Plant Propagation Protocol for *Ophioglossum pusillum*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/OPPU3.pdf


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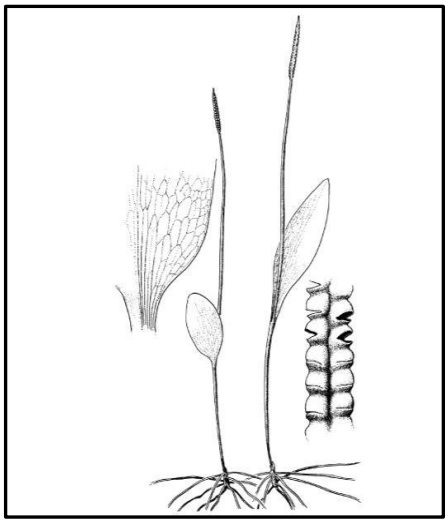
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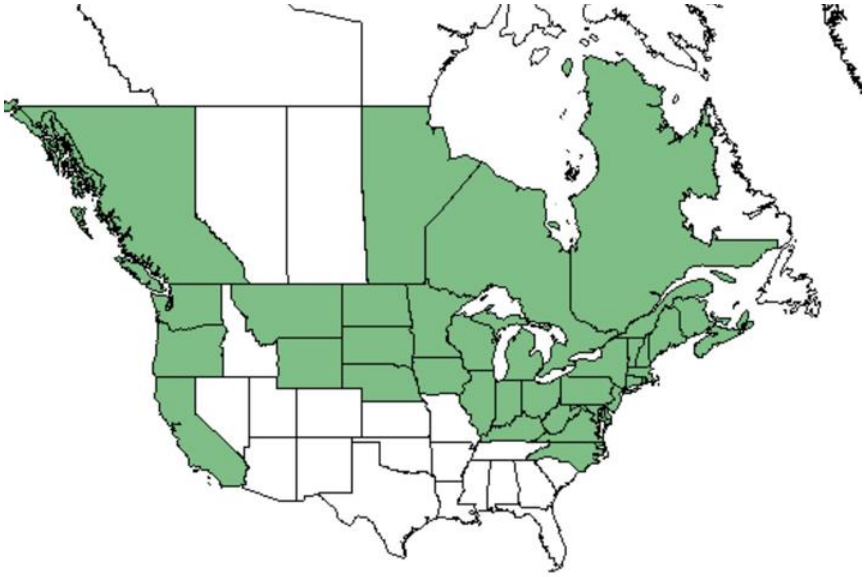
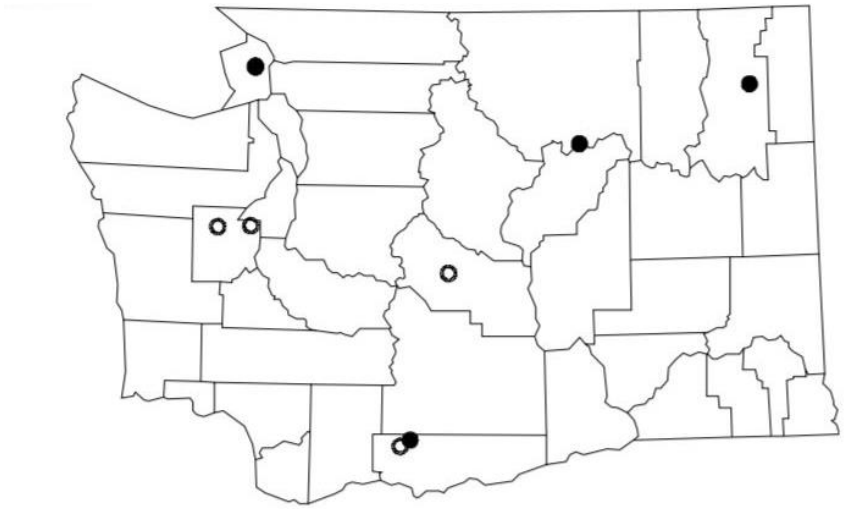
TAXONOMY	
Plant Family	
Scientific Name	Ophioglossaceae
Common Name	Adder's tongue family
Species Scientific Name	
Scientific Name	*Ophioglossum pusillum* Raf.
Varieties	None found
Sub-species	None found
Cultivar	None found
Common Synonym(s)	*Ophioglossum vulgatum* auct. non L. (misapplied) *Ophioglossum vulgatum* L. var. *alaskanum* (E.G. Britton) C. Chr. *Ophioglossum vulgatum* L. var. *pseudopodum* (S.F. Blake) Farw. (USDA, 2018)
Common Name(s)	Northern Adder's Tongue Northern Adderstongue (USDA, 2018)
Species Code	OPPU3 (USDA, 2018)

GENERAL INFORMATION	
Geographical range	 (USDA, 2018)  (WADNR, 2018)
Ecological distribution	*Ophioglossum pusillum* can be found in habitats with wet soil. Meadow and woodland habitats, marsh edges, and shallow fens are common ecosystems where *Ophioglossum pusillum* populations have been observed to occur. (Efloras.org, 2018)

Climate and elevation range	Elevation: 3669' - 6932' Annual Precipitation: 43.3" - 72.1" Summer Precipitation: 1.03" - 1.99" Coldest Month: 33.3° F - 43.6° F Hottest Month: 54.7° F - 65.3° F Humidity: 1.67 - 17.32 vapor pressure deficit (CNPS, 2018)
Local habitat and abundance	In Washington State, *Ophioglossum pusillum* can be found in wet meadows, in marshes and alongside river edges. There are several distinct populations found across the Pacific Northwest. Its commonly associated species include Carex aurea, Solidago canadensis, Trifolium repens and Achillea millifolium. (WTU Herbarium Image Collection, 2018)
Plant strategy type / successional stage	*Ophioglossum pusillum* thrives as an early-successional species, and can commonly be found in areas that face rapid succession. This small fern prefers sunny environments with damp soil, and recently disturbed wetlands create ideal environments for this early-successional plant. (McMaster, 1996)
Plant characteristics	*Ophioglossum pusillum* is a perennial fern. The fern is composed of one vertical main stem, one solitary leaf, and a stem that extends past the main stem which contains the reproductive spores of the plant. The roots of *Ophioglossum pusillum* are rhizomatous in nature, and are capable of producing several plants per each root system given proper conditions. *Ophioglossum pusillum* only grows above ground during the summer, as it remains underground in dormancy during late fall, winter and early spring. (Camp, 2011; WTU Herbarium Specimen 2018).
PROPAGATION DETAILS	
Method: Spores	
Ecotype	N/A
Propagation Goal	Plants
Propagation Method	Seed (spores)
Product Type	Container (plug)
Stock Type	18 ml cone-tainers
Time to Grow	1.5-2 years (Hartmann, 2011)

Target Specifications	Well-developed leaf and stalk, with an extensive and healthy system of roots and rhizomes. Target plants will have one strong stem and one healthy leaf, and should be outplanted before the plant produces spores. (Hartmann, 2011)
Propagule Collection Instructions	While there are no established guidelines for collecting *Ophioglossum pusillum* spores, general guidelines for propagating ferns are thought to apply. The *Ophioglossum pusillum* spores ripen on the tall stalks in late summer, and can be identified as ripe when the stalk turns from green to brown and begins to shed spores. Plucking off the fertile stalks, putting the stalks into a paper envelope, and allowing the spores to release into the paper for 2-3 days is an efficient way to collect spores. (Born, 2018)
Propagule Processing/Propagule Characteristics	In general, fern spores are between 30 and 50 micrometers in width. Fern spores are typically viable for a year or longer, but no specific information for *Ophioglossum pusillum* is available. (Born, 2018)
Pre-Planting Propagule Treatments	Spores collected from ferns must be separated from the chaff. This process can be relatively simple when collecting small numbers of spores, as spores stick to paper and simply tapping a pile of chaff and spore mix will allow the spores to separate from the chaff. (Born, 2018) Cleanliness of the spores and of the growing medium is essential to propagating ferns form spores. Sterilizing the germination mixture removes fungi spores which would harm young fern sporophytes. Make sure to follow sterilization practices to increase the success and establishment of sporophytes. (Hua, 2009)
Growing Area Preparation / Annual Practices for Perennial Crops	Fern spores are difficult to separate into individuals. So, it is often best to sprinkle on a moist medium (a mixture of loam, peat moss and vermiculite has been found to be an effective germination medium) and allowed to germinate. The size of the container will depend on the number of germinants desired, but germination trays with a depth of 2” will be effective until germinants are ready to be up-potted to cone-tainers or ½ gallon pots. (Australian National Herbarium, 2015)
Establishment Phase Details	Spores should be covered in breathable plastic or glass to prevent spores from blowing off. Sporophytes appear like moss in their early development, but will eventually grow to form mature ferns. (Australian National Herbarium, 2015)

Length of Establishment Phase	Germination often takes place from 2-6 weeks, allowing the spores to become sporophytes. (Born, 2018)
Active Growth Phase	Sporophytes should be allowed to grow for several weeks, developing a stem and a root system in their original media. If necessary, sporophytes can be thinned as they develop. After a root system and stem have been developed, the sporophytes should be up potted into individual containers. (Born, 2018)
Length of Active Growth Phase	*Ophioglossum pusillum* can grow for several months in their active growth phase after germination, before entering winter dormancy. (Born, 2018)
Hardening Phase	*Ophioglossum pusillum* is a perennial plant that goes into dormancy during the winter months. In order to send *Ophioglossum pusillum* into artificial dormancy when it is kept in a nursery, the plants should be kept in an environment where there is a gradual reduction in temperature mimicking the environmental factors where they will be planted. Watering should occur even during dormancy. (LeBude, 2017)
Length of Hardening Phase	The process of hardening generally takes several weeks in nursery conditions, and should be carefully monitored to ensure that decreasing temperatures and precipitation does not injure the plant. *Ophioglossum pusillum* will harden and enter dormancy from August to April. (LeBude, 2017)
Harvesting, Storage and Shipping	*Ophioglossum pusillum* ferns are delicate plants, and should be handled with care when shipping and storing. (Williams, 2011)
Length of Storage	It is best to plant *Ophioglossum pusillum* before they mature and create spores. Spores can be problematic in a nursery environment, where they can unintentionally seed in other media. (Williams, 2011)
Guidelines for Outplanting / Performance on Typical Sites	*Ophioglossum pusillum* establishes best in moist environments with adequate sunlight. Watering after planting can help improve the success of establishment. Not many details are available for *Ophioglossum pusillum* on site performance, as they are not commonly used in research. (Williams, 2011)

Other Comments	On the east coast of the United States, *Ophioglossum pusillum* is listed as endangered or threatened in some states. Be aware of rules applying to endangered plants in each state before collecting spores from these states. As a general practice, it is best to collect spores from plant populations in a similar region to their ultimate planting location. (WADNR, 2018)
Method: Rhizomes	
Ecotype	N/A
Propagation Goal	Plants
Propagation Method	Vegetative
Product Type	Container (plug)
Stock Type	½ gallon containers
Time to Grow	1-1.5 years (Hartmann, 2011)
Target Specifications	Well-developed leaf and stalk, with an extensive and healthy system of roots and rhizomes. Target plants will have one strong stem and one healthy leaf, and should be outplanted before the plant produces spores. (Hartmann, 2011)
Propagule Collection Instructions	Full sized, mature *Ophioglossum pusillum* plants often develop several shoots from a single rhizome. It is possible to carefully uproot the plant and sever the rhizome between the two shoots. Divisions can be made throughout the year, but fall is generally the best time to create divisions. (McMaster, 1996)
Propagule Processing/Propagule Characteristics	As rhizome divisions are made, ensure that each section of the rhizome contains a shoot or bud/eye. Place each rhizome into the soil with the shoot facing upwards, no deeper than1 inch. (Hartmann, 2011)
Pre-Planting Propagule Treatments	Maintain a sterile potting environment to prevent the spread of disease as divisions are made. Rhizomes should not remain outside of the media for more than a few hours, as risk of wilting and plant death increase with time. (Hartmann, 2011)

Growing Area Preparation / Annual Practices for Perennial Crops	As these plants will be derived from an already existing root system, they will need to be planted in containers larger than cone-tainers. ½ gallon or 1 gallon pots should be sufficient for individual stalks of *Ophioglossum pusillum*. There is no information on which types of media benefit *Ophioglossum pusillum* rhizomes the most. (Sadhu, 1989)
Establishment Phase Details	If performed correctly, each rhizome should form a shoot. Ensure that the plant is receiving plenty of water, as divisions put stress on a plant which makes this is a particularly delicate time in the plant's development. (Sadhu, 1989)
Length of Establishment Phase	Several weeks (Hartmann, 2011)
Active Growth Phase	*Ophioglossum pusillum* rhizomes should expand their root system as they grow. The stalk will also grow, and be aware that the spore bearing stem (sporophore) may also develop. (Williams, 2011)
Length of Active Growth Phase	2-3 months (Calflora.org, 2018)
Hardening Phase	*Ophioglossum pusillum* is a perennial plant that goes into dormancy during the winter months. In order to send *Ophioglossum pusillum* into artificial dormancy when it is kept in a nursery, the plants should be kept in an environment where there is a gradual reduction in temperature mimicking the environmental factors where they will be planted. Watering should occur even during dormancy. (LeBude, 2017)
Length of Hardening Phase	The process of hardening generally takes several weeks in nursery conditions, and should be carefully monitored to ensure that decreasing temperatures and precipitation do not injure the plant. *Ophioglossum pusillum* dormancy from August to April. (LeBude, 2017)
Harvesting, Storage and Shipping	*Ophioglossum pusillum* ferns are delicate plants, and should be handled with care when shipping and storing. (Williams, 2011)
Length of Storage	It is best to plant *Ophioglossum pusillum* before they mature and create spores. Spores can be problematic in a nursery environment, where they can unintentionally seed in other media. (Williams, 2011)

Guidelines for Outplanting / Performance on Typical Sites	*Ophioglossum pusillum* establishes best in moist environments with adequate sunlight. Watering after planting can help improve the success of establishment. Not many site performance details are available for *Ophioglossum pusillum*, as propagation methods and outplanting have not been investigated thoroughly. (Williams, 2011)
Other Comments	On the east coast of America, *Ophioglossum pusillum* is listed as endangered or threatened in many states. Be aware of rules applying to endangered plants in each state before collecting rhizomes from these states. As a general practice, it is best to collect rhizomes from plant populations in a similar region to their ultimate planting location. (WADNR, 2018)
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