

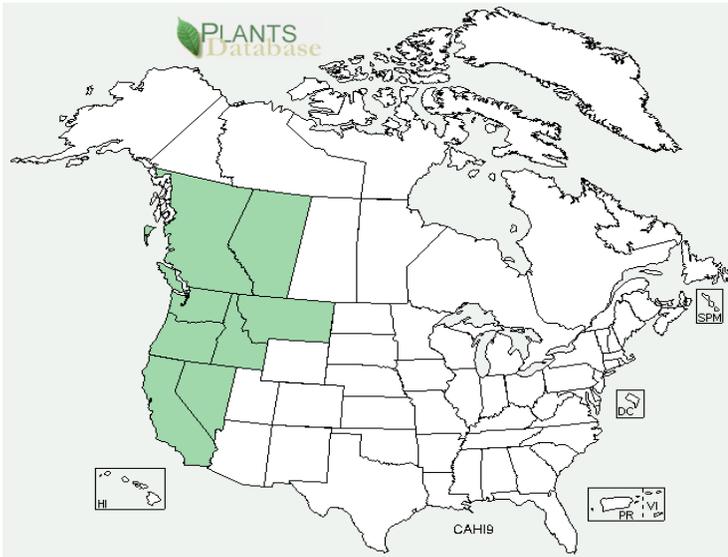
**Plant Propagation Protocol for *Castilleja hispida***

ESRM 412 – Native Plant Production

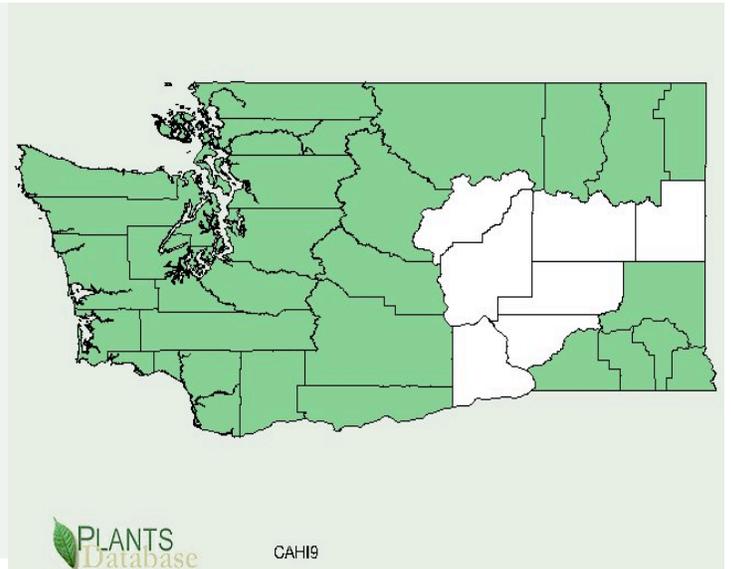
Spring 2014

Protocol URL: <https://courses.washington.edu/esrm412/protocols/CAHI9.pdf>

North America Distribution



Washington Distribution



Source: USDA PLANTS Database

**TAXONOMY**

<b>TAXONOMY</b>	
Plant Family	
Scientific Name	Scrophulariaceae
Common Name	Figwort Family
Species Scientific Name	<i>Castilleja hispida</i> Benth.
Scientific Name	<i>Castilleja hispida</i> Benth.
Sub-species	<i>Castilleja hispida</i> Benth. ssp. <i>acuta</i> Pennell <i>Castilleja hispida</i> Benth. ssp. <i>brevilobata</i> (Piper) T.I. Chuang & Heckard <i>Castilleja hispida</i> Benth. ssp. <i>hispida</i>
Cultivar	
Common Synonym(s)	<i>Castilleja angustifolia</i> var. <i>hispida</i> <i>Castilleja hispida</i> spp. <i>abbreviata</i>
Common Name(s)	Harsh indian paintbrush, acute indian paintbrush <sup>4</sup> , short-lobe indian paintbrush
Species Code (as per USDA Plants database)	CAHI9
<b>GENERAL INFORMATION</b>	
Geographical range	Found across southwestern Canada from Vancouver Island to southwestern Alberta, southward through northwestern Montana and northern Idaho to northeastern Oregon, west across Oregon

	and Washington to the Pacific coast (as far south as Benton County, OR.). <sup>4</sup> See above maps for distribution in North America and Washington state.
Ecological distribution	Prefers sunny locations such as meadows, forest openings and edges, and grassy slopes. <sup>5</sup>
Climate and elevation range	Grows best in dry openings in forests and meadows, from the coast to high elevations. <sup>1</sup>
Local habitat and abundance	Found from southwest Alberta to northwest Montana to Vancouver Island; south along the coast to Benton County, Oregon, and in the interior to Grant County, Oregon and Payette County, Idaho. <sup>3</sup>
Plant strategy type / successional stage	Seral
Plant characteristics	<p>Perennial, with erect, clustered stems, 20 to 60 centimeters tall. The lower leaves are entire and reduced; the upper leaves are larger with one to two pair of lateral lobes. The inflorescence is usually conspicuous, bright red or scarlet, sometimes yellow.<sup>3</sup></p> <p>Hemiparasitic; Though it does not always require a host plant, it may grow better with a host, such as Roemer's fescue (<i>Festuca roemerii</i>).<sup>1</sup></p> <p>It is an important larval host for Taylor's checkerspot (<i>Euphydryas editha taylori</i>) butterflies<sup>1</sup></p>
<b>PROPAGATION DETAILS</b>	
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	116 ml containers <sup>2</sup>
Time to Grow	5 months
Target Specifications	Height: 5 cm <sup>2</sup> Root system: firm plug in container <sup>2</sup>
Propagule Collection Instructions	<p>Seeds can be collected in midsummer for early spring flowering species and in late summer for mid-elevation species. High elevation species are collected during the fall.<sup>2</sup></p> <p>Dry dehiscent seed capsules ripen 8 to 10 weeks following pollinator activity. There are many tiny seeds per capsule. These are grayish to tan in color with a somewhat wrinkled or pitted surface.<sup>2</sup></p>
Propagule Processing/Propagule Characteristics	<p>Seed longevity may vary depending on population source. It is best to use seeds within 1-2 years.<sup>5</sup></p> <p>350,000 seeds per pound<sup>7</sup></p>
Pre-Planting Propagule Treatments	Imbibe freshly collected seeds in water for 4 to 8 hours and pour

	<p>off the water and any fine debris that might serve as a source of fungal contamination during stratification. Place imbibed seeds into cold moist stratification for 30 to 150 days, between layers of blotter paper in either open plastic bags or in Petri dishes in the refrigerator at 1 to 2 °C.<sup>2</sup></p> <p>Seeds of host plants are also stratified as required so that host and <i>Castilleja</i> seeds are ready for sowing at the same time.<sup>2</sup></p> <p>Species and populations within species responded to cold moist stratification to at least some degree. In general, populations from warmer, low elevation sites had shorter chilling requirements and more rapid germination following cold moist stratification than populations and species from higher and colder sites.<sup>2</sup></p>
Growing Area Preparation / Annual Practices for Perennial Crops	<p>Host plant is not required for seed germination.<sup>2</sup></p> <p>Sowing Method: Direct Seeding. Seeds should be sown thinly in 116 ml (7.0 in<sup>3</sup>) containers or Deep 606 tray-packs (6 cells/pack) and need to be only lightly covered with perlite mulch or a fine chick grit mulch to hold them in place.<sup>2</sup></p> <p>Growing medium used is 2:1:1 (v:v:v) mix of Sunshine Mix #2 (Sungro Horticulture Inc., Bellevue, Washington), large grade perlite, and sharp sterile sand for dry-land and upland species inhabiting rocky or well-drained soils. Species inhabiting riparian areas or moist high elevation meadows rich with organic matter are grown in pure Sunshine Mix #2 commercial growing medium.<sup>2</sup></p>
Establishment Phase Details	<p>Species will germinate well at moderate alternating greenhouse temperatures of 21 to 25 °C day and 10 to 16 °C night. Many northern and high elevation species, however, germinate to higher percentages at cooler temperatures.<sup>2</sup></p> <p>Germination percentages tend to be higher with seeds from low to mid-elevations and/or from warmer climates, whereas subalpine and alpine species tend to have lower germination percentages.<sup>2</sup></p>
Length of Establishment Phase	<p>Stratified seeds tend to germinate and emerge 10 to 14 days after sowing in the greenhouse.<sup>2</sup></p> <p>High elevation species and seed sources tend to germinate more slowly and over a several week period, even after a prolonged cold moist stratification.<sup>2</sup></p>
Active Growth Phase	<p>During active growth, paintbrush seedlings can be fertilized with a very low concentration of complete fertilizer (20N:20P<sub>2</sub>O<sub>5</sub>:20K<sub>2</sub>O) at one-quarter the label recommended rate.<sup>2</sup></p>
Length of Active Growth Phase	4 to 6 weeks <sup>2</sup>
Hardening Phase	During midsummer, seedlings grown in the greenhouse are moved

	outdoors to undergo hardening prior to outplanting. <sup>2</sup>
Length of Hardening Phase	At least 4 weeks prior to outplanting. <sup>2</sup>
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	Most are ready for outplanting 16 weeks after germination. <sup>2</sup>
<b>PROPAGATION DETAILS</b>	
Ecotype	Cuttings gathered on four separate occasions from the Yellow Island Preserve: March 11 <sup>th</sup> , March 25 <sup>th</sup> , April 11 <sup>th</sup> , and April 15 <sup>th</sup> . <sup>6</sup>
Propagation Goal	Plants
Propagation Method	Vegetative
Product Type	Propagules (Cuttings)
Stock Type	One-gallon plastic container
Time to Grow	4 months
Target Specifications	Root System: firm plug in container <sup>6</sup> Height:
Propagule Collection Instructions	Take cuttings in the shade and immediately wrap in moistened paper towels. Next put cuttings into an ice chest containing a pre-frozen blue ice container in the lid. Transport cuttings to a refrigerator that evening. <sup>6</sup>  Cuttings were from plants that had only recently emerged from the ground and consisted of soft, juvenile, vegetative growth. <sup>6</sup>
Propagule Processing/Propagule Characteristics	Plant cuttings the morning following collection. <sup>6</sup>
Pre-Planting Propagule Treatments	Remove cuttings in small batches for the refrigerator and prepare in the following manner: Remove a donor stem from the batch. Make an initial cut five to ten centimeters below the apical end, just below a leaf node. If the donor stock stem is long enough, make another cut five to ten centimeters below the initial one. In such cases, the top intermodal stem sections are removed from the lower cutting by cutting just above the uppermost leaf node. The cutting is then “wounded” by making a slight scratch at the basal end. <sup>6</sup>
Growing Area Preparation / Annual Practices for Perennial Crops	Dip cuttings in rooting hormone (3000 ppm IBA) and plant in the rooting medium, deep enough to anchor them, but not touching the bottom of the individual cell. <sup>6</sup>
Establishment Phase Details	Place each plug immediately onto a heated mist bench in greenhouse. <sup>6</sup>
Length of Establishment Phase	3 weeks <sup>6</sup>
Active Growth Phase	Transplant surviving plants into a one-gallon plastic container in identical growing medium as was in the plug flats. Place the one-gallon plastic containers back on the mist bed for one more week.

	After one week, remove plants from mist bed and hand water the soil in containers <sup>6</sup>  After planting, fertilize the cuttings with 20-20-20 water soluble fertilizer at a rate of 100 ppm every two weeks. <sup>6</sup>
Length of Active Growth Phase	4 weeks <sup>6</sup>
Hardening Phase	Grow in 1000 square foot Quonset-style “hoop” greenhouse (a house covered with a double layer of clear poly plastic with a dead air space between the layers inflated by a small fan). Greenhouse temperature should be set to 40 °F. If greenhouse temperatures exceed 90 °F, open vents at end of greenhouse. <sup>6</sup>
Length of Hardening Phase	6 weeks <sup>6</sup>
Harvesting, Storage and Shipping	
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	Once root space becomes constricted in the plug cells, transplant the plants. <sup>6</sup>  Plants grown from seeds with the earliest collection date (March 11 <sup>th</sup> ) had the highest survival rate of 81.25%. <sup>6</sup>
Other Comments	Most success can be achieved when cuttings are collected early in the growing season. <sup>6</sup>  Common pest was slug. To protect the cuttings, regular applicator of slug abit was used. <sup>6</sup>  Introduction of a host is often necessary for continued growth and development. <sup>3</sup>
<b>INFORMATION SOURCES</b>	
References	See Below
Other Sources Consulted	See Below
Protocol Author	Kayla Finnegan
Date Protocol Created or Updated	5/20/15

### References:

<sup>1</sup> Bush, Kelli. "SPP Plant Profile: Harsh Indian Paintbush (*Castilleja Hispida*) « Sustainability in Prisons Project." *Sustainability in Prisons Project*. The Evergreen State College, 18 Jan. 2012. Web. 15 May 2014. <<http://sustainabilityinprisons.org/blog/2012/01/18/spp-plant-profile-harsh-indian-paintbush-castilleja-hispida/>>.

<sup>2</sup> Luna, T. (April 01, 2005). PROPAGATION PROTOCOL FOR Indian Paintbrush CASTILLEJA SPECIES. *Native Plants Journal* (indiana University Press), 6, 1.)

<sup>3</sup> Wick, Dale; Luna, Tara. 2008. Propagation protocol for production of container *Castilleja rhexiifolia* Rydb. plants (172 ml conetainers); USDI NPS - Glacier National Park, West Glacier,

Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 15 May 2014). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

<sup>4</sup> Slichter, Paul. "Acute Indian Paintbrush, Harsh Paintbrush." : *Castilleja Hispida Var. Acuta* (Synonyms: *Castilleja Hispida Ssp. Acuta*, *Castilleja Taedifera*). Web. 20 May 2014. <<http://science.halleyhosting.com/nature/basin/5petal/figwort/paint/harsh.htm>>.

<sup>5</sup> Sprenger, Samantha M. *Castilleja Hispida*. Protocol. N.p., n.d. Web. <<http://depts.washington.edu/propplnt/Plants/castilleja%20hispida.htm>>.

<sup>6</sup> Schmidt, D. (1998). Restoration of a prairie ecosystem at the Yellow Island Preserve and the propagation of *Castilleja hispida* by vegetative cuttings.

<sup>7</sup> "Castilleja Hispida Plant." *FindTheBest*. N.p., n.d. Web. 21 May 2014. <<http://plants.findthebest.com/l/801/Castilleja-hispida>>.

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Young, J. A., & Young, C. G. (1992). Seeds of woody plants in North America. Portland, Or: Dioscorides Press.

Above is a revised version of the below protocol:

Found at <http://depts.washington.edu/proplnt/Plants/castilleja%20hispidia.htm>

*Castilleja hispida* Benth. (*Scrophulariaceae*)  
harsh Indian paintbrush



*Castilleja hispida* in its two very different color forms (it also occurs in various shades in between). Photo on left taken by Rod Gilbert 2003. Photo on right taken by Ben Legler 2004 at Deception Pass State Park, Skagit County. (Burke Herbarium)

## Climate, elevation

Low to mid elevations

## Range/ Local occurrence

From SW Alberta/ NW Montana west to Vancouver Island and south to Oregon and Idaho.

In Washington State, this species grows on both sides of the Cascades.

Note: there are two sub species of *C. hispida*.

## Habitat preferences

*C. hispida* prefers sunny locations such as meadows, forest openings and edges, and grassy slopes.

## Plant strategy type

Perennial. Like other members of the genus *Castilleja*, this plant is hemiparasitic. Though it may not be necessary, it will likely grow better with a host plant such as Roemer's fescue.

## Associated species

*Festuca idahoensis* var. *rhoemerii* (Roemer's fescue)

## May be collected as:

Seeds or cuttings. Do not try to transplant *Castilleja* species.

## Seed germination

There is conflicting information concerning the propagation of *C. hispida*. While some claim that it is extremely difficult, others have had good success. It has been observed that, though the seeds may be easily germinated, the seedlings often do not survive. This may be explained by summer drought, herbivory, or lack of a host plant.

Beth Lawrence explains in detail how to propagate another *Castilleja* species, *C. levisecta*, in her thesis entitled, "Studies to Facilitate Reintroduction of Golden Paintbrush (*Castilleja levisecta*) to the Willamette Valley, Oregon." It is quite likely (though not certain) that these methods would be appropriate for *C. hispida*. The following guidelines for seed germination and propagation from seed are taken from her work.

Germination requirements may vary depending on the source of the seed. In general, seeds must be stratified for 6-8 weeks. Set seeds on a moist paper towel or germination paper in a dark place at 5° C for 6-8 weeks. Follow this by a post-chill incubation: set seeds in a warm, well-lit place for two weeks (checking for germination during this period). Keep moist.

## Seed life

Seed life, as with viability, may vary depending on population source. It is best to use seeds within 1-2 years.

## Recommended seed storage conditions

Store at a low-temperature (5° C) in a dry, dark place.

## Propagation recommendations

Seed: Once the seeds have germinated and have their first root (radicle), carefully put the seeds in soil. After 4-6 weeks, seedlings may be transplanted into a container with a host plant such as *Eriophyllum lanatum* or *Festuca roemerii*. Outplant after at least 3 months. Make sure that the host plant is not out-competing the golden paintbrush seedling

Vegetative cutting: David Schmidt conducted research on the propagation of this species from vegetative cuttings. He had the best results when cuttings were made early in the season (March) and applied with root hormone before setting in soil. This may be one good option for propagation, but the timing of the cutting (firmness of the stalk) is tricky and vegetative propagation alone does not offer the genetic variability that propagating from seed does.

## Soil or medium requirements

Plant in well-drained soil. Some fertilization every two weeks may help increase

the success of the seedlings.

## Installation form

Plant seedlings with a host plant in an open area.

## Care requirements after installed

Make sure that the host plant does not out-compete the paintbrush. Watering during dry months may also increase survival rates.

## Sources cited

Lawrence, Beth. 2005. Master's Thesis: Studies to Facilitate Reintroduction of Golden Paintbrush (*Castilleja levisecta*) to the Willamette Valley, Oregon. Department of Biology and Plant Pathology. Oregon State University. Corvallis, OR.

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Schmidt, David. 1998. Master's Thesis: Restoration of a Prairie Ecosystem at the Yellow Island Preserve and the Propagation of *Castilleja hispida* by Vegetative Cuttings. College of Forest Resources. University of Washington. Seattle, WA.

Data compiled by Samantha Martin Sprenger June, 2006.