Plant Propagation Protocol for *Pedicularis ornithorhyncha*
ESRM 412 – Native Plant Production
Spring 2008

TAXONOMY	
Family Names	
Family Scientific Name:	Scrophulariaceae
Family Common Name:	Figworts
Scientific Names	
Genus:	*Pedicularis*
Species:	*ornithorhyncha*
Species Authority:	Benth.
Common Synonym(s)	
Genus:	*Pedicularis*
Species:	*pedicellata*
Species Authority:	Bunge
Genus:	*Pedicularis*
Species:	*subnuda*
Species Authority:	Benth.
Common Name(s):	Ducksbill lousewort, Bird's-beak lousewort
Species Code (as per USDA Plants database):	PEOR
GENERAL INFORMATION	
General Distribution (geographical range (states it occurs in), ecosystems, etc):	*Pedicularis ornithorhyncha* is found in the Cascades of Washington and British Columbia and extends to SE Alaska (USDA PLANTS).
Climate and elevation range	*Pedicularis ornithorhyncha* is found between 6,000 and 7,000 feet at Mount Rainier (Biels 2000). In British Columbia it is found between 905 and 2435 meters (E-Flora BC).
Local habitat and abundance; may include commonly associated species	Common in subalpine and alpine meadows, heath, stream banks, rocky slopes (Pojar and MacKinnon 1994).

Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	*Pedicularis ornithorhyncha* is considered a seral or climax species (UW Digital Collections).
PROPAGATION DETAILS	
Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):	Extensive search found no information for this particular species, so recommendations are based on propagation of *Pedicularis contorta* and *Pedicularis groenlandica*, species occurring in our geographic area (Native Plant Nursery, Glacier National Park).
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Plants
Propagation Method (Options: Seed or Vegetative):	Most propagation protocols for *Pedicularis* recommend seed, but the University of Vermont suggests that division may be possible.
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Conetainer (plug), 160 ml conetainers were used for *P. contorta*. Conetainer (plug), 172 ml conetainers were used for *P. groenlandica*.
Stock Type:	
Time to Grow (from seeding until plants are ready to be outplanted):	*P. contorta*: 9 months *P. groenlandica*: 2 years
Target Specifications (size or characteristics of target plants to be produced):	4 cm, root plug firm in container.
Propagule Collection (how, when, etc):	Flowers from mid-July through mid-August (Macior 1973). Seeds occur in pods and can be collected in late August.

Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Seed capsules can be stored in paper bags in a well-ventilated drying shed. Density is unknown; *Pedicularis* densities vary by more than 1,000,000 seeds/kg. Chaff is removed by hand screening (*P. contorta*) or hammermill and fan (*P. groenlandica*). Longevity is unknown.
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	*P. contorta* seeds are treated with 500 ppm gibberellic acid for 15 minutes. Seeds are rinsed with distilled water. Seeds are placed into moist paper towels inserted in a open plastic bag under refrigeration at 1 to 3 C for 90 days. Seeds germinate after 90 days of stratification and are planted as germinants. *P. groenlandica* seeds are treated with 200 ppm gibberellic acid for 24 hrs. Afterwards, seeds are thoroughly rinsed with water. Seeds are placed into a 90 to 100 day cold, moist stratification at 1 to 3 C. Seeds begin to germinate during stratification and are planted as germinants.
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	*P. contorta* were grown in a greenhouse. Germinants were planted using a growing medium of 6:1:1 milled spaghnum 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 container. Containers were irrigated thoroughly prior to sowing germinants. Greenhouse temperatures are maintained at 21 to 25C during the day for 12 hours and 12 to 18C at night for 8 hours. *P. groenlandica* were grown in an outdoor nursery growing facility or temperature controlled greenhouse using the same growing medium and container size. Direct seeding, in which seeds are lightly covered with medium, may also be used for *P. groenlandica*.
Establishment Phase (from seeding to germination):	Planted *P. contorta* developed cotyledons 3 days after sowing and true leaves 7 days later. Seedlings require a host plant, such as *Poa alpina*, in the container after establishment. After seedlings are well established, they must dry down between irrigations. *P. groenlandica* seedlings developed the first set of true leaves at 4 weeks after germination. *Carex nigricans* was used as a host plant, as *Pedicularis* are hemiparasites. The initial root growth is very thin and unbranched, and seedlings grow slowly until the seedling root penetrate the roots of the host plant.
Length of Establishment Phase:	4 weeks.
Active Growth Phase (from germination until plants are no longer actively growing):	Root and shoot development of *P. contorta* occured at a moderate rate. True leaves were evident 3 weeks after planting. Seedlings were fertilized with 20-10-20 liquid NPK fertilizer during the growing season. Plants are root tight 16 weeks following germination. *P. groenlandica* seedlings are fertilized with 20-20-20 liquid NPK at 100 ppm once per month during active growth.
Length of Active	16 weeks

Growth Phase:	
Hardening Phase (from end of active growth phase to end of growing season; primarily related to the development of cold-hardiness and preparation for winter):	Irrigation of is gradually reduced in September and October. Plants are leached with clear water once before winterization.
Length of Hardening Phase:	*P. contorta*: 5 months. *P. groenlandica*: 4 weeks.
Harvesting, Storage and Shipping (of seedlings):	Overwinter in outdoor nursery under insulating foam cover and snow.
Length of Storage (of seedlings, between nursery and outplanting):	5 months.
Other Comments (including collection restrictions or guidelines, if available):	*Pedicularis ornithorhyncha* is bumblebee pollinated with a 74% pollination rate in nature (Macior 1973) *Pedicularis ornithorhyncha* is a hemi-parasite (BC Flora).
INFORMATION SOURCES	
References (full citations):	1. USDA PLANTS Profile http://plants.usda.gov/java/profile?symbol=PEOR 2. Pojar, J. and A. MacKinnon *eds*. 1994. Revised Plants of the Pacific Northwest Coast. Vancouver, B.C.: Lone Pine. 3. Biels, D. 2000. Flora of Mt. Rainier National Park. Corvallis, OR: Oregon State University Press. 4. Macior, L. W. 1973. The pollination ecology of Pedicularis on Mount Rainier. American Journal of Botany 60(9) 863-871. 5. University of Washington Digital Collections http://content.lib.washington.edu/u?/plants,294 6. E-Flora BC http://linnet.geog.ubc.ca/Atlas/Atlas.aspx?sciname=Pedicularis%20ornithorhyncha 7. BC Flora

	http://www.bcflora.org/data/taxon/3419.php 8. University of Vermont "Propagation Methods for Herbaceous Perennials" http://www.uvm.edu/pss/ppp/proptabP.htm 9. Protocol: *Pedicularis contorta*. Native Plant Nursery, Glacier National Park. http://www.nativeplantnetwork.org/network/view.asp?protocol_id=217 10. Protocol: *Pedicularis groenlandica*. Native Plant Nursery, Glacier National Park. http://www.nativeplantnetwork.org/network/view.asp?protocol_id=218
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Date Protocol Created or Updated (MM/DD/YY):	04/16/08

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