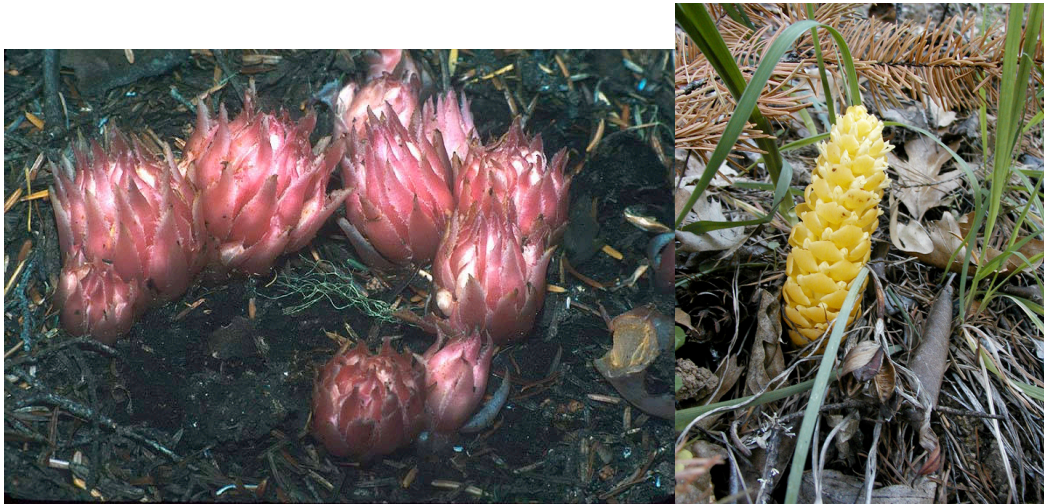


Plant Propagation Protocol for *Boschniakia hookeri* (Vancouver Groundcone)
 ESRM 412 – Native Plant Production



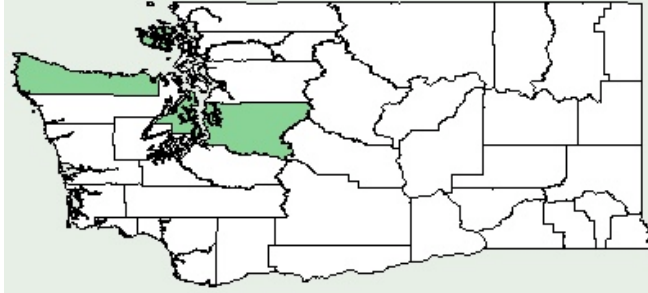
Top Photos from Source 4; Bottom Photos from Source 8 and Source 9, respectively

TAXONOMY	
Family Names	
Family Scientific Name:	Orobanchaceae (1)
Family Common Name:	Broomrape family (1)
Scientific Names	
Genus:	<i>Boschniakia</i> (1)
Species:	<i>Hookeri</i> (1)
Species Authority:	Walpers (15)

Variety:	Not found
Sub-species:	None found
Cultivar:	N/A
Authority for Variety/Sub-species:	N/A
Common Synonym(s) (include full scientific names (e.g., <i>Elymus glaucus</i> Buckley), including variety or subspecies information)	<i>Boschniakia strobilacea</i> auctt. non A. Gray (2)
Common Name(s):	Vancouver Groundcone (3), Poque (7)
Species Code (as per USDA Plants database):	BOHO

GENERAL INFORMATION

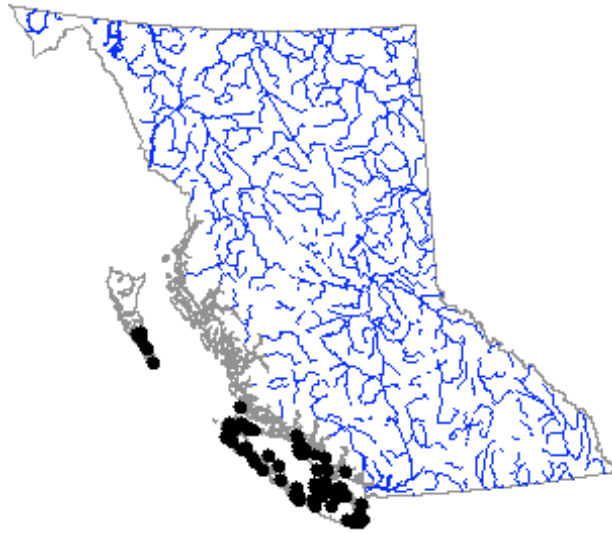
Geographical range (distribution maps for North America, Washington state, and BC)	 <p align="right">(1)</p>
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PLANTS
Database

BOHO

(1)



(4)

Ecological distribution (ecosystems it occurs in, etc):

Vancouver groundcone grows in temperate coastal forests where rain is moderate; it can be found in virtually any understory, but it prefers closed-canopy forests (but not Douglas fir forests) (4). The following chart summarizes ecological information regarding Vancouver groundcone:

ECOLOGY

Ecological Framework for *Boschniakia hookeri*

Site Information	Value / Class

	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 5px;">(SMR) [0 - very xeric; 4 - mesic; 8 - hydric]</td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td style="text-align: center; padding: 5px;">Modal Nutrient Regime Class</td> <td colspan="4" style="text-align: center; padding: 5px;"><u>Poor</u></td> </tr> <tr> <td colspan="5" style="padding: 5px;">Source: <u>Klinkenberg 2008 (5)</u></td> </tr> <tr> <td colspan="5" style="padding: 5px;">Pojar offers that Vancouver groundcone usually grows with salal (<i>Gaultheria shallon</i>) at lower elevations in southwestern British Columbia and in southern to northern California (7).</td> </tr> </table>	(SMR) [0 - very xeric; 4 - mesic; 8 - hydric]					Modal Nutrient Regime Class	<u>Poor</u>				Source: <u>Klinkenberg 2008 (5)</u>					Pojar offers that Vancouver groundcone usually grows with salal (<i>Gaultheria shallon</i>) at lower elevations in southwestern British Columbia and in southern to northern California (7).				
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Climate and elevation range	Vancouver groundcone grows well in maritime summer-dry, cool mesothermal climates (4). It decreases in abundance as latitude and elevation increase (4). Its minimum elevation is 2 meters, and its maximum elevation is 840 meters; its average elevation is 251 meters (5, see chart above).																				
Local habitat and abundance; may include commonly associated species	According to the E-Flora database designed by the University of British Columbia, Vancouver groundcone is “parasitic on <i>Gaultheria shallon</i> [salal] in moist to mesic forests in the lowland zone; locally frequent on S Vancouver Island and the Gulf Islands, rare on the Queen Charlotte Islands and SW mainland; S to N CA” (4). The Washington State Department of Natural Resources describes its habitat: “ <i>Boschniakia hookeri</i> grows in dense stands of salal and young forest stands, near salt water from 120 to 500 ft (37 to 152 m). Associated species include western hemlock (<i>Tsuga menziesii</i>), western red cedar (<i>Thuja plicata</i>), Sitka spruce (<i>Picea sitchensis</i>), and Douglas fir (<i>Pseudotsuga menziesii</i>)” (15).																				
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	Vancouver groundcone is “a shade-tolerant/intolerant, submontane to montane, Pacific North American parasite” (4). Vancouver groundcone is a root-parasite; it connects to the roots of plants and derives its nutrition from these plants (7). It is most commonly parasitic on salal, kinnikinnick (<i>Arctostaphylos uva-ursi</i>), and evergreen huckleberry (<i>Vaccinium ovatum</i>) (7, 15).																				
Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc)	<p>The USDA classifies Vancouver groundcone as a forb/herb (1). It is native to both British Columbia and the United States (4). E-flora summarizes the plant with the following description:</p> <p style="margin-left: 40px;"><i>General:</i> Parasitic herb from a coarse fleshy root and thickened stem-base; stems single or clustered, stout, up to 3 cm thick above, yellow to red or purple, 8-12 cm tall.</p> <p style="margin-left: 40px;"><i>Leaves:</i> Basal leaves lacking; stem leaves scaly-bracteate, alternate, the bracts entire,</p>																				

overlapping like the bracts on a conifer cone.

Flowers:

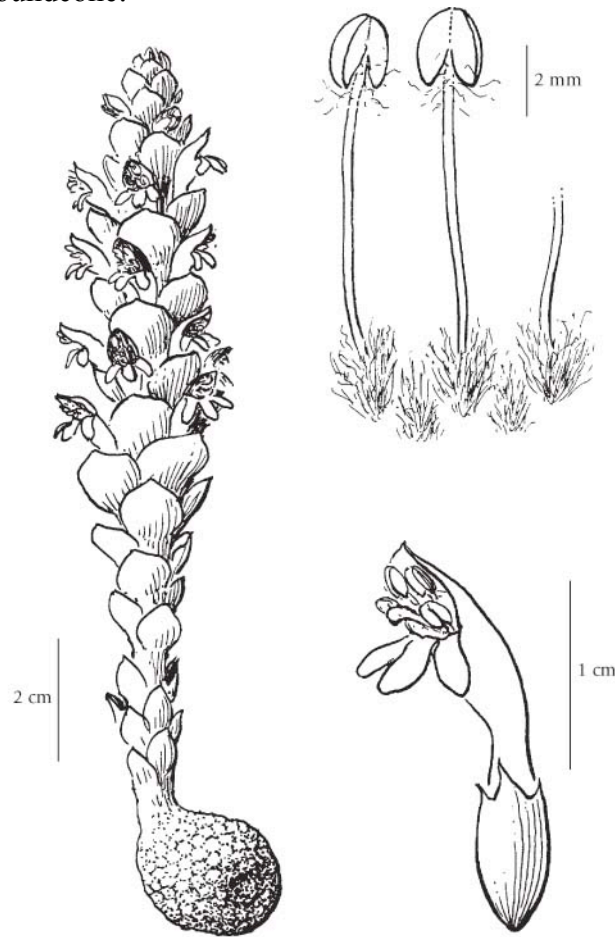
Inflorescence of numerous flowers in dense spikes, each flower subtended by a bract; corollas yellow to purple, 1-1.5 cm long with the lower lip shorter than the upper lip; calyces with 2-3 lobes; filaments with tufts of basal hairs.

Fruits:

Capsules, 1-1.5 cm long; seeds numerous, minute, honeycombed. (4)

One groundcone plant can produce more than one-third of a million seeds (7).

The *Illustrated Flora of BC* provides the following illustration of Vancouver groundcone:



Boschniakia hookeri

(6).

Furthermore, as Vancouver groundcone is parasitic, it does not produce its own chlorophyll (15).

PROPAGATION DETAILS

NOTE: Because Vancouver groundcone is a parasitic plant, there is sparse propagation information available for this plant.

Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):	N/A
Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):	Seeds (7)
Propagation Method (Options: Seed or Vegetative):	Seed (4, 7)
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Seeds (10)
Stock Type:	No information found
Time to Grow (from seeding until plants are ready to be outplanted):	Seeds may not grow for 7 to 12 years, even decades, after dispersal (10, 11, 12, 13). No specific time range for plant growth could be found.
Target Specifications (size or characteristics of target plants to be produced):	Vancouver groundcone grows to 12 cm at its mature height, so a seedling of a few centimeters is the targeted height for outplanting (7, 13).
Propagule Collection (how, when, etc):	Seeds are collected in late June or early July (12, 15).
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Seeds can survive for decades in soil after they are dropped from the flower (11, 12, 13).

Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	Seeds should not be sown until ripe (10). Seeds require a one to two week precondition period at a temperature between 10 and 30 degrees C in a moist environment (12). Seeds cannot begin to germinate until a chemical signal from a host plant is received (11, 12, 13).
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	Sow the seed in an area where there is a host plant, such as salal (10, 7). The seeds may be either planted in a pot in a greenhouse or in situ (10). A host plant is usually within a few millimeters of the Vancouver groundcone seed (12). Light inhibits germination (12). The seed grows best when it is sown 10 cm below the soil (12).
Establishment Phase (from seeding to germination):	No information found
Length of Establishment Phase:	No information found
Active Growth Phase (from germination until plants are no longer actively growing):	The active growth phase initiates after the seed receives a chemical signal from a host plant (11, 12, 13).
Length of Active Growth Phase:	No information found
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):	No information found
Length of Hardening Phase:	No information found
Harvesting, Storage and Shipping (of seedlings):	Seedlings may be harvested after growing for one summer in the greenhouse (10).
Length of Storage (of seedlings, between nursery and outplanting):	No information found
Guidelines for	Outplant the seedling near a host plant to ensure survival (10, 12).

<p>Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):</p>	<p>Washington State Department of Natural Resources warns, “any disturbance to the immediate habitat, such as timber harvest, development, and recreational activities, may be harmful” (15).</p>
<p>Other Comments (including collection restrictions or guidelines, if available):</p>	<p>Washington State Department of Natural Resources cites that “Additional inventory and information on the distribution of <i>B. hookeri</i> is needed. Appropriate habitats in Clallam, Kitsap, and Mason counties should be systematically surveyed for additional populations and the documented occurrences should be re-visited” (15). Couple this with the fact that it is a root parasite, Vancouver groundcone has limited information available about its propagative behavior.</p>

INFORMATION SOURCES

<p>References (full citations):</p>	<ol style="list-style-type: none"> 1. “Plant Profile: <i>Boschniakia hookeri</i>.” USDA Plant Profiles On-line. http://plants.usda.gov/java/nameSearch?keywordquery=Vancouver+groundcone&mode=comname&submit.x=17&submit.y=13. May 28, 2009. 2. “<i>Boschniakia hookeri</i>.” The Burke Museum of Natural History and Culture On-line. http://biology.burke.washington.edu/herbarium/imagecollection.php?Genus=Boschniakia&Species=hookeri. May 28, 2009. 3. “ITIS Report: <i>Boschniakia hookeri</i> Walp.” ITIS On-line. “<i>Boschniakia hookeri</i>.” May 28, 2009. 4. Klinkenberg, Brian. (Editor). “E-Flora BC: Electronic Atlas of the Plants of British Columbia.” 2009. E-Flora BC: Electronic Atlas of the Plants of British Columbia [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. [Accessed: 5/30/2009 1:48:00 PM] 5. Klinkenberg, Brian (Editor). “ECOLOGICAL INFORMATION DERIVED FROM THE BEC DATABASE.” 2008. E-Flora BC: Electronic Atlas of the Plants of British Columbia [www.eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver. [Accessed: 5/30/2009 2:35:00 PM] 6. Douglas, G.W., D.V. Meidinger and J. Pojar (editors). 2002. Illustrated Flora of British Columbia. B.C. Ministry of Sustainable Resource Management and B.C. Ministry of Forests. Victoria. 7. Pojar, Jim and Andy MacKinnon. <i>Plants of the Pacific Northwest Coast:</i>
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	<p><i>Washington, Oregon, British Columbia & Alaska.</i> Vancouver: Lone Line, 1994.</p> <p>8. "<i>Boschniakia hookeri</i>." University of Washington Libraries On-line. http://content.lib.washington.edu/cdm4/item_viewer.php?CISOROOT=/plants&CISOPTR=468&CISOBOX=1&REC=1. May 30, 2009.</p> <p>9. "<i>Boschniakia hookeri</i>: Vancouver Groundcone." CalPhotos: University of California Berkeley On-line. http://calphotos.berkeley.edu/cgi/img_query?query_src=photos_index&enlarge=0000+0000+0206+0481. May 30, 2009.</p> <p>10. "<i>Boschniakia hookeri</i>." Plants for a Future Database On-line. http://www.ibiblio.org/pfaf/cgi-bin/arr_html?Orobanche+tuberosa. May 31, 2009.</p> <p>11. Alejandro Pérez-de-Luque, Hanan Eizenberg, Jan H. Grenz, Josefina C. Sillero, Carmen Ávila, Joachim Sauerborn, and Diego Rubiales. "Broomrape management in faba bean." Available on-line 26 March 2009. Accessed on-line 31 May 2009. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6M-4VXJVX1-1&_user=582538&_rdoc=1&_fmt=&_orig=search&_s=ort=d&view=c&_acct=C000029718&_version=1&_urlVersion=0&_userid=582538&md5=bedb732fe76ee10e6dcf82279ba20af9.</p> <p>12. "Broomrape." California Department of Food and Agriculture on-line. http://www.cdffa.ca.gov/PHPPS/ipc/weedinfo/orobanche.htm#anchor711880. May 31, 2009.</p> <p>13. C. Parker and C.R. Riches. "Parasitic Weeds of the World: Biology and Control." CAB International: Wallingford, 1993.</p> <p>14. "Native Seeds Harvesting Dates." Native Plant Study Group On-line. http://www.npsg.ca/downloads/harvesting_dates.pdf. May 31, 2009.</p> <p>15. "<i>Boschniakia hookeri</i> Walpers." Washington State Department of Natural Resources On-line. http://www1.dnr.wa.gov/nhp/refdesk/fguide/pdf/boshoo.pdf. May 31, 2009.</p>
<p>Other Sources Consulted (but that contained no pertinent information) (full citations):</p>	<p>1. "Global Change Master Directory: Forest Management" Global Change Master Directory NASA On-line. http://gcmd.nasa.gov/KeywordSearch/Keywords.do?Portal=GCMD&KeywordPath=Parameters%7CAGRICULTURE%7CFOREST+SCIENCE%7CFOREST+MANAGEMENT&MetadataType=0&lbnode=mdlb2. May 28, 2009.</p>

	<p>2. Biogeoclimatic Ecosystem Classification Program On-line. http://www.for.gov.bc.ca/hre/becweb/. May 29, 2009.</p> <p>3. "Garden Guide: Vancouver Groundcone." Garden Guides On-line. http://www.gardenguides.com/plants/plant.asp?symbol=BOHO. May 30, 2009.</p> <p>4. Kartesz, J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. 2nd edition. 2 vols. Timber Press, Portland, OR.</p> <p>5. "<i>Boschniakia hookeri</i>." NatureServe Explorer On-line. http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Boschniakia+hooker. May 30, 2009.</p> <p>6. "<i>Boschniakia hookeri</i> Walp." University of California, Berkeley: Jepson Flora Project: Jepson Interchange for California Floristics On-line. http://ucjeps.berkeley.edu/cgi-bin/get_cpn.pl?Boschniakia%20hookeri. May 30, 2009.</p> <p>7. Hickman, James C. <i>The Jepson Manual: Higher Plants of California</i>. Berkeley: University of California Press, 1993.</p>
Protocol Author (First and last name):	Andrew Lurker
Date Protocol Created or Updated (MM/DD/YY):	May 30, 2009

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