen irrigations (P. viscosum)[8]
Length of Establishment Phase	*8 days (P. pulcherrimum)[9], 4 weeks (P. viscosum)[8]
Active Growth Phase	*Plants were root tight 12 weeks following germination. Plants did not produce flowers the first year (P. pulcherrimum)[9] *Root development occurs rapidly following germination. Seedlings have 4 to 6 true leaves 6 weeks after germination. Plants were fertilized with 13-13-13- NPK at 75 ppm fertilizer during the growing season (P. viscosum)[8]
Length of Active Growth Phase	*12 weeks (P. pulcherrimum)[9], (P. viscosum)[8]
Hardening Phase	*Plants are fertilized with 10-20-20 liquid NPK at 200 ppm during August and September. Irrigation is gradually reduced in September and October. Plants were given one final irrigation prior to winterization (P. pulcherrimum)[9], (P. viscosum)[8]

Length of Hardening Phase	*4 weeks (P. pulcherrimum)[9], (P. viscosum)[8]
Harvesting, Storage and Shipping	*Total Time To Harvest: 6 months Harvest Date: June Storage Conditions: Overwinter in outdoor nursery under insulating foam and snow cover (P. pulcherrimum)[9] *Total Time To Harvest: 10 months Harvest Date: August Storage Conditions: Overwinter in outdoor nursery under insulating foam cover and snow (P. viscosum)[8]
Length of Storage	*5 months (P. pulcherrimum)[9], (P. viscosum)[8]
Guidelines for Outplanting / Performance on Typical Sites	No information available
Other Comments	Division can be done in late summer or early spring (in regards to genus)[11] Threatened species in WA[1]
INFORMATION SOURCES	
References	See below
Protocol Author	Jacob Stephens
Date Protocol Created or Updated	04/29/19

References:

[1]*Polemonium carneum* A. Gray royal Jacob's-ladder. (n.d.). Retrieved April 30, 2019, from https://plants.usda.gov/core/profile?symbol=POCA4

[2]Rebecca L. Stubbs, Ruth E. Timme & Dieter H. Wilken 2014, *Polemonium carneum*, in Jepson Flora Project (eds.) Jepson eFlora, Revision 2, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=38971, accessed on April 29, 2019.

[3]*Polemonium carneum* | salmon polemonium | Wildflowers of the Pacific Northwest. (n.d.). Retrieved April 30, 2019, from https://www.pnwflowers.com/flower/polemonium-carneum

[4]*Polemonium carneum*. (n.d.). Retrieved April 28, 2019, from https://xeraplants.com/plants/polemonium-carneum/

[5]Camp, P., Gamon, J., & Arnett, J. (2011). *Field guide to the rare plants of Washington* [Adapted PDF file]. Seattle: University of Washington Press. Retrieved April 28, 2019, from https://www.dnr.wa.gov/publications/amp_nh_poca4.pdf?cekbiy.

[6]2015. Propagation protocol for production of Container (plug) *Polemonium carneum* plants USDA NRCS - Corvallis Plant Materials Center Corvallis, Oregon. In: Native Plant Network. URL: http://NativePlantNetwork.org (accessed 2019/05/02). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources.

[7]WTU Herbarium, Burke Museum, & University of Washington. (n.d.). *Polemonium carneum*. Retrieved April 28, 2019, from http://biology.burke.washington.edu/herbarium/imagecollectionnew/taxon.php?Taxon=Polemonium carneum

[8]Luna, Tara; Wick, Dale. 2008. Propagation protocol for production of Container (plug) *Polemonium viscosum* Nutt. plants 160 ml conetainers; USDI NPS - Glacier National Park West Glacier, Montana. In: Native Plant Network. URL: http://NativePlantNetwork.org (accessed 2019/05/02). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources.

[9]Luna, Tara; Evans, Jeff; Wick, Dale. 2002. Propagation protocol for production of Container (plug) *Polemonium pulcherrimum* Hook. plants 172 ml conetainers; USDI NPS - Glacier National Park West Glacier, Montana. In: Native Plant Network. URL: http://NativePlantNetwork.org (accessed 2019/05/02). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources.

[10]Grant, V. (1989). Taxonomy of the Tufted Alpine and Subalpine Polemoniums (Polemoniaceae). *Botanical Gazette, 150*(2), 158-169. Retrieved from http://www.jstor.org.offcampus.lib.washington.edu/stable/299523

[11]Stewart, R. (1970, January 01). Jacobs Ladder. Retrieved April 29, 2019, from http://rslandscapedesign.blogspot.com/2010/04/polemonium.html