

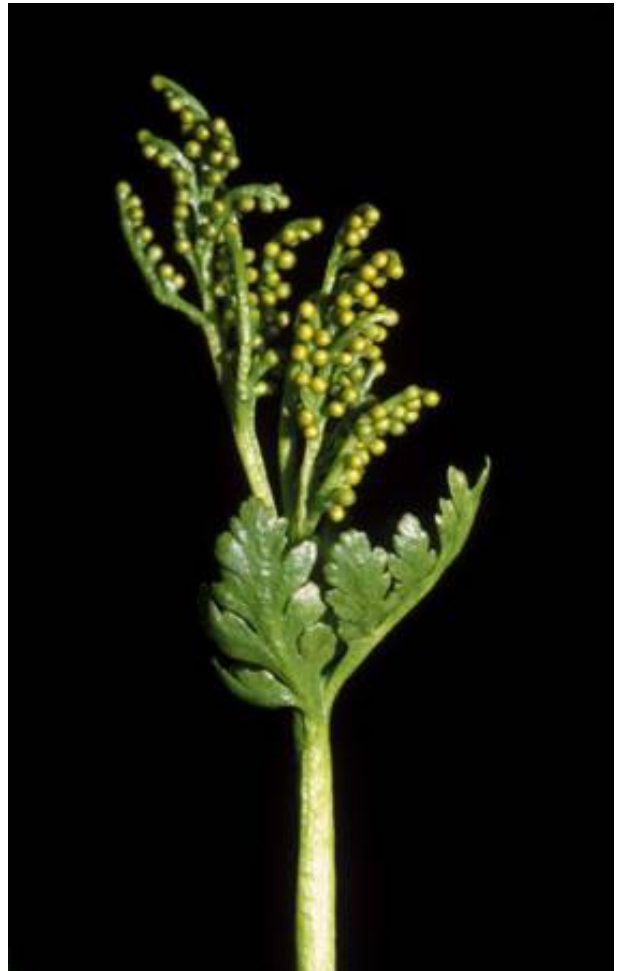
Plant Propagation Protocol for *Botrychium lanceolatum*

ESRM 412 – Native Plant Production

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



ssp. angustisegmentum (Farrar, 2005)³



ssp. lanceolatum (Farrar, 2005)³



Right: Var. *lanceolatum*
(eFloras.org)⁴

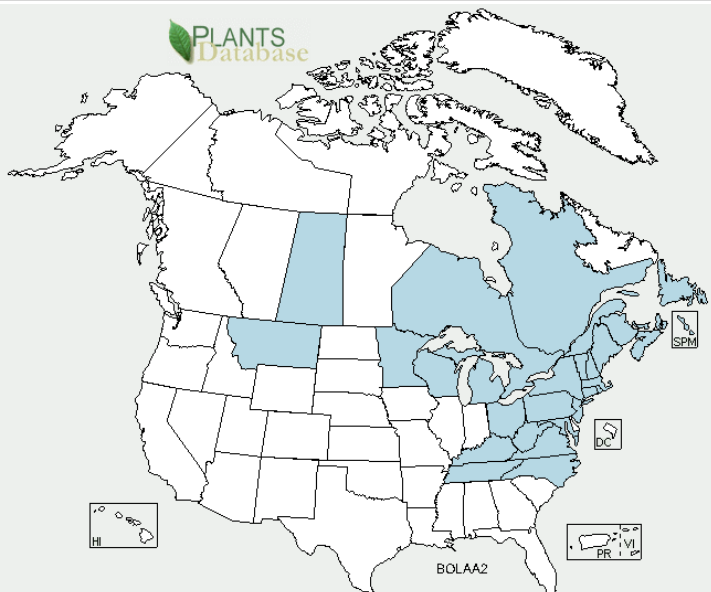
Left: Var. *lanceolatum*
(© 2005, Ben Legler)¹¹

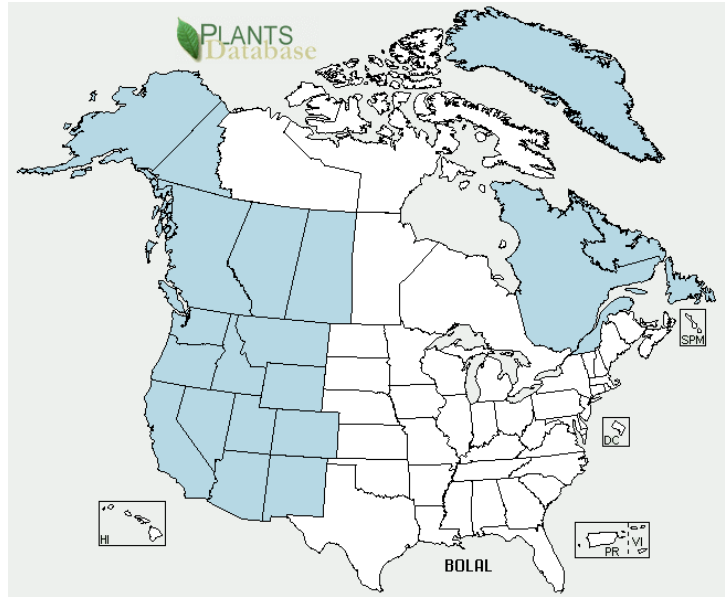


TAXONOMY

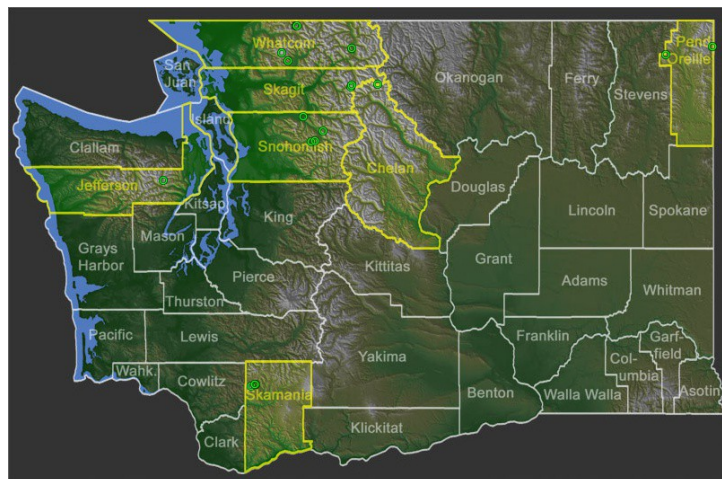
Plant Family	
Scientific Name	<i>Ophioglossaceae</i> ¹⁰
Common Name	adder's-tongue ferns
Species Scientific Name	
Scientific Name	<i>Botrychium lanceolatum</i> (S.G. Gmel.) Angstr. ¹⁰
Varieties (those varieties that are recognized in the USDA Plants database; report name and authority for each variety)	<ul style="list-style-type: none"> • <i>Botrychium lanceolatum</i> (S.G. Gmel.) Angstr. var. <i>angustisegmentum</i> Pease & A.H. Moore • <i>Botrychium lanceolatum</i> (S.G. Gmel.) Angstr. var. <i>lanceolatum</i>
Sub-species	None
Cultivar	Var. <i>lanceolatum</i> type red and green. ³
Common Synonym(s) (include full scientific names, including variety or subspecies information)	<ul style="list-style-type: none"> • <i>Botrychium angustisegmentum</i> (Pease & A.H. Moore) Fernald¹⁰ • <i>Botrychium lanceolatum</i> (S.G. Gmel.) Angstr. ssp. <i>angustisegmentum</i> (Pease & A.H. Moore) R.T. Clausen¹⁰ • <i>Botrychium lanceolatum</i> (S.G. Gmel.) Angstr. Ssp. <i>typicum</i> R.T. Clausen¹⁰
Common Name(s)	lanceleaf grapefern ¹⁰ , lanceleaf moonwort ⁵ , triangle moonwort ⁹
Species Code (as per USDA Plants database)	BOLA ¹⁰

GENERAL INFORMATION

Geographical range (distribution maps for North America and Washington state)	 <p style="text-align: center;">Var. <i>angustisegmentum</i>¹⁰</p>
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Var. *lanceolatum*¹⁰



Var. *lanceolatum* in WA¹¹

Ecological distribution (ecosystems it occurs in, etc)

Only variety *lanceolatum* is native to Washington state¹⁰, unless otherwise specified the data below pertains to var. *lanceolatum*. Grows in wet to moist habitats, grassy or rocky slopes, in woodlands, along roads and lakes, but generally always at high elevations.¹ Is found from Alaska to Oregon and Idaho.¹ Also found in Colorado, Utah, New Mexico, and Arizona at higher elevations.¹ Also found across northeastern US and Canada, where it is typically found in hardwood forests.² It may also be found in Scotland, Sweden, Siberia, and Japan.³ In Alaska, it can be found on beach meadows, subalpine and alpine meadows, and sites of human disturbances such as roadsides and aircraft landing strips.⁹

Climate and elevation range	Found typically from sealevel to 3,700m elev. ⁴ In Colorado, var. <i>lanceolatum</i> is found from 2,740m to treeline. ³ This species is primarily found in montane habitats. ⁶
Local habitat and abundance	This species is myco-heterotrophic and dependent on mycorrhizal fungi. ² Populations are generally small and fluctuate widely. ² May require part- to full-shade. ⁷ Var. <i>angustisegmentum</i> is not typically found in forests younger than 25 years old. ²
Plant strategy type / successional stage	Short-lived perennials, can be tolerant of light to moderate disturbances. ²
Plant characteristics	Grows from underground rhizomes, which produce a single deciduous leaf stalk from 2.5-20cm in height. ⁹ Spore cases resemble clusters of tiny grapes, hence the common name of this species. ² The spores are wind-dispersed and can travel a maximum of 3m from the parent plant, though it is suspected that animal dispersal may also play a role. ² The two varieties can be distinguished by var. <i>angustisegmentum</i> having succulent yellow-green leaf blades with the middle and terminal blade segments being wider than 2mm whereas the var. <i>lanceolatum</i> has firm dark green blades with middle blade segments being less than 2mm wide. ²
PROPAGATION DETAILS	
Propagation Goal	Plants
Propagation Method	Spores (Seed).
Product Type	Container
Stock Type	
Time to Grow	Multiple years. ^{2,6,8}
Target Specifications	Mature spore-bearing plant.
Propagule Collection Instructions	
Propagule Processing/Propagule Characteristics	Estimated to be thousands of spores per capsule, with 20-50 capsules per plant. ²
Pre-Planting Propagule Treatments	Unknown viable storage duration, but spores can persist in soil for several years. ²
Growing Area Preparation / Annual Practices for Perennial Crops	Moist soil, partial or full shade. ⁷
Establishment Phase Details	Germination can happen immediately, or can take up to 5 years after infiltration into soil. ² Spores germinate in darkness, thus must be covered by soil. ² Spores may require fungal interaction in order to germinate. ²
Length of Establishment Phase	0-2 years ⁸ , may take up to 6 years for above-ground growth ² .
Active Growth Phase	Plants may remain underground for 1-3 years and will produce no more than a single stem and leaf per

	growing season, emerging in late spring to early summer. ² Only about 5-10% of above-ground plants will grow larger, bearing 20-50 spore-bearing segments. ²
Length of Active Growth Phase	Unknown
Hardening Phase	Unknown
Length of Hardening Phase	Unknown
Harvesting, Storage and Shipping	N/A – species cannot be transported, must be directly-planted in order to survive <1yr. ²
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	Transplanting of this species appears to be widely unsuccessful, with transplanted plants surviving only 1 year. ² Sow collected spores directly onto moist ground where plants are desired.
Other Comments	Very little information was found regarding this particular species, see more general fern propagation protocols for guides on possible methods to test on this species.

INFORMATION SOURCES

References	<ol style="list-style-type: none"> 1. B.C. Conservation Data Centre. 2014. Species Summary: <i>Botrychium lanceolatum</i> ssp. <i>lanceolatum</i>. B.C. Minist. of Environment. Available: http://a100.gov.bc.ca/pub/eswp/speciesSummary.do?id=19911 Accessed May 19, 2014. 2. Chadde, S. & G. Judray. 2001. Conservation Assessment for Narrow Triangle Moonwort (<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>). USDA Forest Service, Eastern Region. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsm91_054153.pdf Accessed May 19, 2014 3. Farrar, D.R. 2005. Systematics of Western Moonworts <i>Botrychium</i> subgenus <i>Botrychium</i>. In: Popovich, S.J. (ed.). United States Forest Service moonwort workshop. Arapaho-Roosevelt National Forests and Pawnee National Grassland, Fort Collins, Colorado, July 13-15 2005. http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/ca-va-app08-b-lanceolatum-2005-01-13.doc Accessed May 19, 2014 4. Flora of North America – <i>Botrychium</i> ssp 2008. http://efloras.org/florataxon.aspx?
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	<p>flora_id=1&taxon_id=200002875 Accessed May 19, 2014.</p> <ol style="list-style-type: none"> 5. Heidel, B., W. Fertig, & S. Laursen. Region 2 Sensitive Species Evaluation Form: <i>Botrychium lanceolatum</i> var <i>lanceolatum</i>. USDA Forest Service, Rocky Mountain Region Colorado: February 19, 2002. http://www.fs.fed.us/r2/projects/scp/evalrational/evaluations/ferns/botrychiumlanceolatumvarlanceolatum.pdf Accessed May 19, 2014 6. Hitchcock, C. L., and A. Cronquist. 1973. Flora of the Pacific Northwest. Seattle: University of Washington Press. 7. LadyBird Johnson Wildflower Center. 2007. Native Plant Database. Search: Botrychium lanceolatum. http://www.wildflower.org/plants/result.php?id_plant=BOLA Accessed May 19, 2014 8. Stensvold, M. C. A taxonomic and phylogeographic study of the Botrychium lunaria complex. (Dissertation). Iowa State University, 2007. 9. Stensvold, M. 2010. Ferns of the National Forests in Alaska. US Forest Service, Alaska Region Botany program, USDA: June 2010. http://www.fs.fed.us/wildflowers/regions/alaska/documents/FernsNFsinAK.pdf Accessed May 19, 2014 10. USDA, NRCS. 2014. The PLANTS Database (http://plants.usda.gov , 19 May 2014). National Plant Data Team, Greensboro, NC 27401-4901 USA. 11. Weinmann, F., P.F. Zika, D.E. Giblin, B. Legler. 2002+. Checklist of the Vascular Plants of Washington State. University of Washington Herbarium. 19 May 2014._ http://biology.burke.washington.edu/herbarium/waflora/checklist.php
Other Sources Consulted	<ul style="list-style-type: none"> • Camp, P. & J. Gamon. <u>Field Guide to the Rare Plants of Washington: online edition</u>. Washington Natural Heritage Program, 2011. Accessed May 14, 2014. • Dumroese , R.K. Native Plant Network. 2009.

	<p>http://www.nativeplantnetwork.org Accessed 19 May 2014).</p> <ul style="list-style-type: none"> • Calflora: Information on California plants for education, research and conservation. 2014. Berkeley, California: The Calflora Database. Available: http://www.calflora.org/ Accessed: May 19, 2014. • Argus, G.W. 2012. Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/IJM.html Accessed on May 19 2014
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