

Plant Propagation Protocol for *Castilleja applegatei*

ESRM 412 – Native Plant Production

URL: <https://courses.washington.edu/esrm412/protocols/2023/CAAP4.pdf>



Source: Calscape



Source: Calflora



Source: CPNWH

TAXONOMY

Plant Family

Scientific Name Orobanchaceae (Scrophulariaceae)

Common Name Figwort

Species

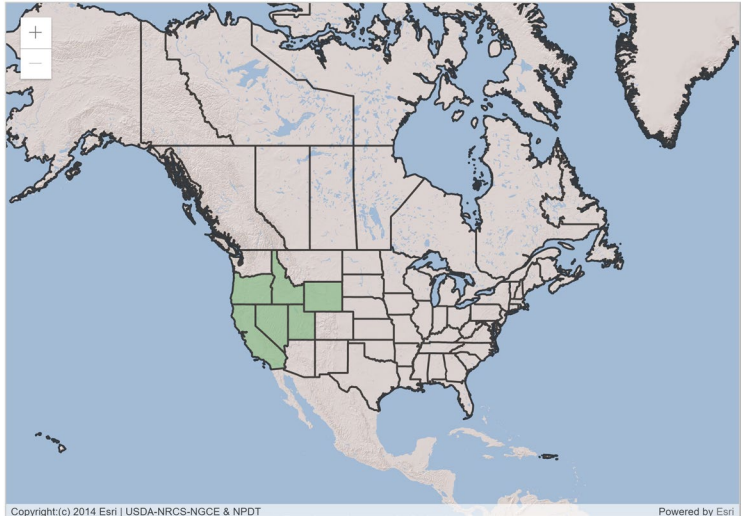
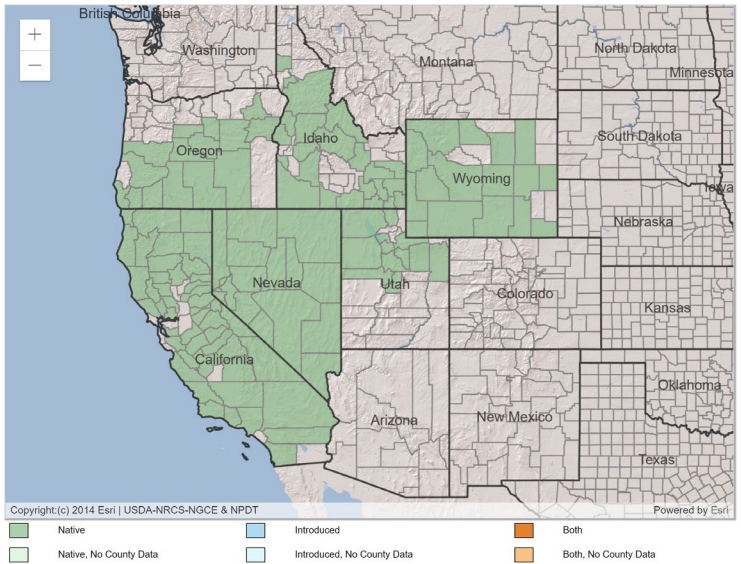
Scientific Name *Castilleja applegatei*

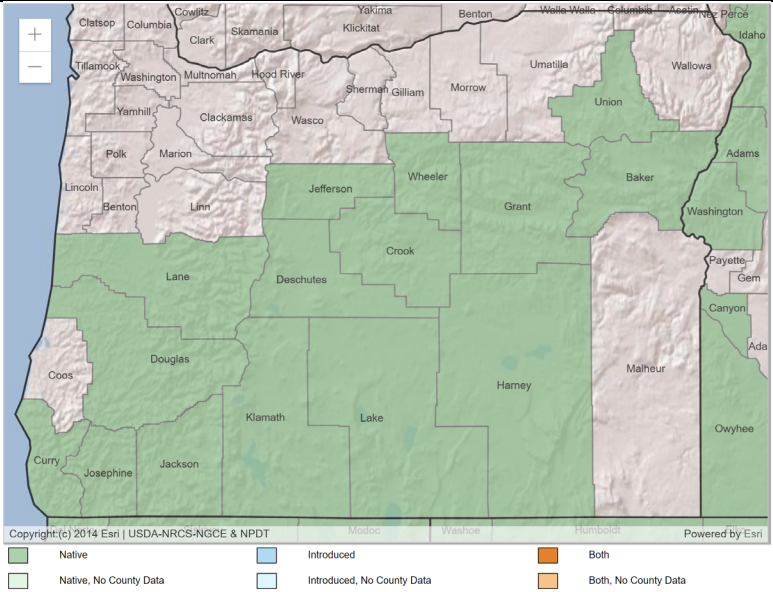
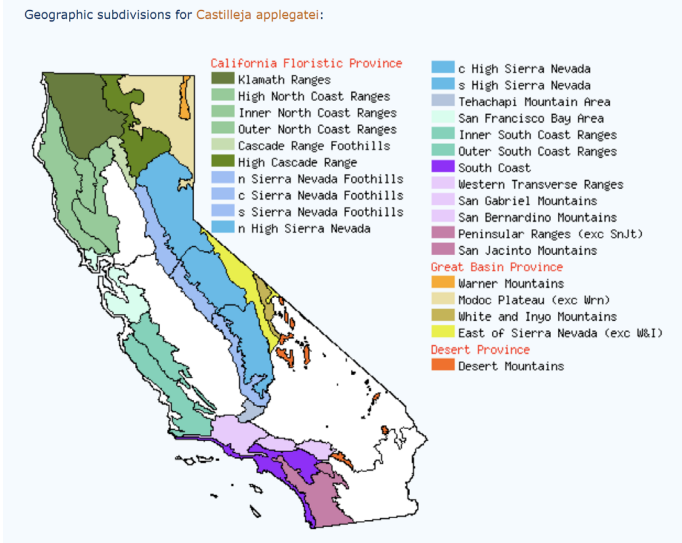
Varieties
Castilleja applegatei Fernald var. *pinetorum* (Fernald) N.H. Holmgren
Castilleja applegatei Fernald var. *fragilis* (Zeile) N.H. Holmgren
Castilleja applegatei Fernald var. *viscida* (Rydb.) Ownbey
Castilleja applegatei Fernald var. *breweri* (Fernald) N.H. Holmgren

Sub-species

Castilleja applegatei Fernald ssp. *Applegatei*
Castilleja applegatei Fernald ssp. *disticha* (Eastw.) T.I. Chuang & Heckard
Castilleja applegatei Fernald ssp. *martinii* (Abrams) T.I. Chuang & Heckard
Castilleja applegatei Fernald ssp. *pallida* (Eastw.) T.I. Chuang & Heckard
Castilleja applegatei Fernald ssp. *pinetorum* (Fernald) T.I. Chuang & Heckard

Cultivar

Common Synonym(s)	<i>Castilleja pinetorum</i>
Common Name(s)	Applegate's Indian Paintbrush, Pine Indian Paintbrush, Pine Paintbrush, Wavy-leaf Paintbrush, Wavy-leaved Indian Paintbrush, Wavy-leaved Paintbrush
Species Code	CAAP4
GENERAL INFORMATION	
Geographical range	<p>This plant grows in Oregon, California, Idaho, Nevada, Utah and Wyoming.</p> <p>Source: Native Plant Network</p>  

	<div></div> <p>Source: USDA Plants Database.</p> <div><p>Geographic subdivisions for <i>Castilleja applegatei</i>:</p></div> <p>Source: Jepson Herbarium, UC Berkeley</p>
Ecological distribution	<p>Observed in Yellow Pine Forest, Red Fir Forest, Lodgepole Forest, Subalpine Forest, Northern Juniper Woodland, and Pinyon-Juniper Woodland communities.</p> <p>Source: Calflora</p>
Climate and elevation range	<p>Annual Precipitation: 3.8" - 155.3", Summer Precipitation: 0.23" - 5.98", Coldest Month: 18.4" - 54.4", Hottest Month: 39.1" - 82.8", Humidity: 0.14" - 34.87", Elevation: 60" - 13689"</p> <p>Source: Calscape</p>

Local habitat and abundance	<p>Short, sub-shrub/forb, found throughout the Western United States except in WA. Prefers dry, open locations in generally wooded areas with loamy or clay soils. <i>Castilleja</i> species generally occur in ‘wide range of habitats, including, low-elevation wetlands and riparian areas, to dry grasslands, steppe-shrub communities, and rocky slopes to mid- to high elevation mountain meadows and slopes” (Luna, 2005).</p> <p>Source: Calscape; American Southwest</p>
Plant strategy type / successional stage	<p>Hemi- /parasitic. <i>Castilleja</i> species are facultative parasites. Seeds will germinate independently of host species, but tend to germinate and establish better when plants can parasitize grasses or herbaceous perennials with taproots and in association with pines.</p> <p>Sources: Luna, 2005; Rose, Chachulski and Haase, 1998; Johnson and Millard, 1993.</p>
Plant characteristics	<p>1.5 – 2.6ft tall perennial herb with upright form and sticky, wavy-edged leaves. Bears bright red, paintbrush-shaped flowers that bloom from Spring-Summer, however exact flower and bract color can vary widely even within species. Successful growth and flowering depends on plant’s ability to develop haustoria, specialized roots that parasitize an adjacent host and supplement <i>Castilleja</i>’s water and nutrient uptake.</p> <p>Source: Luna, 2005; Calscape; Eggers, et. al. 2020</p>
PROPAGATION DETAILS	
SEED PROPAGATION WITHOUT HOST – RNGR Native Plant Network	
Ecotype	High elevation ecotype at Lassen National Park, Ca
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Container
Stock Type	Plug
Time to Grow	weeks
Target Specifications	n/a
Propagule Collection Instructions	Seed retention in <i>Castilleja applegatei</i> is high. Collect dried flowering stalks in late season. Cut stalks from the plant and place in paper bags to dry.
Propagule Processing/Propagule Characteristics	n/a

Pre-Planting Propagule Treatments	Use stationary thresher to separate dried pots from stem and to break them open. Use small screen or air-screen machine to separate seed from hulls or other detritus. Dehulling seed does not seem to affect germination rates.
Growing Area Preparation / Annual Practices for Perennial Crops	Stubby containers
Establishment Phase Details	n/a
Length of Establishment Phase	n/a
Active Growth Phase	n/a
Length of Active Growth Phase	n/a
Hardening Phase	n/a
Length of Hardening Phase	n/a
Harvesting, Storage and Shipping	n/a
Length of Storage	n/a
Guidelines for Outplanting / Performance on Typical Sites	n/a
Other Comments	n/a
SEED PROPAGATION WITH HOST – Luna, T., 2005; Roseto, A. 2017; Castama, M., 2018; Rose, Chachulski and Haase, 1998; Eggers, et. al. (2020)	
Ecotype	Plant occurs widely in areas within geographic distribution. Note ecotype characteristics during seed collection and collect seeds of probable host species (e.g. <i>Bouteloua gracilis</i> or <i>Lupinus polyphyllus</i>) at the same time in order to improve chances of hemi-parasitism in resultant stock.
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Container (plug)
Stock Type	Stubby containers
Time to Grow	~ 16 weeks after cold, moist stratification
Target Specifications	<i>Castilleja</i> plants hemi-parasitized on host species.
Propagule Collection Instructions	Dry dehiscent seed capsules typically mature within 8-10 weeks of pollination. Collect dried <i>Castilleja</i> and host flowering stalks in late summer/fall. Place cut stalks in paper bags to dry.
Propagule Processing/Propagule Characteristics	Seed density per capsule is high.
Pre-Planting Propagule Treatments	Imbibe freshly collected seeds in water for 4-8 hours. Pour off water to remove detritus and reduce risk of fungal contamination. Layer seeds between blotting paper in plastic bags or petri dishes. Place seeds in cold stratification environment (e.g. refrigerator) for 90-120 days at 1C to 2C.

	<p>Stratify host seeds separately but at the same time and temperature to improve their chances of germinating at the same time.</p> <p>Cool or high-elevation specimens may break dormancy during stratification. They can be sown as germinants. Stratified seeds can be sown outdoors in Spring or Early Fall.</p>
Growing Area Preparation / Annual Practices for Perennial Crops	<p>Use “2:1:1 mix of Sunshine Mix #2 (Sungro Horticulture Inc), large grade perlite, and sharp sterile sand” (Luna, 2005).</p> <p>Prepare stubby, 1.5”x5.5” Ray-Leach containers for <i>Castilleja</i> and 10” x10” ‘half-flats’ for host species.</p>
Establishment Phase Details	<p>Sow cold-stratified <i>Castilleja</i> and host species separately. Sow <i>Castilleja</i> species shallowly and cover with a 1/8” layer of germination medium or fine chicken grit. Store outdoors or in a greenhouse with temperatures alternating between 21C to 25C and 10C to 16C. Keep germinating seedlings evenly moist. Stratified seeds should germinate and emerge 10-14 days after sowing. Sow host species in open flat at recommended depth and spacing for species.</p> <p><i>Castilleja</i> seedlings should develop 4-6 pairs of true leaves and an unattached haustoria within 4-6 weeks. Pair with a host species at this time by transplanting single seedlings of both specimens into a 1-gallon container, taking care to minimize root disturbance. Successfully parasitizing <i>Castilleja</i> specimens will continue to develop true leaves during the active growth phase, while unsuccessful plants will wither and lose vigor – either going dormant for winter season or dying altogether.</p>
Length of Establishment Phase	6-10 weeks.
Active Growth Phase	Fertilize <i>Castilleja</i> -host containers with a low concentration 20:20:20 fertilizer “at one-quarter the recommended rate” (Luna, 2005). Inspect seedlings regularly to ensure host species is not shading out <i>Castilleja</i> , and trim back host leaves as needed.
Length of Active Growth Phase	10-6 weeks after transplanting into 1-gallon containers.
Hardening Phase	Move greenhouse containers outdoors in mid-summer.
Length of Hardening Phase	Minimum 4 weeks

Harvesting, Storage and Shipping	Take care to avoid unnecessary handling of plants to minimize damage to haustoria connection and taproot of host species.
Length of Storage	
Guidelines for Outplanting / Performance on Typical Sites	Most <i>Castilleja</i> species are ready for outplanting 16 weeks after germination, however this timeline can vary widely based on specimen ecotype and transplanting/parasitism success.
Other Comments	High elevation <i>Castilleja</i> species, such as <i>Castilleja applegatei</i> , tend to have a lower germination rate. Collect, stratify, and sow enough seeds to ensure target plant quantities and qualities for the year.

INFORMATION SOURCES

References	
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Protocol Author	Seyyada Burney
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