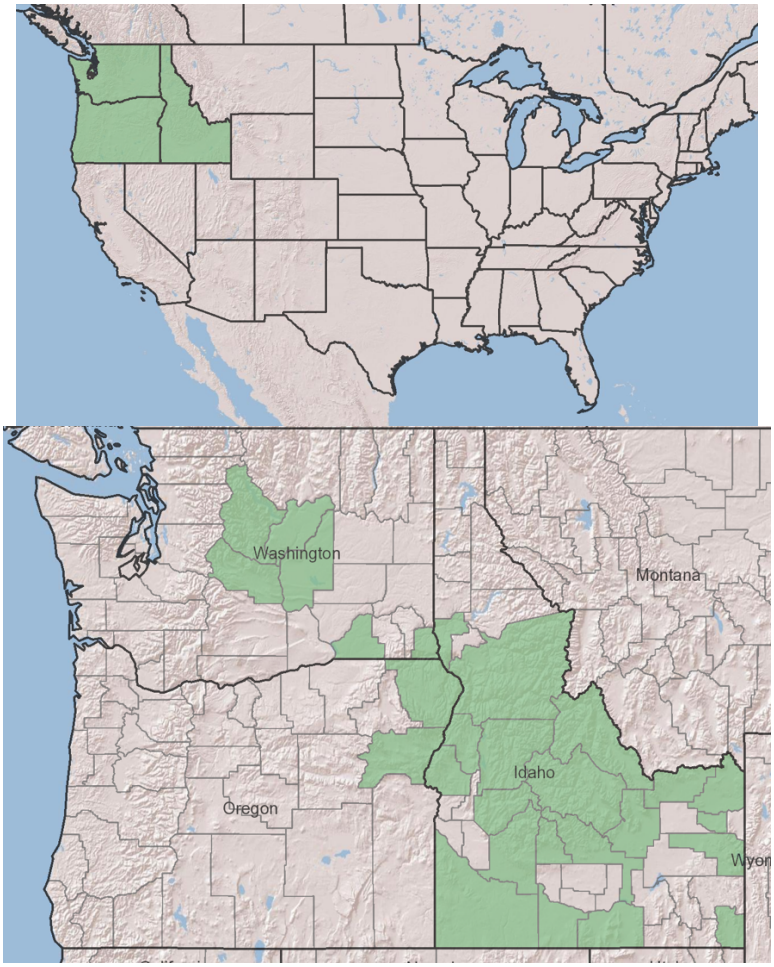
Plant Propagation Protocol for *Hackelia hispida*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/2021/HAHI3.pdf



State- and county-level location of *H. hispida*. Range image courtesy of USDA PLANTS Database.[1]

Photo courtesy of Joe Arnett, copyright 2010 from the Burke Herbarium.[7]

TAXONOMY	
Plant Family	
Scientific Name	Boraginaceae
Common Name	Borage
Species Scientific Name	
Scientific Name	*Hackelia hispida* (A. Gray) I.M. Johnst.
Varieties	
Sub-species	Var. *disjuncta* R.L. Carr (rough stickseed) Var. *hispida* (showy stickseed)
Cultivar	
Common Synonym(s)	Showy stickseed, wild forget-me-not
Common Name(s)	
Species Code (as per USDA Plants database)	HAHI3
GENERAL INFORMATION	
Geographical range	*H. hispida* is present in Oregon, Idaho (Snake River Canyon), and Washington (Grand Coulee area in Chelan, Douglas, and Grant Counties).[1] See the top of the page for a range map.
Ecological distribution	Grows in serpentine soils, in rocky areas such as gravel, unstable talus slopes, and scree, where there is little other vegetation.[2]

Climate and elevation range	Elevation range is 600-1500 ft.[2]
Local habitat and abundance	Found on cliffs and talus slopes.[5] *H. hispida* is especially found in large rock talus with very low competition. More generally, *Hackelia* species prefer disturbed habitats or areas with very well-drained soils.[4] Other species in the Snake River Canyon habitat area are dominant species such as *Poa sandbergii, Agropyron spicatum, Purshia tridentata, Celtis reticulata* and other taxa such as *Rubus bartonianus, Ribes cereum* var. *colubrinum*, *Phlox columbrina, Astragalus cusickii, Astragalus vallaris, Nemophila kirtleyi, and Leptodactylon pungens* subsp. *hazeliae.*[3]
Plant strategy type / successional stage	
Plant characteristics	A gray-green slender perennial from a taproot, sometimes with several hairy stems (when present on a plant part, hairs will point all in the same direction no matter what that direction is).[1,2] Basal leaves are petiolate, lance-shaped and 4-14cm long; stem leaves are smaller and without petioles. Yellowish-white to green-tinged flowers bloom May-June. There are 4 nutlets per flower, each with barbed hairs along the top ridge.[2]
PROPAGATION DETAILS *Seed Germination*	
Ecotype	
Propagation Goal	
Propagation Method	
Product Type	
Stock Type	
Time to Grow	
Target Specifications	
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	
Pre-Planting Propagule Treatments	Remove seed coat to mimic natural process of tumbling down deep talus slopes.[4]

Growing Area Preparation / Annual Practices for Perennial Crops	
Establishment Phase Details	Average germination of tetraploids is often above 78.4% (*H. hispida* is a tetraploid species; most other members of the genus are diploids and the two ploidys have different characteristics). This was achieved in a controlled environment with alternating 12 hours of 24 C and 12 hours of 7 C (this regime helped control fungal growth issues). In these conditions embryos germinated in 96 hours post-seed coat removal.[4]
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	Carr found that *H. hispida* is genetically closely allied to other tetraploid *Hackelia* species[4], and therefore research should explore possible crossover between propagation techniques of other *Hackelia* species (for example, the tetraploid *H. venusta* is one of the most endangered species in Washington, and is highly researched for propagation techniques such as micropropagation[7]). Very little information is available for *H. hispida* specifically.
PROPAGATION DETAILS *Micropropagation of a related species:* Hackelia venusta	
Ecotype	

Propagation Goal	
Propagation Method	*In vitro* vegetative micropropagation
Product Type	Plant
Stock Type	
Time to Grow	6 months from culturing to outplanting[5]
Target Specifications	10 cm tall, 10 cm wide, 15 cm long firm root plug, container volume 170 mL[6]
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	The explant used from the original is a shoot tip or node. Approximately 2.3 microshoots can be obtained per explant for *H. venusta.*[6]
Pre-Planting Propagule Treatments	
Growing Area Preparation / Annual Practices for Perennial Crops	
Establishment Phase Details	
Length of Establishment Phase	
Active Growth Phase	Grow the shoot tip or node in microshoot proliferation media: Murashige & Skoog (1962) (MS) + 0.04 μM BA for 8 weeks. Elongation occurs during proliferation.[6] Then, transfer to MS+2μMIAA media for 4 weeks *in vitro* to root.[6]
Length of Active Growth Phase	8 weeks of proliferation and elongation; 4 weeks rooting.[6]
Hardening Phase	Humidity: Gradually decrease from 88% to 40% to ambient. Sunlight: Increase light exposure from 60% shade to 30% shade to normal greenhouse light conditions.[6]

Length of Hardening Phase	Harden over the course of 4 weeks[6]
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	The first year after outplanting in Wenatchee National Forest, *H. venusta* outplants had 60% survival, and 86% of those plants were reproductive the following spring.[6]
Other Comments	A 20:20:20 fertilizer at 200 ppm N can be used.[6]
INFORMATION SOURCES	
References	1. USDA NRCS. (n.d.). *Hackelia hispida* (A. Gray) I. M. Johnst. USDA PLANTS Database. https://plants.sc.egov.usda.gov/home/plantProfile?symbol=HAHI3. 2. Smith-Kuebel, C. A., & Lillybridge, T. R. (1993). Sensitive plants and noxious weeds of the Wenatchee National Forest. U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Region. https://ir.library.oregonstate.edu/downloads/765372537. 3. Meinke, R. (1988). *Leptodactylon pungens* subsp. *Hazeliae* (Polemoniaceae), a new combination for a Snake River Canyon Endemic. *Madroño, 35*(2), 105-111. Retrieved May 25, 2021, from http://www.jstor.org/stable/41424681 4. Carr, R. (1973). A taxonomic study in the genus *Hackelia* in western North America: Oregon State University. 5. Dumroese, R. K., Edson, J. L., Leege-Brusven, A. D., & Wenny, D. L. (1998). Comparing Micropropagation Protocols for a Herbaceous Perennial, a Woody Shrub, and a Conifer. *Native Plants: Propagating and Planting*, 68–74. https://npn.rngr.net/publications/symposium-proceedings-native-plants-propagating-and-planting/comparing-micropropagation-protocols-for-a-herbaceous-perennial-a-woody-shrub-and-a-conifer/?searchterm=hackelia. 6. Gentry, J. (1974). Studies in the Genus *Hackelia* (Boraginaceae) in the Western United States and Mexico. *The Southwestern Naturalist, 19*(2), 139-145. doi:10.2307/3670274 7. Burke Museum Herbarium. (n.d.). *Hackelia hispidia* - rough stickseed. Burke Herbarium Image Collection. https://biology.burke.washington.edu/herbarium/imagecollection/taxon.php?Taxon=Hackelia+hispida.

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