

Plant Propagation Protocol for *Penstemon serrulatus*

ESRM 412 – Native Plant Production



Penstemon serrulatus, Skamania County, Washington. (Photo with kind permission of Gerry Carr, 2007.)(22)

TAXONOMY	
Family Names	
Family Scientific Name:	Scrophulariaceae (also placed in Plantaginaceae and Veronicaceae)(30)
Family Common Name:	Figwort
Scientific Names	
Genus:	<i>Penstemon</i>
Species:	<i>serrulatus</i>

Species Authority:	Menzies ex Sm. [H&C]
Authority for Group/Subgenus	Benth./(Benth.) Gray (17)
Variety:	
Subspecies:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) (include full scientific names (e.g., <i>Elymus glaucus</i> Buckley), including variety or subspecies information)	<i>Penstemon diffusus</i> Dougl. ex. Lindl. <i>Penstemon diffusus</i> var. <i>albiflorus</i> Hardin <i>Penstemon serrulatus</i> 'Albus'
Common Name(s):	Cascade beardtongue, Cascade <i>Penstemon</i> , coast <i>Penstemon</i> , serrulate <i>Penstemon</i>
Species Code (as per USDA Plants database):	PESE5
GENERAL INFORMATION	

Geographical range (distribution maps for North America and Washington state)

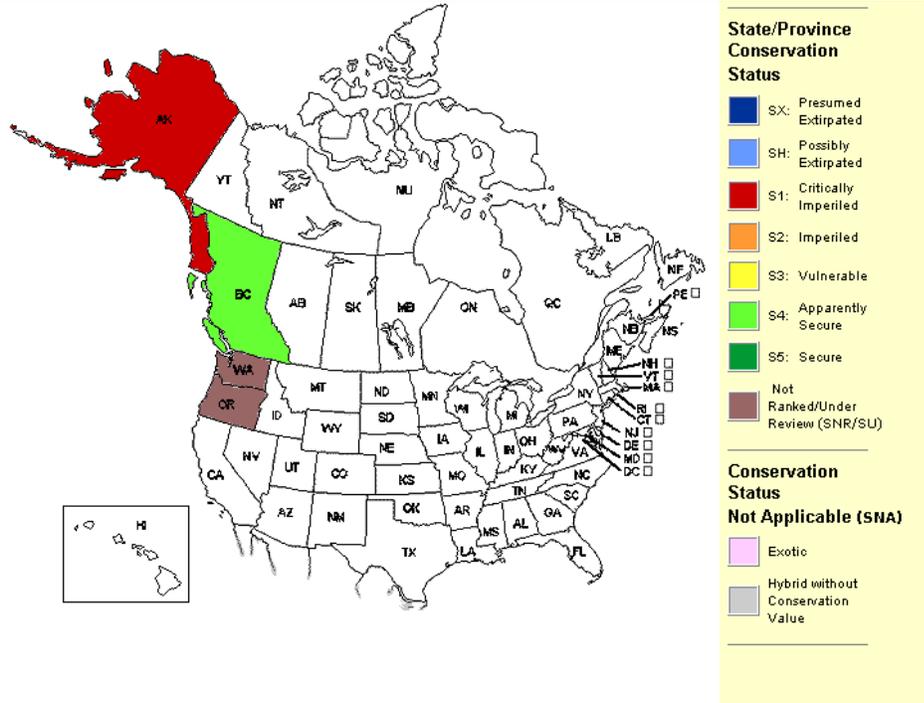


Figure 1: Native distribution of *Penstemon serrulatus*.(22)

Southern Alaska to the west side of the Coast Mountains, in southwest British Columbia. Extending south along the west side of the Cascade Range throughout western Washington and northwest Oregon. Also in the Olympic Mountains. (2,9)

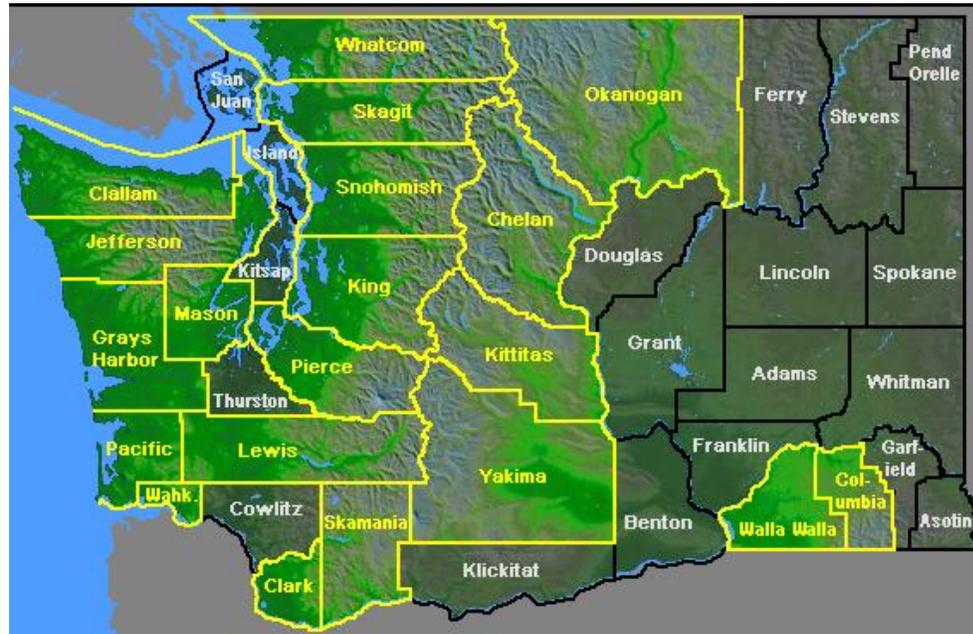


Figure 2: Washington distribution by county.(9)

<p>Ecological distribution (ecosystems it occurs in, etc.):</p>	<p>Zones 6a to 9a in part shade.</p> <p>Forest openings in moist to wet sites (stream and river banks, rocky wooded slopes, gullies); Tundra, and avalanche tracks. On wetter sites than most <i>Penstemon</i> spp. but where soils dry up by late summer. (2,9, 20,24,27)</p> <p>Wetland Status</p> <p>In Alaska, <i>P. serrulatus</i> is a facultative wetland plant, preferring waterlogged situations but occasionally occurring in uplands.</p> <p>In the western mountains, valleys, and coastal regions and in arid western regions, <i>P. serrulatus</i> is a facultative upland plant, usually occurring in the uplands but occasionally growing as a hydrophyte. (31)</p>
<p>Climate and elevation range</p>	<p>Lowland to lower subalpine (0–6,000 feet) (2, 9, 21)</p>
<p>Local habitat and abundance; may include commonly associated species</p>	<p>Locally common in appropriate habitats; otherwise occurring frequently to occasionally.</p> <p>Global conservation status (updated Aug. 8, 1991) is G4: apparently secure. National statuses for Canada and the United States are not ranked. (21)</p>
<p>Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)</p>	<p><i>P. serrulatus</i> may be a pioneer species.</p> <p>Many <i>Penstemon</i> spp. are pioneer species (4,26). <i>P. serrulatus</i> was a pioneer on barren pumice plains on Mt. Saint Helens after the 1980 volcanic eruptions.(33)</p>
<p>Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc.)</p>	<p>Life form: Perennial herb with woody base; 30–70 cm.</p> <p>Longevity: Short-lived (10+ years).</p> <p>Leaves: Cauline, glabrous below, minutely hirsute above; almost entire or finely serrate to saw-toothed margins (hence “<i>serrulatus</i>”).</p> <p>Inflorescence: Blooms June–early August. Usually a crowded thyrse at apex. Flowers deep blue to dark purple, tubular, glabrous (or with sparse beard on palate), 17–25 mm.</p> <p>4 fertile and 1 sterile stamens (hence “pente-” (“5”) and “-stemon” (“stamens”)).</p> <p>Anther sacs closed on outer ends. Horseshoe-shape anthers indicate Type II</p>

	<p>(subgenus <i>Saccanthera</i>) <i>Penstemon</i>.</p> <p>Fruits: 5–8 mm long capsules. (9, 12, 20, 23, 24, 27)</p> <p>Scent: <i>P. serrulatus</i> ‘Albus’ stinks in warm, humid weather. (24)</p>
PROPAGATION DETAILS	
<p>Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):</p>	
<p>Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos, and/or Other Propagules):</p>	Plants
<p>Propagation Method (Options: Seed or Vegetative):</p>	<p>Seed, vegetative</p> <p>Note: Information herein for the genus <i>Penstemon</i> in general may not precisely apply to <i>P. serrulatus</i>.</p> <p>Seeds—<i>Penstemon</i> spp. Propagates easily from seed, although seedlings are susceptible to Fusarium wilt (damping off). (21, 15, 20) Species come fairly true from seed.(1)</p> <p>Vegetative—<i>Penstemon</i> spp. Propagates easily by the following methods:</p> <ul style="list-style-type: none"> • Root, softwood, or semihardwood cuttings

	<ul style="list-style-type: none"> • Layering • Dividing • Micropropagating from lateral buds used as explants <p>(1,10,21,25)</p>
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	<p><i>Penstemon</i> spp.: Pots, trays, water, or moss roll (1)</p> <p><i>P. lyallii</i> and <i>P. procerus</i>: Container (plug) (7,8)</p> <p>Note: Propagation methods described herein for <i>P. lyallii</i> and <i>P. procerus</i> might not work for <i>P. serrulatus</i>; however, species overlap geographically and/or ecologically.</p>
Stock Type:	<p><i>P. serrulatus, Penstemon</i> spp.: unspecified</p> <p><i>P. lyallii, P. procerus</i>: 172 ml Cone-tainers (7,8)</p>
Time to Grow (from seeding until plants are ready to be outplanted):	<p><i>Penstemon</i> spp.: 3–4 months (1)</p> <p><i>P. lyallii, P. procerus</i>: 4 months (7,8)</p>
Target Specifications (size or characteristics of target plants to be produced):	<p><i>P. serrulatus, Penstemon</i> spp.: unspecified</p> <p><i>P. lyalli, P. procerus</i>: (7,8)</p> <ul style="list-style-type: none"> • 6 to 10 true leaves • Height: 6 cm • Root system—firm plug
Propagule Collection (how, when, etc):	<p><i>P. serrulatus</i>: unspecified</p> <p>Seeds</p> <p><i>Penstemon</i> spp.: Hand-strip or cut flower stalk into a container when seeds start darkening in the ovary, before the capsules start opening (6–8 weeks after full bloom).(4) Capsules open after harvest. Dry to prevent molding.(20)</p> <p><i>P. lyallii</i> and <i>P. procerus</i>: Collect seeds late August in paper bags. Store in well-</p>

	<p>ventilated shed. (7,8)</p> <p>Vegetative propagation—<i>Penstemon</i> spp.</p> <p><u>Root cuttings:</u> Take root crown cuttings with attached leaf rosettes. (Kruckeberg)</p> <p><u>Softwood cuttings:</u> Options include:</p> <ul style="list-style-type: none"> • Taking softwood cuttings from nonflowering side shoots of old plants in fall to get plants next season (10) • Taking nodal cuttings spring to fall (1) • Taking nonflowering tip cuttings approximately 10–12.5 cm long; then trimming with sharp knife immediately below leaf node (2) <p><u>Semihardwood cuttings:</u> Take semiripe nodal or stem-tip cuttings late summer to early fall. (1,28)</p> <p>Take tip cuttings from nonflowering stems or from firm, nonwoody parts near the base of flowering stems. Cuttings should be just a few inches long, with four to six pairs of nodes, depending on plant size, leaf size, and node spacing.(2)</p> <p><u>Division:</u> Divide into small clumps winter to spring, depending on climate, as follows: (2)</p> <ul style="list-style-type: none"> • Divide early springtime if plants need time to recover before hot weather. • Divide after bloom or the worst summer heat is past if more appropriate for the climate. <p>Mature <i>Penstemon</i> can be divided biennially.(5,2)</p>
<p>Propagule Processing/ Propagule Characteristics (including seed density (# per pound), seed longevity, etc):</p>	<p>For <i>Penstemon</i> spp.</p> <p>Seed</p> <p><u>Storage/longevity:</u> Seeds are orthodox, often germinating better after 6 months of proper storage</p> <p>Seeds remain viable for at least 5 years.(2, 20) Those up to 15 years old may be 50% viable. (20)</p> <p>Softwood cuttings (2)</p> <ol style="list-style-type: none"> 1. Remove bottom two leaves gently. 2. Cut 1/3 off remaining leaves to prevent desiccation. 3. Dip proximal end in hormone rooting powder. <p>Divisions</p> <p>To prepare plants for division, mound soil in center of crown in spring to stimulate rooting. Divide rooted crown in fall.(2)</p>

<p>Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):</p>	<p>For <i>Penstemon</i> spp.</p> <p>Cleaning Seedlots can easily be cleaned to >95% purity using the following methods:</p> <ul style="list-style-type: none"> • For small seedlots: Shake seeds free of capsules and screen. (Meyers) • For commercial seedlots: Process with hammermill or barley debearder and then use a fanning mill.(20) <p>Seed dormancy Requirements for germination vary among species and even within a species. (20) Growth may be slow and uneven.(10)</p> <p><u>Temperature:</u> Many northern species require long cold-moist stratification. Some <i>Penstemon</i> spp. germinate best if temperatures fluctuate. Others germinate without stratification and are unaffected or negatively affected by stratification. (20)</p> <p><u>Timing:</u> For cold stratification, the length of time seeds should be stratified correlates with the time they would naturally spend under snow cover.(20)</p> <p><u>Methods:</u></p> <ul style="list-style-type: none"> • Sow shallowly Nov. through early Mar. (in cold climates) in a moist mix of vermiculite, perlite, and/or sand and place outside.(2) • Refrigerate seeds in damp perlite or sand in a plastic bag. Check moisture regularly, and add a few drops of water as needed. Remove from refrigerator when begin to germinate.(2) • For stratifying <i>Penstemon</i> spp. 28–56 days at 15 °C may work. (combined recommendations of information sources 10 and 28) • For <i>P. lyalli</i>: 30 to 90 days cold, moist stratification. Seeds are placed in fine mesh bags and buried in moist peat moss in ventilated containers under refrigeration at 1–3 °C.(7) • For <i>P. procerus</i>: 30 to 90 days cold, moist stratification. Seeds are lightly covered with medium. Germination occurs at 21 °C.(8) <p><u>Hormones:</u> Gibberellic acid can break seed dormancy or reduce stratification time in some species.</p> <p><u>Light:</u> Germination of gibberellic-acid-treated seed likely benefits from constant temperature and darkness.(6) Otherwise, light does not seem to matter.(20)</p> <p><u>Scarification:</u> Some species need scarification to break seed dormancy. (2,20)</p>
<p>Growing Area Preparation /Annual Practices</p>	<p>Sustainable, economical coconut coir can replace peat in propagation and growing media.(10)</p> <p>For <i>Penstemon</i> spp., <i>P. lyalli</i>, and/or <i>P. procerus</i>(2,7,8,21,25)</p>

<p>for Perennial Crops (growing media, type and size of containers, etc.):</p>	<p>Seeds</p> <p><u>Media:</u> For germinating seeds, use a coarse, fast-draining mix that hasn't previously been used in agriculture, such as:</p> <ul style="list-style-type: none"> • A mixture of vermiculite, perlite, and/or sand.(2) • 6:1:1 milled sphagnum peat, perlite, and vermiculite, with Osmocote controlled release fertilizer and Micromax fertilizer (12% S, 0.1% B, 0.5% Cu, 12% Fe, 2.5% Mn, 0.05% Mo, 1% Zn) at 1 g. Osmocote and 0.20 g. Micromax per 172 ml Cone-tainer.(20) <p><u>Containers:</u></p> <ul style="list-style-type: none"> • Use elongated containers, such as those used in conifer production.(20) • For <i>P. procerus</i> and <i>P. lyallii</i> 127 ml Cone-tainers are used.(7,8) <p>Vegetative propagation</p> <p><u>Media:</u> Use a thoroughly dampened, 3–5 inch mixture of compost and perlite or a mixture of perlite, vermiculite, and/or sand.(2)</p> <p><u>Containers:(2)</u></p> <ul style="list-style-type: none"> • Use 9 cm pots for up to five cuttings. • Use modular trays for larger quantities.
<p>Establishment Phase (from seeding to germination):</p>	<p>For <i>Penstemon</i> spp.</p> <p>Nursery propagation</p> <p>Spring-sown seed and softwood cutting taken early in the year are easily propagated with bottom heat. (1,2,25)</p> <p>Germinate in shade or under cover at 13–20 °C for 14–35 days. (5,10,20)</p> <p>Outdoor seeding (2)</p> <ol style="list-style-type: none"> 1. Loosen soil in late fall. 2. Scatter the seed thinly on top. 3. Cover with thin layer coarse sand or potting soil.
<p>Length of Establishment Phase:</p>	<p>For <i>Penstemon</i> spp.</p> <p>Seed sown outdoors in late fall produces plants sturdy enough to transplant to permanent sites by mid-spring.(2)</p> <p>Softwood cuttings (nonflowering side shoots from old plants) in fall produce plants for next season.(10)</p> <p>For <i>P. lyalli</i> (7)</p> <p>3 weeks. Germination is uniform, with two leaves emerging 2 weeks after germination. After being thinned, seedling shoots and roots develop rapidly.</p>

	<p>For <i>P. procerus</i> (8)</p> <p>4 weeks. Germination is uniform under greenhouse conditions, with seedlings emerging 5 days after sowing in greenhouse and true leaves appearing 2 weeks after germination. After being thinned, seedling shoots and roots develop rapidly.</p>
<p>Active Growth Phase (from germination until plants are no longer actively growing):</p>	<p>For <i>Penstemon</i> spp.</p> <p>Don't overfertilize or overwater seedlings. Doing so can increase susceptibility to Fusarium wilt (damping off).(2,20)</p> <p>Seeds</p> <ol style="list-style-type: none"> 1. Place germinated seeds in containers atop a growing medium. 2. Expose to bright light—such as daylight or a bank of fluorescent lights 3–5 inches above them—14–16 hours a day. A greenhouse is ideal. 3. Feed young seedlings with dilute liquid fertilizer once they have true leaves. 4. When seedlings have two pairs of true leaves, transplant into individual pots or containers into a mix of garden soil with sand, pumice, or another lightener.(2) <p>Vegetative propagules</p> <p><i>Penstemon</i> spp. easily propagate vegetatively.</p> <p><u>Cuttings:</u>(2) Protect fall-rooted cuttings from frost over winter, although use as little added heat as possible and provide good ventilation.</p> <p>Transfer plants to a soil mix and apply diluted liquid fertilizer when roots are well developed. Harden plants when they are well rooted and weather permits.</p> <p><u>Division:</u>(2)</p> <ol style="list-style-type: none"> 1. Gently loosen soil at base of plant. Plants are ready to divide if separate rosettes are formed with their own roots. 2. Water the plant well. 3. Dig it up the following day, and break into rosettes, each with roots, in a shaded, cool location. 4. In temperate climates, you can immediately replant. <p>In harsher climates, pot each rosette in moist soil, water well, and set in a shaded spot to recover. Then harden off.</p>

Length of Active Growth Phase:	<p><u><i>P. serrulatus, Penstemon spp.</i></u>: unspecified</p> <p><u><i>P. lyalli</i></u>: 8 weeks (7)</p> <p><u><i>P. procerus</i></u>: 9 weeks (8)</p>
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):	<p>For <i>Penstemon spp.</i></p> <p>Gradually expose plants to bright sunlight, wind, and low humidity. Move trays or pots outside in good weather, and put them back under cover or lights in inclement weather. When plants no longer wilt, replant in the ground.(2)</p> <p>For <i>P. procerus</i> and <i>P. lyalli</i></p> <p>In fall fertilize with 10-20-20 liquid NPK at 200 p.p.m., flush pots with water, and gradually reduce irrigation frequency September and October. A final irrigation is applied before covering for the winter.(7,8)</p>
Length of Hardening Phase:	<p><u><i>P. serrulatus, Penstemon spp.</i></u>: unspecified</p> <p><u><i>P. lyalli, P. procerus</i></u>: 4 weeks (7,8)</p>
Harvesting, Storage and Shipping (of seedlings):	<p><u><i>P. serrulatus, Penstemon spp.</i></u>: unspecified</p> <p><u><i>P. procerus</i></u>: Total time to harvest is 4 months. Harvest date: September. Storage: Overwinter in outdoor nursery under insulating foam and snow cover.(8)</p> <p><u><i>P. lyalli</i></u>: Total time to harvest is 4 months. Harvest date: July. Storage: Overwinter in outdoor nursery under insulating foam and snow cover.(7)</p>
Length of Storage (of seedlings, between nursery and outplanting):	<p><u><i>P. serrulatus, Penstemon spp.</i></u>: unspecified</p> <p><u><i>P. lyalli, P. procerus</i></u>: 5 months (7,8)</p>
Guidelines for Outplanting /Perform-	<p>For <i>Penstemon spp.</i></p> <p>Water transplants regularly until well established.</p>

<p>ance on Typical Sites (e.g., percent survival, height or diameter growth, elapsed time before flowering):</p>	<p><i>Penstemon</i> that are propagated by seed in early spring and later outplanted may flower the first year.(10,20) Divisions mature in 3–6 months.(2,5)</p>
<p>Other Comments (including collection restrictions or guidelines, if available):</p>	<p>Subgenera None accepted in the USDA Plants Database.(32) Note: Some sources specify Group II: subgenus <i>Saccanthera</i>.(3, 12,27) American <i>Penstemon</i> Society additionally classifies <i>P. serrulatus</i> in subsection Serrulati.(3) Further information For greater detail, see the American Penstemon Society website, at http://apsdev.org/welcome.html, sources below, and other online and print resources, which are innumerable.</p>
<p>INFORMATION SOURCES</p>	
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Date Protocol Created or Updated (MM/DD/Y Y):	06/10/12

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